

Progress Report on Montréal's 2013-2020 Citywide Greenhouse Gas Emissions Reduction Plan



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LIST OF ABBREVIATIONS

\$... B	billion dollars	MTMDET	Ministère des Transports, de la Mobilité durable et de l'Électrification des transports (ministry of the transport, sustainable mobility and transport electrification)
\$... M	million dollars	ODS	ozone-depleting substances
AMT	Agence métropolitaine de transport	PACC	2013-2020 Climate Change Action Plan
ARTM	Autorité régionale de transport métropolitain (metropolitan regional transit authority)	PHEV	plug-in hybrid electric vehicle
BAPE	Bureau d'audiences publiques sur l'environnement (office for public hearings on the environment)	PMAD	Metropolitan Land Use and Development Plan
BEV	battery electric vehicle	pp	percentage point
BPM	bus preferential measures	QIP	Québec Infrastructure Plan
BRT	bus rapid transit	REM	Réseau Électrique Métropolitain (light rail network)
BVIN	Bureau de la ville intelligente et numérique (smart and digital city office)	RTL	Réseau de transport de Longueuil (Longueuil's transit network)
CO₂ eq	carbon dioxide equivalent	RTM	Réseau de transport métropolitain (metropolitan transport network)
CMM	Communauté métropolitaine de Montréal (Montréal metropolitan community)	SAAQ	Société de l'assurance automobile du Québec (Québec's automobile insurance board)
CSV	car-share vehicle	SOFIL	Société de financement des infrastructures locales du Québec (Québec's funding body for local infrastructures)
ECCC	Environment and Climate Change Canada	STL	Société de transport de Laval (Laval's transit corporation)
GHG	greenhouse gas	STM	Société de transport de Montréal (Montréal's transit corporation)
HEV	hybrid electric vehicle	SUV	sport utility vehicle
IPPU	industrial processes and product use	TECQ	Programme de la taxe sur l'essence et de la contribution du Québec (Québec's gas taxation and contribution program)
kt	kilotonne	TEQ	Transition énergétique Québec (Québec's energy transition body)
LEV	low-emission vehicle	TJ	terajoule
LRT	light rail transit	TOD	Transit-Oriented Development
LTNF	Land Transportation Network Fund	ZEV	zero-emission vehicle
m²	square metre		
MDDDELCC	Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (ministry of sustainable development, the environment and the fight against climate change)		





SUMMARY

Since 2002, the Montréal agglomeration has been engaged in a collective process to fight climate change. The Progress Report on Montréal's 2013-2020 Citywide Greenhouse Gas Emissions Reduction Plan bears witness to the efforts devoted and the progress achieved toward the 12 potential solutions proposed to the citywide community, as well as suggesting directions to consider for the challenges that remain.

Let's recall that in 2014, when the last inventory was carried out, we had reduced emissions by 23% compared to the reference year (1990), while the objective to reach by 2020 is 30%. Emissions reductions of 30.1% compared to the reference year have been observed in stationary energy (residential, commercial, institutional and industrial) and in waste sectors. These reductions were partly cancelled out by the increase of emissions from the transportation sector (+3.8%) and industrial processes and product usage (+3.2%, mainly attributable to the increase in fugitive emissions of refrigerant gas).

State of progress in 2017

This progress report allowed us to make a number of observations about the sources of increasing greenhouse gas emissions (GHGs), the progress achieved and the efforts that must still be made. Table 1 on the next page shows the progress on the various solutions proposed in 2013.

The collated indicators seem to show the Montréal agglomeration is not on track to reach its reduction target of 30% by 2020. Since 2013, household car ownership has accelerated, cylinder capacity has grown, and the modal share of public transportation has shrunk, despite major investments made since 2013 to maintain and increase available public transportation. It's therefore reasonable to suppose that emissions from the transportation sector have increased since 2014 and that this trend will continue, accentuating the gap in reaching the reduction target for 2020. As well, the data we consulted did not predict that any further substantial reductions will materialize by 2020, nor that such reductions could sufficiently compensate for the impact of the expected increases in the transportation sector.

