JOINT CLEAN CLIMATE TRANSPORT RESEARCH PARTNERSHIP

JCCTRP Policy Brief on Transport and Climate Policy in Quebec

IQCarbone
Institut québécois du carbone

CONSULAT GÉNÉRAL DES ÉTATS-UNIS
Montréal, Canada

IET INSTITUT DE L'ÉNERGIE TROTTIER

Université de Montréal

Modeling and decision-making for transport and climate policy

Findings from the Phase 1a Workshop of the Joint Clean Climate Transport Research Partnership (JCCTRP)

27 February 2018

INTRODUCTION

Climate change is one of the defining challenges of our time, requiring an unprecedented level of global cooperation to avoid dangerous levels of greenhouse gas emissions (GHG).[1] Despite the recent diplomatic success of the Paris Accord, climate change politics continues to be characterized by gridlock at the international level.[2] In light of such challenges, coordinated action at the sub-national level has increasingly been seen as a hopeful spur to greater climate action through more "bottom-up" political processes.[3] In North America, Quebec, California and, most recently, Ontario have taken an important leadership role in climate policy through a linked greenhouse gas emissions trading system operating under the auspices of the Western Climate Initiative (WCI)—a voluntary cooperative agreement between partner jurisdictions.[4]

In 2015, the WCI was significantly expanded to include transportation-induced emissions, which constitutes the largest source of emissions in all three jurisdictions—38% California, 42% in Quebec and 34% in Ontario.[5] In this context, jurisdictions should aim to anticipate the effects on carbon trading of various GHG emission reduction measures, notably the effects of measures in the transportation sector. Energy systems modeling allows to explore these issues by beginning to attempt to quantify energy pathways and technology scenarios. Equally important is to understand the role that modeling plays in policy decision-making.

In the spirit of facing this challenge, academics and practitioners from across these three jurisdictions as well as the state of Vermont have come together to develop the Joint Clean Climate Transport Research Partnership (JCCTRP). In this policy note, report on a Phase 1a meeting of the JCCTRP held in early November 2017 in Montreal. The JCCTRP aims to build a network of experts tasked with identifying best practices, clarifying links between modeling and decision-making, and formulating concrete propositions to strengthen modeling capacities across partner jurisdictions.

In this policy brief we report on Quebec's efforts to reduce emissions from the transportation sector. Quebec recently committed to an emission reduction target of 37,5% relative to 1990 levels by 2030.[6] Notable measures presented in its *Politique énergétique 2030* are: (i) raise energy efficiency by 15%; (ii) reduce by 40% fossil fuels use; (iii) phase out coal use for power generation; (iv) raise by 25% power generation from renewable energy sources; and (v) raise bioenergy production by 50%.[7] Below we present some of the key modeling tools and policies that Québec will use to reach these ambitious targets. However, there is reason for concern: emissions in Quebec's transport sector have proven difficult to reduce, driven by a significant increase in light-duty trucks sales (Figure 1).

Figure 1 : Recent emission and market trends in Quebec's transport sector

(a) Energy use and GHG emissions from the transport sector, 1990-2014.
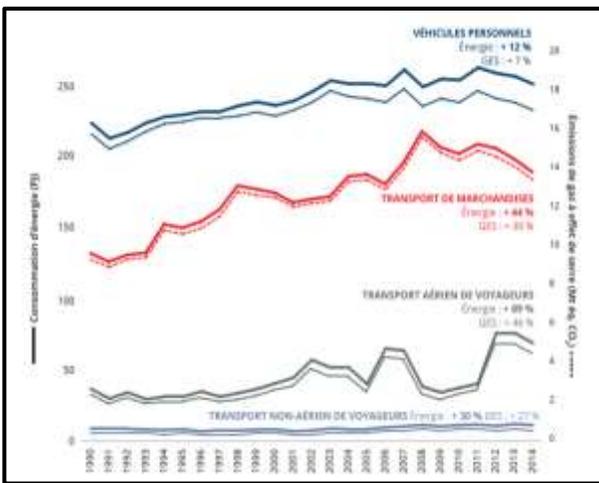
(b) Value and volume of vehicle sales in Quebec, by vehicle type, 1990-2016.
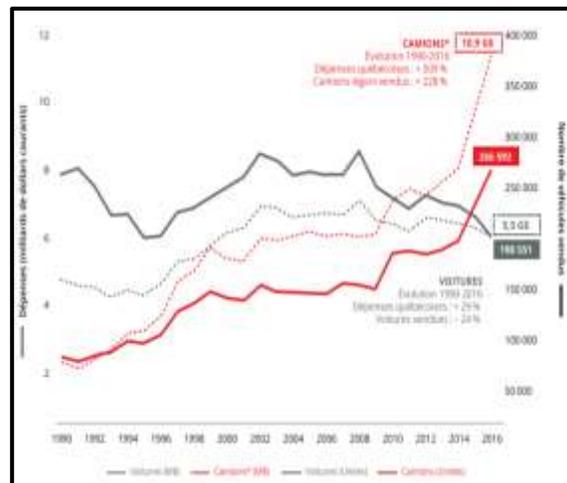
Source : Whitmore J and Pineau P-O (2017) État de l'énergie au Québec 2018, Chaire de gestion du secteur de l'énergie, HEC Montréal, Montréal, pages 26, 28.

