Overview of Climate, Energy and Transport Policy in Quebec

By

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ABOUT THE JCCTRP

The Joint Clean Climate Transport Research Partnership (JCCTRP) is a new research partnership that brings together leading universities, private research institutes, businesses and non-profit organizations from Quebec, California, Ontario and Vermont working on transport and climate policy. The JCCTRP Secretariat is based at the École des sciences de la gestion at the Université du Québec à Montréal (ESG-UQÀM). The ultimate goal of the JCCTRP is to identify technical, economic and political factors shaping the potential for environmentally effective, economically efficient, and politically viable low-carbon transport and climate mitigation policy, and understand their implications for emissions trading.

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ABSTRACT

This working paper presents an overview of Quebec energy, transportation and climate change mitigation policies. Special attention is given to institutional frameworks and key government actors at different levels of government. This includes a review of major policies of the Canadian federal and provincial governments as well as that of the City of Montreal, the largest urban agglomeration in the province. The overview illustrates the complex interactions between institutions and policy actors in Quebec, Canada as well as North America. We also review greenhouse gas (GHG) emission reduction targets and assess progress at different governance scales. This includes assessment of the current state of measures adopted or planned by policy actors at various scales as well as the investments considered, in particular concerning carbon pricing and regulations, the electrification of transport and investments in infrastructure and public transport. This working paper also reviews transport and energy system modeling efforts and the importance of models in the policy process. A special focus is given to Quebec's role as a major producer of clean energy in the northeastern part of North America, where Hydro-Québec has long been a supplier of hydroelectricity.
INTRODUCTION

Written as part of the Joint Clean Climate Transport Research Partnership (JCCTRP), this working paper paints a portrait of Québec’s energy, transportation and climate change mitigation policies. Among various sources of emissions in Canada and the United States, the transportation sector is the largest and one of the most difficult sectors to reduce emissions. Special attention is given to institutional frameworks and key actors at different levels of government. This includes a review of the major policies of the federal and provincial governments as well as that of the City of Montreal, the largest urban agglomeration in the province. The overview illustrates the complex interactions between institutions in Quebec, Canada as well as North America. In 2016, Quebec represented 23% of the Canadian population (Institut de la Statistique du Québec 2018) and was responsible for 11% of Canadian emissions (MELCC 2018b).

There is growing interest in carbon pricing as a policy tool to reduce emissions of greenhouse gases responsible for climate change—including carbon markets and carbon taxes—as well as their links with other regulatory efforts for climate change mitigation. In North America, Quebec and California (and, for the first six months of 2018, also Ontario) have played a leadership role in climate policy through the establishment of an emissions trading system operating under the aegis of the Western Climate Initiative (WCI). At the same time, the Canadian federal government has made carbon pricing a cornerstone of its climate action plan, which will have a significant impact on provincial climate policies undertaken to date. Similarly, states in the northeastern United States, including Vermont, have established the Regional Greenhouse Gas Initiative (RGGI). Recently, almost all RGGI states have announced the development of a framework “for a regional program to address greenhouse gas emissions in the transportation sector” (Commonwealth of Massachusetts 2018). Yet despite the importance of carbon pricing as a policy instrument for combating emissions, it is not the only instrument for reducing emissions. Other regulatory instruments have also been developed to combat emissions in the transport sector such as low carbon fuel standards and zero emission vehicle mandates. Interdisciplinary and transdisciplinary research collaborations across jurisdictions involved in carbon pricing—particularly those linked by emissions trading systems—promises to shed light on many questions facing governments, business and other policy actors in the jurisdictions involved.

CLIMATE AND ENERGY POLICIES AND KEY POLICY ACTORS

In Canada, environmental issues and climate change are areas of shared jurisdiction between federal and provincial governments. This explains a certain overlap between the policies, strategies and regulations of each jurisdiction regarding GHG emissions (Becklumb 2013). With regard to energy, the provinces have the prerogative over the management of resources on their territory and therefore energy resources. For example, electricity generation is under provincial jurisdiction. However, Ottawa holds the prerogative over energy security issues and energy projects across Canada, such as pipelines. In general, the federal government has jurisdiction over cross-border issues. It is also important to note the emissions vary greater across Canadian provinces (Figure 1). Maritime provinces like Nova Scotia have seen emissions since 2005 decline by 33% while those of Alberta, home to Canada’s oil sands, increased by 18% (ECCC, 2019).
Canadian Federal Government Climate and Energy Policies

**Federal Climate Policy**

Canada’s commitment under the 2015 Paris Agreement has been to reduce Canadian emissions 30% below 2005 levels (Government of Canada 2015). The key policy framework for reaching this goal has been the *Pan-Canadian Framework on Clean Growth and Climate Change*, which is a broad regulatory framework to address climate change new regulations, including industries, carbon pricing and low-carbon fuel standards (Government of Canada 2018). The program also provides federal resources for the development of renewable energies, the elimination of coal-fired power plants and the modernization of electricity grids. Significantly, federal investments are intended to complement and accelerate provincial and territorial investments according to applicable program criteria. The framework involves the collaboration of several federal departments, including Environment and Climate Change Canada, Infrastructure Canada, Transport Canada, Natural Resources Canada and Innovation, Science and Economic Development Canada. The division of powers between the federal and provincial governments in the areas of environment, transportation, energy and natural resources has, arguably, fostered a collaborative approach between the two levels of government. The Government of Canada does not issue requirements for policy modeling at the provincial level. However, federal financial transfers are conditional on policy investments by provincial government.