For these reasons, we recommend an update to the Reduction Plan to help the Ville reach its reduction target. However, there is *one sine qua non* condition that will maximize the chances of success: this update must be created in coordination with citywide players as a group.

Potential directions from now to 2030

Potential directions, listed below, are also proposed in regard to mobility, land use planning, stationary energy, awareness-raising and new sources of GHGs, while taking into account current emissions and reduction targets for 2030 and for 2050.

1. Include quantified objectives for reducing the number of solo driving commuters within targets for urban planning and for public and active transport development.
2. Implement significant dissuasive measures against large cylinder capacity vehicles and against excessive household car ownership.
3. Adopt ecofiscal measures regarding free parking.
4. Consider putting into place a Mobility as a Service (MaaS) system.
5. Accelerate the production frequency of mobility-related data.
6. Diversify revenue sources dedicated to funding public transportation.
7. Target GHG emissions from stationary energy in order to reach short-term objectives.
8. Consider GHG reduction objectives in the Ville's housing subsidy programs.
9. Accelerate the adoption of supply requirements for renewable natural gas.
10. Include new sources in the GHG emissions inventories and reduction plans.
11. Produce a GHG reduction guide for citizens.

Table 1
Summary of 2017 progress on potential solutions proposed in the 2013-2020 Reduction Plan

Progress indicators toward targets:						
		Significant		Moderate		Stable or backslide
Potential solutions	2013-2020 targets	Summary of progress in 2017	Progress			
Residential, commercial and institutional						
1. Improve the energy efficiency of buildings	Bring energy consumption down to its 1990 levels or below in the commercial and institutional sector	1.51 GJ/m ² in 2014 1.97 GJ/m ² in 1990				
	Reduce energy consumption by 5% per m ² in residential buildings	0.79 GJ/m ² in 2014 1.00 GJ/m ² in 1990				
2. Reduce fuel oil consumption	Eliminate fuel oil from residential, commercial and institutional buildings	6% of energy supply in 2014 16% of energy supply in 1990				
3. Encourage the use of renewable energy	Carry out at least one large-scale renewable energy use project	25 geothermal energy projects in 2016 and three solar energy projects from 2014 to 2016				
Transportation						
4. Appropriately fund projects to reduce GHG emissions in transport	Ensure appropriate funding for projects that contribute to reducing GHG emissions in transport	<p>Increased funding for public transportation:</p> <ul style="list-style-type: none"> » increase of \$582 M (103%) from the Société de financement des infrastructures locales du Québec (SOFIL, Québec's funding body for local infrastructures) for 2014-2019 as compared to 2010-2014 for all of Québec » increase of \$369.3 M (84.1%) from the Land Transportation Network Fund (LTNF) in 2016-2017 as compared to 2013-2014 for all of Québec » increase of \$42.2 M (9%) from the agglomeration to public transportation companies in 2016 as compared to 2013 <p>Results observed:</p> <ul style="list-style-type: none"> » 14% increase in emissions from the transportation sector in 2014 as compared to 1990 » stagnation of public transit ridership with the Société de transport de Montréal (STM) and the Agence métropolitaine de transport (AMT) in 2016 as compared to 2013 » stability of the STM's asset maintenance deficit in 2016 as compared to 2013 				
5. Gather data to help better evaluate the factors that influence GHG emissions in transport and ways to reduce them	Put into place a data collection system to help better understand mobility behaviours and their impacts on GHG emissions	12 carried-out or in-process projects catalogued (ex.: Waze and MTL Trajet)				

Progress indicators toward targets:

 Significant  Moderate  Stable or backslide

Potential solutions	2013-2020 targets	Summary of progress in 2017	Progress
6. Develop public transit	Create a modal shift of five percentage points from personal vehicles to public transit ^A	Modal shifts in morning rush hour in 2013 as compared to 2008 ^B : <ul style="list-style-type: none"> • public transit: -0.8 pp • automobile: +1.9 pp • active transportation: +0.3 pp 	
7. Optimize parking			
8. Manage transport demand effectively			
9. Develop active transportation	Create a modal shift of three percentage points from personal vehicles to active transportation ^A		
10. Develop other methods of transportation as alternatives to solo driving (car-sharing and taxis)	Stabilize the rate of car ownership at 0.79 vehicles per household ^A	0.899 vehicles per household in 2016	
11. Reduce GHG emissions per vehicle	Reduce the average consumption of vehicles sold in 2020 to 6.0 L/100 km for light vehicles and to 2.1 L/100 tonnes-km for heavy vehicles	<ul style="list-style-type: none"> • Light vehicles: 9.6 L/100 km in 2016 • Heavy vehicles: 2.3 L/100 t-km in 2012 	
	Bring the percentage of taxis using hybrid engines up to 50% on the island of Montréal	30% of taxis use hybrid or fully electric engines in 2017	
12. Facilitate the governance of transport projects	Clarify and simplify transportation governance in the Montréal agglomeration	Launch of the Autorité régionale de transport métropolitain (metropolitan regional transportation authority, or ARTM) on June 1, 2017	
Further solution areas			
Waste	Contribute to reducing Montréal's citywide GHG emissions by 30% for 2020 as compared to 1990	GHG emissions reduced by 78% in 2014 as compared to 1990 (contributing about 44% of total reduction)	
Stationary energy in manufacturing and energy industries	Contribute to reducing the Montréal community's GHG emissions by 30% for 2020 as compared to 1990	GHG emissions reduced by 37% in 2014 as compared to 1990 (contributing about 39% of total reduction)	

A. The target was determined based on data from the 2008 Origine-Destination study.²

B. The next Origine-Destination study will be carried out in 2018 and the results will be available in 2020.

Note: Justifications for the progress indicators and the references that explain progress are provided in the following chapters.

**IN 2005, MONTRÉAL
COMMITTED TO REDUCING
ITS CITYWIDE GREENHOUSE
GAS EMISSIONS BY 30% FOR
2020 AS COMPARED TO 1990.**



INTRODUCTION

This document presents a follow-up on the implementation of the potential solutions proposed in the Plan de réduction des émissions de gaz à effet de serre de la collectivité montréalaise 2013-2020⁹⁰ (Montréal's 2013-2020 plan to reduce citywide greenhouse gas emissions; hereafter, the Reduction Plan), using the most recent available data for 2013-2017. The objective of this exercise is to determine whether or not it is necessary to revise the plan's objectives based on the observations made in 2017 and the evolution of Montréal's citywide greenhouse gas (GHG) emissions sources.

2013-2020 Reduction Plan: 12 potential solutions proposed to the citywide community

The Reduction Plan was produced as a basic tool for the GHG emissions reduction process. It was adopted by the agglomeration council on September 26, 2013 (resolution CG13 0416). The 12 proposed potential solutions and targets were set in order to reach the GHG reduction target set in 2005. Among other things, they are aimed at the activity sectors responsible for the majority of GHG emissions in the Montréal agglomeration: the residential, commercial, institutional and on-road transportation sectors.

Caution!

The data and actions collected in this progress report must be considered as being for information purposes only when it comes to understanding citywide progress in relation to the potential solutions in the Reduction Plan. It's also important to remember that the indicators presented here do not necessarily provide a complete picture of the Montréal agglomeration's fight against climate change. This progress report cannot be considered an exhaustive examination of all the actions taken citywide, in particular those that do not fall under the Ville de Montréal's direct control. As well, let's note that the information presented here was obtained based on the available data and the current state of our knowledge about emissions and GHG emissions reduction. So it is possible that, in the future, new data will call for a revision of the information contained here.



Reduction targets were not specifically set for the industrial and waste sectors, considering that ongoing work was already helping to reduce GHG emissions, specifically the creation of the *Regulation respecting a cap-and-trade system for greenhouse gas emission allowances*⁴⁰ for industries and the Programme de traitement des matières organiques par biométhanisation et compostage⁵², a program for recycling organic waste material by means of biomethanization and composting. In fact, the reduction rate for GHG emissions observed in 2014, as compared to 1990, was 37% for manufacturing and energy industries and 78% for the waste sector, surpassing the 30% reduction target for 2020.