MODELING CAPACITY IN CANADA AND QUEBEC

Quebec's transport and climate policy are bound to be influenced by the federal government's modeling efforts. Canada has developed respectable capacities in energy-systems modeling, distributed within three federal entities, some Canadian universities and a few consulting firms. The National Energy Board (NEB), Environment and Climate Change Canada (ECCC), and Natural Resources Canada (NRCan) developed models to forecast energy markets and GHG emissions.

However, a number of challenges present themselves. First, very few federal planning and modeling initiatives have been documented in the transportation sector.[8] One notable exception is the *Plug-in Electric Vehicle – Charge Impact Model* (PEV-CIM), developed by NRCan to estimate the impact of electric-vehicle market uptake on power demand and GHG emissions in Canada.[9] Second, another important challenge is that climate and transport policy is a shared jurisdiction of federal, provincial and municipal governments, meaning that many of the modeling efforts of the Canadian federal government might find it difficult to gain traction in provincial-level policy discussions.[10]

Some Canada universities and associated consulting firms have developed advanced modeling capacities. Most efforts target energy systems and as such transportation sector analysis is often provided only by indirect modeling, as a component of the energy system.[11] However, there are some modeling efforts specific to transportation. The Canadian Energy Research Institute (CERI) developed a model of personal vehicle fleet turnover.[12] Simon Fraser University in British Columbia hosts the Sustainable Transportation Action Research Team, which is responsible for the development and use of a transit demand simulation model, the REspondent-based Preference and Constraint (REPAC) model.[13] REPAC uses data drawing from a wide range of disciplines including economics, engineering, public opinion, marketing and psychology. It allows to compare the costs and benefits of policies aiming to incentivize zero emission transit, by tapping into an individual-level understanding of transit demand.

In Quebec, participants to the JCCTRP workshop have noted that the provincial government does not have sufficient modeling capacity to undertake integrated analysis of the impacts and interactions of climate, transport and energy policies. Again university researchers are playing a key role. In terms of data collection and analysis, researchers at HEC have been publishing *L'État d'énergie au Québec* since 2015, compensating for the Quebec government's lack of energy surveys.[14] In terms of modeling, ESMIA Consultants developed the most advanced TIMES model for Canada, a component of the NATEM (North American TIMES Energy Model) platform,[15] refined through research projects undertaken at HEC Montreal. Notably, NATEM can be tailored to 13 Canadian provinces and territories. An analysis undertaken with NATEM has led to the identification of important opportunities to reduce emissions, including the electrification of the Canadian transportation sector.[16] See Figure 2 for an overview of the complexity of the interactions NATEM seeks to model. The Centre interuniversitaire de recherche sur les réseaux d'entreprises, la logistique et le transport (CIRRELT) has conducted research on freight optimization using integrated assessment models.[17] CIRRELT brings together a number of university researchers active in the area of transport and logistics, including experts in more micro-level transport and land-use modeling. Finally, additional energy modeling expertise can be found in Québec's private sector, including Dunsky Expertise en énergie and Daméco.[18]

Figure 2 : Overview of NATEM

(a) NATEM Reference Energy System.

(b) NATEM Transport Sector.