**Federal Carbon Pricing Policy**

The establishment of a national carbon price has been at the center of the Canadian climate program. The federal strategy has been to establish a federal carbon price as a backstop measure, required in situations...
where provinces themselves have not implemented a price-based system (like a carbon tax) or cap-and-trade system (MacNeil and Paterson 2018). In such situations, the federal carbon price would begin at $10 CDN per tCO2e and rise to $50 CDN per tCO2e by 2022. Also significant, the Canadian federal backstop is revenue neutral, meaning that any revenues generated by the federal carbon pricing mechanism are returned to residents of the province by the federal government.

It is important to note the that federal government requires provincial instruments to be equivalent and meet the minimum standards for GHG reductions and carbon prices. As the Quebec carbon market is already in effect, it will be necessary to wait for the official review in 2022 to confirm that its cap-and-trade system (SPEDE) meets the federal criteria (Kyriazis 2017). However, the details of these criteria remain subject to discussion. It is not yet established to what extent the criteria will consider equivalence based on the carbon price or the number of emissions reduced by carbon pricing.

**Federal Energy Policy**

In the energy sector, the Canadian federal sector is taking a collaborative approach that takes into account the division of powers between it and provincial governments. Due to the political legacy of the controversial 1980 National Energy Program, the Canadian federal government remains reluctant to undertake a national energy strategy (Doern et al., 2015: 149). The announcement of a Canadian Energy Strategy in 2015 has been entrusted to the Federation Council, an organization that brings together provincial governments. The Strategy aims to improve energy conservation and efficiency, increase clean energy technologies, and bring energy to people and global markets (Conseil de la Fédération 2015). Table 1 presents the key themes and focus areas of this strategy. The Pan-Canadian Framework on Clean Growth and Climate Change includes an electricity component (Government of Canada 2016) that is based primarily on provincial initiatives and this Strategy.

**TABLE 1. KEY THEMES AND FOCUS OF THE 2015 CANADIAN ENERGY STRATEGY**

<table>
<thead>
<tr>
<th>Viability and Conservation</th>
<th>Technology and Innovation</th>
<th>Energy Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Promote energy efficiency and energy conservation.</td>
<td>4. Accelerate the development and deployment of research and energy technologies that will promote the production, transmission and more efficient use of clean and conventional energy sources.</td>
<td>7. Create and improve a set of modern, reliable and environmentally friendly networks for transmission and transmission of energy across Canada or for import and export.</td>
</tr>
<tr>
<td>2. Move to a lower carbon economy.</td>
<td>5. Develop and implement strategies to address the human resource needs of the energy sector, currently and throughout the 21st century.</td>
<td>8. Improve timeliness and predictability of decision-making and approval processes while maintaining rigorous standards of environmental protection and protecting the public interest.</td>
</tr>
<tr>
<td>3. Improve energy information and awareness in this regard</td>
<td>6. Facilitate the exploitation of renewable, green and / or cleaner energy sources in order to meet future demand and contribute to environmental goals and priorities.</td>
<td>9. Promote market diversification.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10. Target the formal participation of provinces and territories in international energy discussions and negotiations.</td>
</tr>
</tbody>
</table>

*Adapté du Conseil de la Fédération (2015), p.9*
Québec Climate and Energy Policies

Quebec Climate Policies

The Government of Québec has set targets for 2020 and 2030 to reduce its emissions by 20% and 37.5%, respectively, from 1990 levels (MELCC 2018a). The 2013-2020 Climate Change Action Plan (CCAP) also plans to reduce GHGs by 80-95% below 1990 levels by 2050. According to Environment and Climate Change Canada, the province reduced emissions to 11% below 1990 levels in 2016 (ECCC 2018).

The 2013-2020 CCAP is a comprehensive climate change mitigation and adaptation program involving 15 provincial government departments and agencies. Programs are mainly in the transport, building, industry, agriculture and waste sectors. The Ministry of Transport, Sustainable Mobility and Transportation Electrification (MTMDET), Québec Energy Transition (TEQ) and the Ministry of the Environment and the Fight Against Climate Change (MELCC) are the main players in the plan’s implementation. The budget for the 2013-2020 period is close to $4 billion CDN (Conseil de gestion du Fonds vert 2018). This is mainly driven by the revenues of the Green Fund, which is in turn largely financed by revenues from carbon market emission allowances auctions. Between 2013 and 2018, nearly $2.25 billion CDN was raised through carbon market auctions, which explains the evolution of the CCAP budget since 2013 (MELCC 2018). Other funding for the 2013-2020 CCAP comes from provincial agencies, the federal government, municipalities and private sources.

According to the 2018 version of the 2013-2020 CCAP Mid-Term Review (MELCC 2018), Quebec is on track to miss its reduction target for 2020. The reduction potential of current measures stands at 2.3 Mt. 2020. Established in 2013, the initial reduction targets for the Action Plan were set at 6 Mt CO2 for 2020. The Green Fund Management Board or Conseil de gestion du Fond vert (CGFV) has reviewed the allocation of the 2013-2020 CCAP funds and their performance. Current measures involve estimate the costs per tonne of reducing emissions to range from $200 to $1300 per tCO2e. As a result, the CGFV recommended abandoning certain measures to enhance the performance of others with better performance (Conseil de gestion du Fonds vert 2018).

However, none of the evaluations of Quebec’s climate policies above, including the 2013-2020 CCAP Mid-Term Review, recognize GHG reductions in California attributable to the purchase of emission allowances.
by Quebec firms via the carbon market. In 2013, Quebec and California linked their efforts in a joint carbon market by means of an administrative agreement between the two governments, the Agreement on the Harmonization and Integration of Cap-and-Trade Programs for Reducing Greenhouse Gas Emissions, which was ratified by order of the Government of Québec in 2013 (Trudeau 2018). Under Article 8 of the 2017 Quebec-California Agreement, initially including Ontario, it is expected that a mechanism for allocating emission reductions across jurisdictions will be implemented. This mechanism will be used to account for reductions attributable to each jurisdiction in order to avoid double-counting of emission reductions (Government of Ontario et al., 2017). As we will see later, it is likely that a significant portion of Quebec's emission reductions have been achieved in California.