Reminder of reduction targets

In 2005, the Ville de Montréal committed to reducing citywide GHG emissions by 30% for 2020 compared to the reference year (1990). Since then, the Montréal administration has endorsed the declaration from the Climate Summit for Local Leaders held in December 2015 in Paris as part of COP21 (the 21st annual Conference of Parties, also known as the Paris Climate Conference). Among other things, this commitment aims to reduce citywide GHG emissions by 80% for 2050, a target included in the Sustainable Montréal 2016-2020 Plan⁹³, with an intermediate target for 2030, so that local governments overall reduce GHG emissions by 3.7 Gt beyond national commitments.

BACKGROUND

The scope of the GHG emissions inventories and reduction plans is citywide, meaning the entire territory covered by the Montréal agglomeration. The agglomeration manages some services in matters of common interest, such as police services, fire safety, water production and wastewater treatment. The reconstituted cities and boroughs, for their part, manage what we call local services. Among other things, they administer public works, urban design, and sports and recreation.

Citywide GHG emissions from Montréal as it faces reduction objectives

Table 2, excerpted from the *Inventaire 2014 des émissions de gaz à effet de serre de la collectivité montréalaise*⁸⁰ (the 2014 inventory of Montréal's citywide greenhouse gas emissions; hereafter, the 2014 inventory), presents citywide GHG emissions in 1990 and in 2014, as well as the variations between the two years (see next page). We can see that emissions dropped by 23% in 2014 as compared to the reference year. Knowing that GHG emissions reduction reached 3,457 kt CO₂ eq in 2014 and that the 30% reduction objective for 2020 represents 4,489.5 kt CO₂ eq, we need an additional reduction effort of 1,032.5 kt CO₂ eq in order to reach the objectives. Note also that citywide emissions changed little from 2013 to 2014.

On the basis of the 2014 inventory, the two sub-sectors that present the highest increases, with 969 kt CO₂ eq in absolute variation, are:

- Transportation – on-road: increase of 494 kt CO₂ eq (3.3% of the agglomeration's total emissions in 1990);
- Industrial processes and product use (IPPU) – product use: increase of 474 kt CO₂ eq (3.2% of the agglomeration's total emissions in 1990).

GHG emissions from the transportation sector increased by 14% in 2014 as compared to 1990, representing 40% of overall emissions. On-road transportation alone represents 87% of the total increase of GHG emissions for this sector. More specifically, they grew 16% between 1990 and 2014.



This increase, also observed in 2013, can be attributed to the 19% increase in the number of licensed vehicles on the territory as a whole and the 179% increase in light trucks (sport utility vehicles, small trucks and vans), despite a population increase of only 9%. On the other hand, the number of light vehicles (cars and taxis) dropped by 8% during this same period.

The 76% increase in GHG emissions from the IPPU sector between 1990 and 2014 can be attributed to the increased production and consumption of halocarbons (cooling gases used as substitutes for ODS), sulphur hexafluoride and nitrogen trifluoride, whose emissions were negligible in 1990 (0.5 kt CO₂ eq). Hydrofluorocarbons (HFC) and perfluorocarbons (PFC) are used for refrigeration and the manufacturing of plastic foams, solvents, propellants and anesthetics.

Emissions from the stationary energy sector dropped by 36% between 1990 and 2014, contributing to the overall reduction observed. The gradual move away from fuel oil, the variation of manufacturing companies' activity levels and the reduced GHG emission factor for electricity count among the main factors that have contributed to the observed reductions.

Emissions from the waste sector dropped by 78% between 1990 and 2014, which also contributed to the overall reduction. Improvements to the detection systems for biogas emitted by landfills are the main factor behind this reduction.

We can thus conclude that, if emissions from the IPPU and on-road transportation sectors had remained constant, the reduction objectives for 2020 would have been reached in 2014.