Sources : Vaillancourt, K., Bahn, O., Frenette, E., Sigvaldason, O., 2017. "Exploring deep decarbonization pathways to 2050 for Canada using an optimization energy model framework", Applied Energy 195, 774-785.; TEFP - Trottier Energy Futures Project (2016) Canada's challenge & opportunity – Transformations for major reductions in GHG emissions. [Online] http://iet.polymtl.ca/en/tefp

Despite these efforts and current capacities, participants to the JCCTRP workshop identified opportunities for improvement, notably with respect to the development of models linking the energy-system, emissions and the transportation sector. Of considerable importance would be to clarify the relationship between macro-models applicable at the provincial-level like NATEM and micro-level transport models amenable to land-use planning and municipal decision-making. Moreover, actual models have two important drawbacks. First, available data are unsatisfactory: modeling experts must be able to rely on a more extensive dataset and on up-to-date data. Second, it is imperative to integrate demand behaviour modules to transit and energy models. Refining our understanding of behaviour is key to modeling technology uptake, which in turn is key to energy and emission forecasting. The Institut de l'Énergie Trottier, housed at the École Polytéchnique, has begun to take a leadership role in organizing climate and energy modeling efforts in Canada and Québec.[19]

MODELING AND DECISION-MAKING IN CANADA AND QUEBEC

Despite growing modeling expertise in Quebec, some JCCTRP workshop participants pointed to the lack of coherence between the provincial emission reduction targets and the measures adopted by the government. For example, Normand Mousseau of IET has estimated that the emission reduction measures listed in *Politique énergétique 2030* would only reduce emissions by 30% from 1990 levels by 2030, which is insufficient to meet the 37.5% target.[20] The target could, however, be met by reductions in other sectors or by the purchase of emissions allowances from other jurisdictions through the carbon

market. Perhaps more concerning is that the actions outlined in *Politique énergétique 2030* are not based on a transparent modeling effort. It is not clear what the expected impact of the proposed policy measures would have on emissions—a sharp contrast with the role of modeling in California's Scoping Plan (see JCCTRP Policy Brief, California).

Similar concerns were raised about the coherence between climate, transport and energy policy bodies, particularly the recently established Transition énergétique Québec (TEQ). Established in 2017, TEQ is responsible for the administration of several energy efficiency programs targeting individuals, corporations, organizations and institutions. TEQ also publishes the efficiency measures of the programs it supervises, including the GHG emissions reduction (Figure 3). Unfortunately, TEQ was not able to participate in the JCCTRP and it would be important to learn more about the role of modeling in its deliberations. While many JCCTRP participants were impressed with TEQ's ambition, questions remained. For example, while ostensibly an independent agency of the Ministry of Energy and Naturel Resources, TEQ is reliant for its budget on the Green Fund generated through the carbon market auctions and managed by the MDDELCC. Will TEQ have the authority to ramp up program spending if its actions do not deliver the expected results?

Overall, the impact of modeling on Quebec government's transport and energy policies is largely unknown. It is unknown whether actual transportation sector modeling outputs are integrated to the decision-making process, at the different government levels. As noted by JCCTRP workshop participants, Canada and Quebec government bodies are not mandated by law to take into account modeling outputs to design or assess policy options. Important delays in data gathering and the absence of a legally binding obligation to use simulations suggest modeling has a negligible impact on policy. Part of the challenge is undoubtedly to better integrate micro- and macro-level transport models, given that so much decision-making authority for transport is found at the municipal level. Here new organizations like The Montreal Institute of Electric and Intelligent Transportation, established by the City of Montreal only in 2017, could also play a crucial role. Renewed attention to modeling in Quebec creates an opportunity to clearly delineate its actual importance and the role it should bear in Quebec climate policy-making.

Finally, when discussing the role of energy and transport system modeling in the decision-making process, it is also important to underline the uncertainty surrounding the scenario modeling and cost assumptions, especially of emerging technologies. Conveying findings along with uncertainties to decision-makers is a key challenge. It is particularly at this level where the JCCTRP hopes contribute, by help decision-makers and the public understand what energy and transport system models can and can't tell us.

Figure 3 : Programs administered by Energy Transition Quebec

CONCLUSION

In comparison to California, which is a world leader for integrating modeling efforts with transport and climate policy-making,[21] the JCCTRP found room for improvement in Quebec. It has been decisively shown that governments are key actors in the social and technological innovation process. This role may need to be intensified to transition in an efficient and timely manner to low-carbon energy-systems and to stabilize the climate. To do so, it is imperative to enhance our understanding of how modeling best contributes to the policy decision-making process.

As modeling has recently been benefitting from greater levels of attention and support in Quebec, it is important to point out that the analysis of energy-emissions-transportation interactions has not been the focus of any systematic effort. In addition, much of existing modeling capacity is concentrated at the provincial-level. The absence of modeling capacities at more local levels poses a challenge for the design, implementation and assessment of transportation policies at regional, municipal and local scales. We anticipate that models will be adapted to account for finer resolutions: they will spatial-specific and they will take into account land-use planning and infrastructure. The challenge here will be to ensure that such

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micro-level transport models relate to macro-level models in order to ensure that Quebec stays on track to achieve its emission reduction targets.

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