**Quebec Carbon Market**

Under the auspices of the Western Climate Initiative (WCI), the governments of Quebec and California have linked their respective carbon markets, with a first joint auction taking place in November 2014. The Quebec market covers nearly 85% of the province's overall emissions, across the transportation, industrial, residential, commercial, institutional and agricultural sectors. The unhedged share of total emissions is mainly found in the waste, fertilizer, aviation and marine sectors (Ministère des Finances du Québec 2017). At the last joint auction in May 2019, the settlement price stood at $17 USD or $23 CDN in May 2019 (CARB & MELCC, 2019).
As has already been suggested, when considering the contribution of the carbon market to Québec’s efforts to reach its emission reduction targets for 2020 and 2030, it is important to distinguish the emission reductions achieved in Quebec from those of Québec firms in California. This linked carbon market has been the focus of considerable modeling efforts. For example, scenarios for GHG reductions and the economic impacts of the carbon market between Quebec and California have been projected using the General Equilibrium Model of the Quebec Ministry of Finance (MEGMFQ). The Ministry of Finance has modeled two scenarios of carbon pricing, one in which prices rise gradually and the other in which prices rise more rapidly (Table 2). In the first scenario, prices would rise from approximately $21 CDN per tCO2e in 2020 to $59 CDN per tCO2e in 2030. According to the second scenario, where prices rise more rapidly, the price of emission allowances would increase from approximately $22 CDN per tCO2e in 2020 to $93 CDN per tCO2e in 2030. The two scenarios were estimated to lead to a reduction between 3.6-5.3 MtCO2e on the territory of Quebec by 2030. Put differently, it is estimated that the carbon market will contribute between 14% and 20% of Québec’s efforts to achieve its 2030 target. Efforts to achieve the remaining 80% to 86% of reductions would be achieved through other policy measures as well as the purchase of emission allowances outside Quebec by Québec firms. According to the North American Model TIMES Energy Model (NATEM), considering the current state of technology in Quebec, significant technological changes in Quebec would occur only at relatively higher prices, above $100 CDN per tCO2e (Ministère des Finances du Québec 2017).
TABLE 2: CARBON MARKET’S IMPACTS ON CARBON PRICE AND AND GHG EMISSIONS IN 2023 AND 2030
ACCORDNG TO TWO ALLOWANCES PRICE SCENARIOS

<table>
<thead>
<tr>
<th></th>
<th>Gradual increase in Allowances prices Scenario</th>
<th>2023</th>
<th>2030</th>
<th>Faster increase in Allowances prices Scenario</th>
<th>2023</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission Allowances Prices</td>
<td>$CAN/t CO(_2)</td>
<td>21$</td>
<td>59$</td>
<td></td>
<td>22$</td>
<td>93$</td>
</tr>
<tr>
<td>Quebec reductions resulted from changes in behavior of economic agents due to Carbon Market</td>
<td>Mt CO(_2)</td>
<td>2.2</td>
<td>3.6</td>
<td></td>
<td>2.6</td>
<td>5.3</td>
</tr>
<tr>
<td>Other measures and purchases of emission allowances outside Québec</td>
<td>Mt CO(_2)</td>
<td>13.8</td>
<td>22.8</td>
<td></td>
<td>13.4</td>
<td>21.2</td>
</tr>
<tr>
<td>Total reductions of GHG emissions</td>
<td></td>
<td>16.0</td>
<td>26.4</td>
<td></td>
<td>16.0</td>
<td>26.4</td>
</tr>
</tbody>
</table>

Adapté de « Impacts économiques du système de plafonnement et d’échange de droits d’émission de gaz à effet de serre du Québec, » par le Ministère des Finances du Québec, 2017, Gouvernement du Québec, p. 6 et 23.

It is important to note that carbon prices in Quebec would likely be much higher without the carbon market linked with California. Previous modeling efforts estimated that, by 2020, the Quebec-California market would enable Quebec firms to reduce compliance costs by between 20% and 47%, compared to the actual costs of reducing emissions in Quebec (Purdon and Sinclair-Desgagné 2015). In order for Quebec to reach its 2020 emission reduction goal without linking its carbon market with California—with reductions achieved entirely within Quebec—the price of emission allowances would be between $79 and $93 CDN per tCO\(_2\)e (Purdon and Sinclair-Desgagné 2015, 11). See Figure 6. In other words, carbon prices in an unlinked Québec carbon market in 2020 would be comparable prices in a linked California-Quebec carbon market in 2030. Similarly, it is estimated that the carbon price needed for Canada to achieve its 2030 emission reduction target under the Paris Agreement is in the range of $160-200 CDN per tCO\(_2\)e by 2030 (Jaccard 2016, Jaccard et al 2016). Overall, more emission reductions would be expected to be achieved at lower carbon prices made possible by the market link with California, where economic models suggest that it is relatively cheaper to reduce carbon emissions. Given that Québec’s economy is relatively clean, due to the important role of hydroelectricity, it would only be possible to achieve significant technological change in Quebec at a very high carbon price. Although this is not impossible, it will be more difficult politically to achieve reductions at high carbon prices.
It is also interesting to compare the impact of carbon price and taxes on gas prices in different jurisdictions. In Table 3, we compare 2018 carbon prices between Quebec and British Columbia (BC), including the two metropolitan areas of Montreal and Vancouver. British Columbia is well known for its carbon tax, which was raised to $35 CDN per tCO2e in 2018, which is significantly higher than the price of $23 CDN recently observed on the California-Quebec carbon market. However, there is a distinction between the price of gasoline before taxes, the impact of carbon pricing and the impact of other taxes on the price at the pump. First, we observe that despite the considerable increase in the price of carbon in BC, gas taxes are higher in Quebec. This includes Montreal and Vancouver, where gasoline taxes were $0.55 per liter and $0.51 per liter, respectively. Outside the two largest metropolitan areas, gasoline taxes were $0.51 and $0.38 per liter respectively in Quebec and British Columbia. In 2018, carbon prices in both jurisdictions amounted to only an addition of $0.04 per liter in Quebec and $0.08 per liter in British Columbia. But the Vancouver transit tax alone contributes about $0.17 per liter, about double the carbon tax.