Public consultations

At public consultations held by the Commission sur l'eau, l'environnement, le développement durable et les grands parcs (committee on water, the environment, sustainable development and large parks), participants made a range of recommendations about building design from a sustainable development perspective on the Ville de Montréal territory.⁸¹ The public also made recommendations about reducing Montréal's dependence on fossil fuels⁵³ at public consultations held by the Office de la consultation publique de Montréal (OCPM, Montréal's public consultation office). These recommendations, presented on the next page, could have an impact on reducing citywide GHG emissions.

Table 2
Montréal citywide GHG emissions in 1990 and in 2014⁸⁰

Activity sectors and sub-sectors	Emissions (kt CO ₂ eq)		Variation
	1990	2014	%
Stationary energy	8,320	5,332	-36
Residential	2,310	1,236	-47
Commercial and institutional	2,319	1,755	-24
Manufacturing industries and construction	1,506	1,238	-18
Energy industries	2,171	1,093	-50
Fugitive emissions	15	11	-27
Transportation	4,048	4,616	14
On-road	3,073	3,567	16
Off-road	10	11	8
Railways	148	189	27
Waterborne navigation	325	272	-16
Aviation	491	578	18
Waste	1,956	437	-78
Disposal of solid waste	1,787	315	-82
Biological treatment of organic waste	–	8	–
Incineration of waste	137	76	-45
Wastewater treatment	33	38	15
Industrial processes and product use (IPPU)	634	1,117	76
Industrial processes	171	180	5
Product use	463	937	103
Agriculture, forestry and other land use (AFOLU)	6.7	5.7	-15
Enteric fermentation and manure management	6	4	-26
Agricultural soil management	0.7	1.1	69
Liming, urea and other carbon-based fertilizers	0.04	0.12	172
Total	14,965	11,508	-23

Note: The results presented here are rounded. For this reason, calculations made from these data may differ from the values presented.

Table 3
Recommendations emerging from public consultations

Recommendation number and description	
Commission sur l'eau, l'environnement, le développement durable et les grands parcs⁸¹	
R-6	Make sure that information and awareness-raising sources are available regarding the sustainable construction, renovation and maintenance of buildings as part of the support provided through housing financial aid programs.
R-17	In the <i>By-law concerning the construction and conversion of buildings</i> (11-018) ¹⁰² , include the requirements for the energy-related performance of materials and equipment present inside buildings (insulation materials, light bulbs, certified doors and windows, programmable electronic thermostats, etc.).
R-18	For new residential building developments, ensure that passive solar planning is implemented and plan for the possibility of implementing an overall adapted land use plan by developing grids of east-west streets and by regulating the way buildings are added (bioclimatic design).
R-19	Progressively ban the use of fuel oil for existing heating systems and completely ban its use in Montréal buildings, while encouraging energy transition projects toward renewable energy.
R-20	Roll out comparative energy analysis mechanisms for municipal buildings, disclose their results and reassess their air conditioning and heating performance from an energy efficiency perspective.
R-21	Consider and, when possible, opt for geothermal energy as a heating and air conditioning source for municipal buildings.
R-22	Encourage the use of geothermal energy, thermal and photovoltaic solar energy, and all other forms of locally produced renewable energy.
R-24	Implement comparative energy analysis mechanisms, meaning the collection and disclosure of standardized data on buildings' energy performance, first by targeting major energy consumers. The Ville de Montréal should set precise targets to reach in this regard.
R-37	Emphasize active, public and eco-friendly transportation and reduce the impact of parking lots on the sustainable design of neighbourhoods as part of rolling out the new <i>Politique de stationnement</i> ¹⁰¹ (parking policy). (Include safe spaces to lock bicycles, provide parking spaces for carpooling and car-sharing vehicles, include charging stations for electric vehicles, reduce parking spaces.)
Office de la consultation publique de Montréal¹⁵³	
2	Provide alternatives to single-person cars (reduce parking spaces, support car-sharing options, allocate parking spaces, design reserved lanes for carpooling). The Ville must encourage the boroughs to adopt a local transportation plan by taking inspiration from the borough of Saint-Laurent's current bylaw. ^{91, 96} To convert lanes in the urban highway network, the Ville de Montréal should exert political leadership within the Communauté métropolitaine de Montréal (Montréal metropolitan community, or CMM) and with the Ministère des Transports (Québec's ministry of transport, or MTQ).
3	Ban the construction of multi-level parking garages and allow the reduction of the number of parking spaces required in new buildings in the central neighbourhoods that are well served by public transportation.
7	Develop active transportation (adopt Vision Zero; develop the bike path network; create safe spaces to lock bikes near metro, commuter train and bus line stations; promote the Trotibus).
8	Ensure smooth traffic flow by banning heavy weights and delivery trucks on the territory at rush hour.
10	Without delay, adopt high energy efficiency and building quality requirements, update them regularly, and then intervene with the Québec government to revise the provincial construction code.
11	Adopt new regulatory standards to increase buildings' energy efficiency.
12	Put into place simple, easy-to-access financial aid programs in order to help small owners in the residential and commercial sectors to renovate their buildings and improve their energy performance.
13	Develop fiscal and regulatory tools to accelerate the renovation of empty buildings and prevent them from deteriorating.
15	Engage in education work with Montréalers, particularly by means of public information, education and awareness-raising campaigns about behaviours that help reduce everyday fossil fuel consumption.



09
RÉSERVÉ

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RÉSERVÉ

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Potential Solution 1

Improve the energy efficiency of buildings

2013-2020 targets

- Bring energy consumption down to its 1990 levels or below in the commercial and institutional sector (1.97 GJ/m² in 1990).
- Reduce energy consumption by 5% per m² in residential buildings (1.00 GJ/m² in 1990).

Energy consumption levels for 1990 have been recalculated in keeping with the revisions made to the data sources and with the methodological changes made when we produced the Inventaire des émissions de gaz à effet de serre 2013 de la collectivité montréalaise (the 2013 inventory of Montréal's citywide greenhouse gas emissions).⁷⁹ As such, today the 1990 residential sector number is estimated to have been 1.00 GJ/m², while in the Reduction Plan it had been estimated at 1.10 GJ/m². The commercial and institutional sector number in 1990 is estimated today to have been 1.97 GJ/m², while in the Reduction Plan it had been estimated at 2.17 GJ/m².

Indicators

Table 4 presents the indicators that help us understand current citywide performance against the targets.

Table 4
Indicators regarding buildings' energy efficiency

Indicators	Data	Observations
Intensity of energy consumption in residential sector buildings	0.79 GJ/m ² in 2014 ⁸⁰	20% reduction from 1990
Intensity of energy consumption in commercial and institutional sector buildings	1.51 GJ/m ² in 2014 ⁸⁰	23% reduction from 1990

Actions

Sustainable buildings in Montréal

From 2013 to 2016, a number of sustainable building projects were carried out on the agglomeration's territory, aiming to optimize energy performance, among other things. The listed certifications are as follows:

- 93 projects following LEED certification²⁴ and covering 2,558,219 m²;
- 112 BOMA BEST certified projects¹⁹ from 2013 to 2016;
- Two projects in the process of achieving Passive House certification*;
- One Living Building Challenge project.**

Québec government programs to improve energy efficiency

We estimate that from 2013 to 2016, 7,716 energy efficiency projects aiming to reduce the consumption of natural gas were carried out on the agglomeration's territory, making for an average annual reduction of 32.7 kt CO₂ eq (98.2 kt CO₂ eq over three years), or 0.2% of Montréal's citywide GHG emissions in 1990.***

* Maison Passive Québec, data obtained by email, July 2017.

** Living Building Challenge, data obtained by email, June 2017.

*** Énergir Inc., data obtained by email, 2017.

According to data obtained from Transition énergétique Québec (Québec's energy transition body, or TEQ), 12,347 projects related to the Novoclimat (3,899) and Rénoclimat (8,448) programs were conducted on the agglomeration's territory from 2008 to 2016. TEQ estimates the energy savings resulting from these projects at 198,290 GJ, or 0.25% of the energy consumption of residential buildings in 1990. The avoided GHG emissions are estimated at 5.9 kt CO₂ eq, or 0.04% of Montréal's citywide GHG emissions in 1990. These data show that on average, the energy savings per participant is 16.1 GJ, or 11% of the average household energy consumption.⁵⁴

As part of measures 18.1 (Programme d'efficacité énergétique et de conversion vers des énergies moins émettrices de GES, a program for energy efficiency and conversion to forms of energy with lower GHG emissions) and 20.1 (Conversion et efficacité énergétique dans les bâtiments commerciaux et institutionnels, for conversion and energy efficiency in commercial and institutional buildings) from the Québec government's 2013-2020 Climate Change Action Plan (PACC 2013-2020)⁵¹, 61 projects targeting energy efficiency improvement were catalogued for 2014-2016.