Essentially, Quebec has long imposed higher taxes on gasoline than other Canadian provinces, with carbon pricing in places like British Columbia starting to approach Quebec’s overall tax levels. It should be noted that other taxes have a similar effect to a carbon tax on consumer behavior and, once aggregated, raise the price of gasoline. Thus, according to the Canadian Taxpayers Federation (Bowes 2018), if all gasoline taxes are considered to be an implicit carbon tax, taxes would be $231 per tCO2e in Montreal and $215 per tCO2e in the rest of Quebec. In the case of Vancouver and the rest of British Columbia, it would be $228 per tCO2e and $173 per tCO2e. Overall, while the official carbon price in Quebec is lower than in British Columbia, total gas taxes and, therefore, the real price of carbon in this important segment of the transportation sector is actually higher in Quebec.
Table 3: Comparison of Gas Prices in Québec and British-Columbia in 2018

<table>
<thead>
<tr>
<th></th>
<th>Montreal</th>
<th>Vancouver</th>
<th>Rest of Quebec</th>
<th>Rest of BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Price ($/t CO2)</td>
<td>$18.00</td>
<td>$35.00</td>
<td>$18.00</td>
<td>$35.00</td>
</tr>
<tr>
<td>Price at the pump ($/liter)</td>
<td>$1.38</td>
<td>$1.55</td>
<td>$1.32</td>
<td>$1.31</td>
</tr>
<tr>
<td>Price before Taxes ($/liter)</td>
<td>$0.83</td>
<td>$1.05</td>
<td>$0.81</td>
<td>$0.92</td>
</tr>
<tr>
<td>Taxes ($/liter)</td>
<td>$0.55</td>
<td>$0.51</td>
<td>$0.51</td>
<td>$0.38</td>
</tr>
<tr>
<td>- Carbon Price ($/liter)</td>
<td>$0.04</td>
<td>$0.08</td>
<td>$0.04</td>
<td>$0.08</td>
</tr>
<tr>
<td>- Transit Tax ($/liter)</td>
<td>$0.03</td>
<td>$0.17</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>- Other taxes ($/liter)</td>
<td>$0.46</td>
<td>$0.26</td>
<td>$0.47</td>
<td>$0.30</td>
</tr>
<tr>
<td>% Taxes</td>
<td>40%</td>
<td>33%</td>
<td>39%</td>
<td>29%</td>
</tr>
</tbody>
</table>


Quebec Energy Policies

In 2016, the Government of Quebec published the 2030 Energy Policy with the objective of improving by 15% the efficiency with which energy is used, reducing by 40% the quantity of petroleum products consumed, increasing by 25% the total production of renewable energies and increasing bioenergy production by 50% by 2030. According to the targets established in the 2030 Energy Policy, the proportion of renewable energy consumed in Quebec will increase from 48% in 2016 to 61% by 2030 (Gouvernement du Québec 2016). Emission reductions under program targets would result in a reduction of 16 MtCO2e by 2030. This represents a reduction of provincial emissions by 18% compared to 1990 (Gouvernement du Québec 2016).

Significantly, the 2030 Energy Policy led to the creation in 2017 of Transition énergétique Québec (TEQ), a state agency with a mandate to support Quebec’s transition towards an efficient and low-carbon energy economy. TEQ provides coordination between the various departments for the implementation of energy efficiency programs in the residential, industrial, commercial, institutional and transport sectors (Gouvernement du Québec 2017). According to its 2018-2023 Master Plan (TEQ 2018), TEQ plans investments of $6.7 CDN billion, in collaboration with other departments (Whitmore and Pineau 2019). The organization anticipates a reduction in petroleum product consumption of 12% in 2023 compared to 2013 (Transition énergétique Québec 2018).

Quebec Electricity: Production and Exports

Electricity generation in Quebec is 95% hydroelectric with 3.8% generated from wind source (Figure 8). Electricity meets 36% of the province’s energy demand. Quebec remains, for its consumption, 64% dependent on fossil energy (Figure 9). The oil consumed in Quebec is imported mainly from Western Canada (53%) and the United States (40%). Previously, the vast majority of oil imported into Quebec came from overseas. Since 2015, the reversal of Enbridge’s 9B pipeline and the expansion of American unconventional oil production has led to this change in Quebec’s oil supply (Whitmore and Pineau 2019).
Hydro-Québec, a state-owned corporation responsible for the generation, sale, purchase and transmission of all electricity in Quebec, is one of the central energy players in the province (Lanoue and Hafsi 2010). Hydro-Québec’s Transportation division, TransÉnergie, manages one of the largest electrical transit zones on the North American continent, with 15 interconnections linking it to Ontario, New Brunswick and the New England states and New York state (Hydro-Québec TransÉnergie 2017). Hydro-Québec is thus collaborating with American partners, such as the New York Independent System Operator (NYISO), in the operationalization of transportation and exchanges on the Northeastern American power grid.