Energy efficiency standards

At the provincial level, let's note that on August 30, 2012, new and higher energy efficiency standards (equivalent to Novoclimat 1.0) took effect for the construction and expansion of dwellings with at most three storeys and at most 600 m² of building area.

In May 2016, the Ville de Montréal city council tasked the Commission sur l'eau, l'environnement, le développement durable et les grands parcs (committee on water, the environment, sustainable development and large parks) with formulating recommendations for building design from a sustainable development perspective.⁸¹ A number of the Commission's recommendations address the improvement of buildings' energy efficiency (see Table 3).

Ville de Montréal renovation programs

From 2009 to 2016, the Ville de Montréal subsidized renovation projects for 2,146 buildings containing 9,933 apartments. The Ville's subsidy programs are Renovation à la Carte, Major Residential Renovation, and Stabilization of Residential Building Foundations.⁷⁷ When renovation projects include doors and French windows, the Ville requires that new components be ENERGY STAR certified in order to qualify for the subsidy. As well, as part of an agreement with Hydro-Québec to administer the Programme rénovation énergétique pour les ménages à faible revenu pour le volet privé – municipalités¹⁰⁷ (private energy renovation program for low-income households – municipalities) on the Ville de Montréal territory, the Ville quantifies the energy savings for certain projects that involve the insulation of exterior walls, roofs and foundations and provides this information to Hydro-Québec. No up-to-date data are available regarding the expected or achieved energy savings and GHG emissions reductions for renovation projects that fall under these programs.

Conclusion

The data indicate that the targets for this solution have been surpassed as of 2014. If we consider that GHG emissions attributed to the residential, commercial and institutional sectors were estimated at 2,991 kt CO₂ eq in 2014, or 26.0% of total emissions, and that 95% of these emissions came from the use of fossil fuels, there is still the potential to further reduce by prioritizing the conversion of fossil fuel sources to renewable energy sources.



Potential Solution 2

Reduce fuel oil consumption

2013-2020 target

- Eliminate fuel oil from residential, commercial and institutional buildings.

Indicators

Table 5 presents the indicators that show current citywide performance relative to the target.

Actions

Programs to improve energy efficiency

According to the data obtained from TEQ, there were 2,337 listed participants in *Chauffez vert* (a clean heating incentive program) on the Montréal agglomeration's territory from 2013 to 2016. TEQ estimates that the reduction of annual recurring GHG emissions from all the projects that it has subsidized on the agglomeration's territory reached 15.5 kt CO₂ eq in 2016.*

Under measures 18.1 (Programme d'efficacité énergétique et de conversion vers des énergies moins émettrices de GES, a program for energy efficiency and conversion to forms of energy with lower GHG emissions) and 20.1 (Conversion et efficacité énergétique dans les bâtiments commerciaux et institutionnels, for conversion and energy efficiency in commercial and institutional buildings) from the PACC 2013-2020, five projects targeting the total or partial conversion of energy sources toward ones with lower GHG emissions were listed for 2014-2016, including at least one targeting fuel oil.

* The *Chauffez vert* program aims to replace fossil fuel systems (not counting natural gas) by electrical systems and other renewable energies.