The Northeast Power Coordinating Council (NPCC) is the regional body covering Quebec, Ontario, the Canadian Maritime provinces, as well as the US states of Maine, Vermont, New Hampshire, Massachusetts, New York, Connecticut and Rhode Island. NPCC is mandated to create regional standards to improve the reliability of the interconnected power system in the Northeastern US (Northeast Power Coordinating Council Ltd.). This is one of eight regional "electrical reliability organizations" (EROs) linked to the North American Electric Reliability Corporation (NERC). Acting under the supervision of the US Federal Energy Regulatory Commission (FERC) and Canadian governmental authority, NERC is responsible for reducing the risk, reliability and safety of power grids in North America (NERC 2017). See Figure 10. The TransÉnergie division of Hydro-Québec must therefore meet the requirements submitted, particularly with regard to reliability standards, data transmission and transmission system modeling (Hydro-Québec TransÉnergie 2018).

In 2017, Hydro-Québec's export capacity was close to 6,000 MW. Of the 206 TWh of electricity sold by Hydro-Québec, 34 TWh was exported to Québec's outside markets. More than 76% of these exports were destined for New York and New England states.
Hydro-Québec estimates that exports have avoided 8.0 MtCO2e of emissions (Hydro-Québec International 2019). According to the latest Hydro-Québec Annual Report published in February 2019, hydropower exports reached a record for the year 2018 at 36 TWh (Hydro-Québec 2019).

Three new electricity export projects are currently under consideration by Hydro-Québec and involve the construction of new lines (Hydro-Québec International 2019). The Northern Pass line through New Hampshire would have a potential of 1,090 MW. This project alone would result in an estimated 9% reduction in New England’s current emissions (Northern Pass Transmission s. d.) This project is currently pending following the New Hampshire’s refusal to permit construction. The New England Clean Energy Connect (NECEC) line across Maine and to Massachusetts would increase Hydro-Québec’s export capacity by 1,200 MW. Commissioning of the new line is scheduled for 2022 (New England Clean Energy Connect s. d.). The completion of the NECEC project is necessary for Hydro-Québec to honor the supply contract of 9.5 TWh per year over 20 years that the state-owned corporation obtained in 2018 from electricity distributors in Massachusetts (Hydro-Québec 2019). Finally, the Hudson Power Express Champlain Project would increase the export capacity of 1,000 MW to the New York metropolitan area (Transmission developers Inc 2019). Québec’s hydropower export opportunities are accentuated by growing interest of the American states in renewable energies.

**Figure 10: North American electricity grid institutional structure**

**Urban Climate Policies in Quebec**

In Quebec, the largest urban center is the city of Montreal, which has adopted Montreal’s 2013-2020 Citywide Greenhouse Gas emissions Reduction Plan. The city has set a 30% GHG reduction target compared to 1990 (Ville de Montréal 2018). The plan proposes 12 solutions including energy efficiency in the residential, commercial and institutional sectors, as well as a transition in modes of transport and the development of public transit. The Montréal 2016-2020 Sustainable Montréal Report (Ville de Montréal 2016b) is part of the same initiative, but includes a more global approach related to the Sustainable Development Goals (SDGs) of the United Nations. In 2014, the efforts of the city of Montreal are estimated to have contributed to a 23% reduction in emissions compared to 1990. However, in 2018, the municipality is doubtful of achieving its 2020 goal. This is attributed to the growth of household personal vehicle use, the increase in polluting vehicles and a decrease in the modal share of public transit despite significant investments (Ville de Montréal 2018).
**Transport Policies and Key Policy Actors**

Jurisdiction over the transportation sector in Canada is shared between the federal government and the provinces. Marine, air and freight transportation as well as interprovincial transportation issues are federal jurisdiction. Provincial governments have jurisdiction over intra-provincial transportation. All road and transit infrastructure, land use and regulation are therefore provincial and municipal matters.

**Federal Transport Policies**

The transport sector is intimately related to infrastructure. In 2016, Infrastructure Canada's *Investing in Canada Plan* included a $180 CDN billion investment in infrastructure across the country over a 12-year period (Infrastructure Canada 2018b). Of these investments, $28.7 CDN billion and $26.9 CDN billion were allocated to public transit and green infrastructure, respectively. The federal government requires provincial budget contributions as part of federal transfers to the provinces and municipalities. All requirements are specified through bilateral agreements between Infrastructure Canada, the provinces and territories (Infrastructure Canada 2018a).

In the area of green infrastructure, the allocation of funds to provinces and municipalities is done under Infrastructure Canada's *Climate Lens*. This document, published in collaboration with Environment and Climate Change Canada, is intended to support the Pan-Canadian Framework on Clean Growth and Climate Change. It presents the requirements for the evaluation of GHG mitigation projects. GHG reductions should be calculated relative to a business-as-usual scenario in accordance with ISO standards for quantification, monitoring and reporting of emission reductions (ISO 2019) or GHG Protocol for Project Accounting procedures (Infrastructure Canada 2018c). The Canada Infrastructure Bank, with a $35 CDN billion fund, is also a key player in supporting provincial, municipal and private sector initiatives in transformative infrastructure projects, including transit projects (Infrastructure Canada 2016).

With respect to Transport Canada, the *Transport 2030* policy included provisions for green transport and technology innovation for a low-carbon transportation system in support of Canada's climate plan. Investments are planned, in particular, in the development of regulations and innovation in transport and clean energy.

**Clean Fuel Standards**

Transport Canada is working with Environment and Climate Change Canada as well as Innovation, Science and Economic Development Canada on the development of a low-carbon fuel standard known as the *Clean Fuel Standard* (Transport Canada 2018). This aims to reduce annually 30 MtCO2e by 2030 in Canada. According to ECCC, the regulatory proposal is expected to be unveiled in 2019. Implementation is scheduled for 2022. Regulatory development would be based on a cost-benefit analysis of such a standard for stakeholders in Canada. In addition, in July 2018, ECCC also issued a call for tenders for the acquisition of a fuel life cycle analysis model for the design of the standard. The unveiling of the draft model is also scheduled for 2019 (Gouvernement du Canada 2018).

**Zero Emissions Vehicles Mandate (ZEV mandate)**

Inspired in part by Quebec measures discussed below, Transport Canada announced in 2017 its intention to adopt a ZEV mandate by the end of 2018 (Transport Canada 2017). However, this measure was still
pending in early 2019. Using the REspondent-based Preference and Constraint model (REPAC), experts have demonstrated the potential of a ZEV mandate. It constitutes a financial incentive to purchase ZEVs and the deployment of a network of charging stations in Canada for the electrification of the fleet. The baseline scenario forecasts an increase in annual rechargeable electric vehicle sales of 6% to 17% in Canada by 2030. With the adoption of a ZEV mandate, a $7,500 purchase incentive, and the implementation of a network of charging stations in Canada, the modeling scenarios predict a potential increase in ZEV market share from 30% to 48% in Canada by 2030 (Axsen, Goldberg, and Wolinetz 2017).

**Vehicle Emission Standards**

With respect to the vehicle emission standards, Canadian federal regulations have been linked to the US Environmental Protection Agency (EPA) standards as a reference since 2012 (Posada et al., 2018). Given the current US administration’s intention to freeze low-emission vehicle regulations in the US auto industry, some argue that Canada should consider establishing its own regulations in this sector (Bérubé and Turcotte 2018).

**Quebec Policies**

In 2018, the Government of Quebec launched its 2030 Sustainable Mobility Policy: Moving Quebec to Modernity and its 2018-2023 Action Plan. The policy deals with public and active transport, road, maritime, air and rail, as well as interventions on the road network, from an integrated perspective. It puts forward nine targets by 2030, including a 20% reduction in solo car trips, a 40% reduction in transportation oil consumption, a 37.5% reduction in GHG emissions in the transportation sector below the 1990 level and a 20% reduction in gross expenditures of households allocated to transportation (Gouvernement du Québec 2018). The Québec Ministry of Transport is one of the main players in the implementation of politics. Investments under the 2018-2023 Action Plan are estimated at more than $9.7 CDN billion (Whitmore and Pineau 2019).

In addition to its key role in the 2030 Sustainable Mobility Policy, the Québec Ministry of Transport is an important player in the achievement of goals set out in the 2030 Energy Policy through the 2015-2020 Electrification Action Plan. The latter targets bringing 100,000 electric and hybrid vehicles to Quebec’s roads by 2020 and 300,000 by 2026 (Ministère des Transports du Québec 2015). There were nearly 39,000 electric and hybrid vehicles in 2018 (Whitmore and Pineau 2019) and it is estimated that 319,000 will be in circulation in 2026 according to Hydro-Québec (Desjardins 2018). The plan involves collaboration with several departments and $420 million of funding, mostly from the Green Fund. Among the measures are the program Roulez Électrique (Drive Electric) which offers a $8,000 rebate on the purchase of an electric vehicle. The Ministry of Energy and Natural Resources’ Branché au Travail (Charging at Work) program provides financial assistance to businesses and municipalities for the installation of charging stations in workplace. The program has also included the development of Circuit Électrique, the provincial network of public electricity charging stations (Ministère des Transports du Québec 2015).

**Quebec ZEV Mandate**

The Ministry of Environment and Climate Change's (MELCC) introduced a ZEV Mandate, which came into force in 2018. Car manufacturers are now required to accumulate a minimum number of ZEV credits for sales of ZEVs and low-emissions vehicles (LEVs), in a policy that is replicates a similar system in
Between 2018 and 2025, the required share of ZEV is expected to increase from approximately 3% to 20% of total vehicle sales (Whitmore and Pineau 2019). See Figure 11 below.

**Figure 11. Required Credits (%) from Car Manufacturer Based on their Sales and Leans of New Cars**


**Quebec Transport Modeling**

The Quebec Ministry of Transport uses five types of models in transportation planning for the province's six major metropolitan areas: Montreal, Quebec City, Trois-Rivières, Sherbrooke, Outaouais and Saguenay (Table 4). The models are based on Origins-Destinations (OD) surveys repeated every five years between the six regions on samples ranging from 5% to 15% of the population (Ministère des Transports du Québec 2019a). Those surveys are done during spring to assemble data on a “typical” business day in the urban zones. There is currently no transport model used for the entire province.
### Table 4. Models Types and Characteristics

<table>
<thead>
<tr>
<th>Model types</th>
<th>Purpose</th>
<th>Models and systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Forecasting Model</td>
<td>Estimate the number and structure of trips that will be made in the future (Ministère des Transports du Québec 2019b)</td>
<td>The demand forecasting model is based on the results of origin-destination surveys crossed with socio-demographic data from the Institut des Statistiques du Québec (ISQ).</td>
</tr>
</tbody>
</table>
| Road Network Assignment Model        | Simulate car travel on the road network. They make it possible to analyze the current or future level of solicitation of the road network. (Ministère des Transports du Québec 2019b) | Macroscopic (Metropolitan area): Aggregate Demand Analysis Model, EMME-2 system (Equilibrium Model/Modèle d’Équilibre) developed by INRO  
Mesoscopic (Sub-regional network): DYNAMES and AIMSUN-2 systems  
Microscopic (Crossroads): AIMSUN-2 system |
| Public Transport Assignment Model    | Simulate travel within public transit systems. They are used to analyze the current transit system or to assess the impact on people's movements of changing the network or creating a new services. (Ministère des Transports du Québec 2019b) | Montréal/Québec: Aggregated Demand Analysis Model (MADEDE), MADIGAS system of MADITUC Group  
Other regions: Aggregate Demand Analysis Model, EMME-2 system developed by INRO |
| Mode Shift Model                     | Estimate the variations in the market shares of the different modes of transport as a result of a change in transport supply or the adoption of a new policy. They make it possible to anticipate changes in the mode of transport of users in function of relative variations in transport supply. (Ministère des Transports du Québec 2019b) | Calculations are programmed directly by the Transportation Systems Modeling Directorate (DMST).                                                                                                                  |
| Emission Modeling System             | Quantify emissions based on expected network traffic. (Ministère des Transports du Québec 2019b)                                                                                                | MOVES system (Motor Vehicles emissions simulator), developed EPA.                                                                                                                                                 |

Sources: (Ministère des Transports du Québec 2019b), (Tremblay et al. 2002), (Ministère des Transports du Québec 2018a), (Ministère des Transports du Québec 2018b), (Ministère des Transports du Québec 2018c) et (Phan 2017).

### Municipal Transport Policies in Quebec

The City of Montreal is the largest municipality in Quebec with 1.7 million inhabitants. In alignment with Quebec policy, the City of Montreal's 2016-2020 Transportation Electrification Strategy proposes the purchase of nearly 1,000 electric or hybrid buses by 2025 and the exclusive acquisition of eclectic buses starting in 2025. Montreal is also aiming to install 1000 electrical charging stations by 2020 in the collaboration with the Circuit Électrique program of Quebec government. The plan also includes measures for car-sharing initiatives, self-service cars, the taxi industry and parking (Ville de Montréal 2016a). Technological innovation and intelligent transportation are also part of the strategy developed by Jalon MTL, Montreal's Institute of Electrification and Intelligent Transportation (Jalon MTL 2019).
The larger Montreal metropolitan area has 82 municipalities and about 4 million people. All municipalities are represented under the authority of the Communauté métropolitaine de Montréal (CMM). The latter has authority in the planning, coordination and funding of land use, public transit, economic development, social housing and environment (CMM 2019). In 2012, the CMM published its Metropolitan Land Use and Development Plan (PMAD). One of the three axes of the plan revolves around public transport. The plan aims in particular to increase the modal share of public transport at rush hour from 25% to 30% by 2021 and to 35% by 2031. The other two axes of the PMAD concern land use and protection of the environment and natural environments (CMM 2012).

A new transportation governance body in the Montréal region since 2017 is the Metropolitan Transportation Regional Authority (ARTM). It plans, finances and organizes the provision of public transport services in accordance with guidelines established by the CMM and laid out in the PAMD. The ARTM oversees the Metropolitan Express Network (REM) project, plans to extend the Montreal metro extension and the Bus Rapid Transit Service (SRB). The agency works with Municipal Public Transit Organizations (OPTC) to manage and coordinate the service offer of each municipality. By example, the City of Montreal has its own public transportation service, the Service de Transport de Montréal (STM), but the coordination for such services in larger metropolitan area are governed by the ARTM. The ARTM bases its service planning on OD surveys conducted every 5 years on 4% of households in the metropolitan region (Autorité régionale de transport métropolitain 2018).

SYNTHESIS AND DISCUSSION

Summary tables of climate, energy and transport policies in Canada, Quebec and Montreal are presented in Figure 12 below. Under the Paris Agreement, Canada’s goal is to reduce emissions by 30% below 2005 by 2030. Canada's climate policy is built around the Pan-Canadian Framework on Clean Growth and Climate Change, where carbon pricing is a key component. The federal strategy has been to establish a federal carbon price as a backstop measure, required in situations where provinces themselves have not implemented a price-based system (like a carbon tax) or cap-and-trade system. In such situations, the federal carbon price would begin at $10 CDN per tCO2e and rise to $50 CDN per tCO2e by 2022. Also significant, the Canadian federal backstop is revenue neutral, meaning that any revenue generated by the federal carbon pricing mechanism is returned to residents of the province by the federal government. Another pillar of Canada's low-carbon strategy is Infrastructure Canada's investment of several tens of billions of dollars in green infrastructure and public transit. Finally, across Canada, the launch of a ZEV mandate and a low-carbon fuel standard is expected before the next federal election in October 2019.

Through the 2013-2020 CCAP, the Quebec government has set 2020 and 2030 targets as reductions of 20% and 37.5% respectively, compared to 1990 emission levels. Quebec was the first province to adopt a ZEV mandate, which came into force in 2018. It is a major pillar of the 2015-2020 Transportation Electrification Plan, which targets 100,000 electric and hybrid vehicles on Quebec roads in 2020 and 300,000 in 2026. The plan includes investments in the transportation system, the development of a network of charging stations and a $8,000 rebate on the purchase of electric vehicle for consumers. There is a strong interest in the electrification of transportation in Quebec, as 98.8% of electricity generation comes renewable sources, largely hydroelectric but also some wind sources. Similar policies at the municipal level in Montreal have been adopted to be consistent with provincial policies.
According to Environment and Climate Change Canada, in 2016, Quebec had reduced emissions on its territory by 11% compared to 1990. The gap between current reductions and targets illustrates the challenge facing jurisdictions aspiring to reduce emissions on in their respective territories. However, there is currently no precise information on the amount of emission allowances purchased by Quebec firms in California via the carbon market, which should be considered when assessing Québec's efforts to achieve its objective of reducing greenhouse gas emissions by 2020 to 20% below 1990 levels. Comprehensive accounting for carbon market transactions is not expected until 2020, although most economic models indicate that Quebec firms will buy significant amounts of allowances to their California counterparts. The implication is that the carbon market is an important element of Québec’s current efforts to mitigate climate change as it allows Quebec companies to reduce their emissions at lower cost in California. The costs of reducing emissions would be significantly higher for Quebec if the carbon market was not linked to that of California.

The importance of the Quebec carbon market is also apparent when looking forward to 2030. The Quebec Ministry of Finance (MFQ) estimates that the carbon market will be responsible for 14% to 20% of the province’s reduction efforts. The MFQ's projections also anticipate a price on the California-Québec common market of between $59 CDN per tCO2e and $93 CDN per tCO2e in 2030. However, certain modeling efforts have indicated that a price close to $100 CDN per tCO2e would be required in Quebec to see significant improvements in technology from Quebec firms to reduce emissions in Quebec. Ultimately, Quebec society will need to decide the appropriate mix of climate mitigation strategies. On one hand, it might adopt higher carbon prices to incite technological and behavioural change for low-carbon transitions while, on the other, it might continue to achieve emission reductions at lower carbon prices outside the province.

In the energy sector, it is important to highlight the interactions between Québec and the Northeastern American states. These states' interest in Hydro-Québec's hydro-electricity comes from the fact that Quebec electricity allows them to reduce their emissions by buying surpluses from the Québec state corporation. The three power line connections to the US that are currently under consideration would increase Hydro-Québec's export capacity by almost 3,300 MW. Among these, the NECEC project aims to respond to the new supply contract in Massachusetts of an additional 9.45 TWh and the commissioning of the new line is scheduled for 2022. In 2018, Hydro-Québec's total net exports were 36.1 TWh.

Finally, this document has sought to paint a portrait of the different models used in the planning and development of climate, energy and transport policies in Quebec. Despite the information presented in this discussion paper, it remains unclear to what extent modeling is considered in policy decision-making process. Several models have been developed and are available to decision makers. More research is needed to determine how these are used, for what purposes, and whether their results influence policy significantly.
### Figure 12. Summary Tables of Climate, Energy and Transportation Policies in Canada, Quebec and Montreal

#### Canadian Policies

<table>
<thead>
<tr>
<th>Policies/programs</th>
<th>Main Stakeholder(s)</th>
<th>Collaborator(s)</th>
<th>Goal(s)</th>
<th>Deposit Date (Deadline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan-Canadian Framework on Clean Growth and Climate Change, 2016</td>
<td>Canadian Government</td>
<td>Provinces and Territories, various ministries, Indigenous People</td>
<td>30% reduction in GHG emissions compared to 2005</td>
<td>2016 (2030)</td>
</tr>
<tr>
<td>Canadian Energy Strategy, 2015</td>
<td>The council of the federation</td>
<td>Canadian Government</td>
<td>Improve the means to produce, move and use energy in Canada</td>
<td>2015 (n/a)</td>
</tr>
<tr>
<td>Transportation 2030</td>
<td>Transport Canada</td>
<td></td>
<td>Support a low-carbon transportation network and technological innovation</td>
<td>2018 (2016-2028)</td>
</tr>
</tbody>
</table>

#### Quebec Policies

<table>
<thead>
<tr>
<th>Policies/programs</th>
<th>Main Stakeholder(s)</th>
<th>Collaborator(s)</th>
<th>Goal(s)</th>
<th>Deposit Date (Deadline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-2020 Climate Change Action Plan</td>
<td>Government of Quebec</td>
<td>15 provincial government departments and agencies, including MTMDET, TEQ and MDDELCC</td>
<td>GHG emission reduction of 30% below the 1990 level</td>
<td>2015 (2020)</td>
</tr>
<tr>
<td>Quebec Cap and Trade System for Greenhouse Gas Emissions Allowances</td>
<td>Government of Quebec and California, under the Western Climate Initiative (WCI)</td>
<td>Ministry of Finance of Quebec, other Quebec ministries</td>
<td>Reduce GHG emissions in the most emitting sectors (transportation, industry, buildings)</td>
<td>2013 (n/a)</td>
</tr>
<tr>
<td>The zero-emission vehicle (ZEV) standard, 2018</td>
<td>Ministry of the Environment and Climate Change</td>
<td>n/a</td>
<td>Stimulate the offer of ZEV and LiBV (22% of ZEV credits required) and reduce GHG emissions from the fleet</td>
<td>2018 (2015)</td>
</tr>
<tr>
<td>The 2030 Energy Policy</td>
<td>Government of Quebec</td>
<td>TEQ, MERN, Hydro-Quebec</td>
<td>Promote green energy, reduce the use of coal and oil, and reduce GHG emissions by 18% compared to 1990</td>
<td>2016 (2020)</td>
</tr>
<tr>
<td>Politique de mobilité durable 2030 (Action Plan 2016-2023)</td>
<td>Government of Quebec</td>
<td>Ministry of transportation</td>
<td>90% reduction in solo car trips and 40% reduction of transportation oil consumption, Investment of $7.8 billion from 2016 to 2023</td>
<td>2018 (2016 and 2023)</td>
</tr>
<tr>
<td>Policies/programs</td>
<td>Main Stakeholder(s)</td>
<td>Collaborator(s)</td>
<td>Goal(s)</td>
<td>Deposit Date (Deadline)</td>
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<tr>
<td>-------------------------------------------------------</td>
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</tr>
<tr>
<td>Greenhouse Gas Emission Reduction Plan for the Montréal Community 2013-2020</td>
<td>City of Montréal</td>
<td>STM, AMT, Sustainable Development Division, other</td>
<td>GHG emission reduction of 30% below the 1990 level</td>
<td>2023 (2030)</td>
</tr>
<tr>
<td>Metropolitan Land Use and Development Plan</td>
<td>Montreal Metropolitan Community</td>
<td>Metropolitan Regional Transportation Authority, Québec Government, Regional county municipalities</td>
<td>Improve transit services and increase their modal share of travel by 15% to 30%</td>
<td>2012 (2025)</td>
</tr>
</tbody>
</table>
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**ADDITIONAL DOCUMENTATIONS**


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