** Énergir Inc., data obtained by email, 2017.

Table 5

Indicators regarding fuel oil usage in residential, commercial and institutional buildings

Indicators	Data	Observations
Energy consumed from light fuel oil in the residential sector	4,874 TJ in 2014 ^A	72% reduction from 1990
Energy consumed from light and heavy fuel oil in the commercial and institutional sector	3,438 TJ in 2014 ^B	56% reduction from 1990

A. In 2014, the portion of light fuel oil compared to all energy sources was 6%, while it was 22% in 1990.

B. In 2014, the portion of light and heavy fuel oil compared to all energy sources was 5%, while it was 10% in 1990.

For 2009-2016, 2,440 conversions from fuel oil to natural gas were carried out on the agglomeration's territory. The recurrent annual GHG emissions reduction is estimated at 14.6 kt CO₂ eq in 2016.** As well, 78 fuel oil heating systems were replaced by electrical systems from 2006 to 2015 under the Ville de Montréal's *Renovation à la Carte* subsidy program.

Conclusion

Fuel oil use was reduced by 72% for the residential sector and by 56% for the commercial sector in 2014. We can therefore conclude that, while fuel oil has not been totally eliminated, its use has dropped considerably since 1990. To maximize the potential reduction of stationary energy, we recommend encouraging conversion to renewable energy sources in order to reduce GHG emissions in a sustainable way. For information purposes only, according to the data from the 2014 inventory⁸⁰, 38% of the energy need for buildings in the residential, commercial and institutional sectors was met by fossil fuels, including 82% from natural gas and 15% from fuel oil.



Potential Solution 3

Encourage the use of renewable energy

2013-2020 target

- Carry out at least one large-scale renewable energy use project.

The renewable energies considered for this solution do not include hydroelectricity.

Indicators

Table 6 presents the indicators that show current citywide performance relative to the target.

Table 6
Indicators regarding the use of renewable energy

Indicators	Data	Observations
Number of geothermal energy projects	25 in 2016 ^A	The number of projects carried out is probably higher.
Number of solar energy projects	Three from 2013 to 2016 ^B	The number of projects carried out is probably higher.

- A. The data come from information collected from construction permit applications submitted by the boroughs and reconstituted cities for 2016. They may therefore be somewhat imprecise relative to the real number of projects carried out. The *By-law of the urban agglomeration council to encourage coherent action to protect principal water and sewers mains from drilling and post-hole digging on private property* (RCG 14-039), once fully implemented by the boroughs, could be used to more precisely inventory the number of geothermal energy projects.
- B. The data come from information collected from construction permit applications submitted by the boroughs and reconstituted cities for 2016 and those obtained by the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (Québec's ministry of sustainable development, the environment and the fight against climate change, or MDDELCC) with regard to following measure 20.5 (Aide à l'installation d'équipements solaires opérationnels, or assistance in installing operational solar equipment) from the PACC 2013-2020.

Actions

Ville de Montréal

The biogas conversion plant at the Saint-Michel Environmental Complex (CESM), launched in 1996, is the main source of renewable energy produced on the agglomeration's territory. With 4.8 MW of power, today it's operated by Biomont énergie S.E.C. and was relaunched in October 2017.

The borough of Rosemont–La Petite-Patrie offered \$10,000 to the organization Solon to study the feasibility of developing an alleyway heat network in 2016.¹⁰⁸ They plan to launch a pilot project in 2018 in three of the borough's alleyways.¹⁰

A first biomethanization plant for organic waste is expected to open in Montréal-Est in 2020. Its anticipated production capacity is 4 million m³ of biomethane per year.

In 2016 and 2017, the Commission sur l'eau, l'environnement, le développement durable et les grands parcs (committee on water, the environment, sustainable development and large parks) studied the question of building design from a sustainable development perspective on the Montréal territory.⁸¹ A number of their observations and recommendations deal with buildings' energy efficiency and the use of renewable energy (see Table 3).

Supply of renewable natural gas

As part of its *Bill 106: An Act to implement the 2030 Energy Policy and to amend various legislative provisions*¹⁴, the Québec government gave itself the power to determine, by regulation, the quantity of renewable natural gas that must be delivered by natural gas distributors as well as the conditions and methods of such delivery. While no regulation has yet been adopted in this regard, one of the actions listed in the 2017-2020 Action Plan for the 2013 Energy Policy⁴¹ was to adopt, in 2017, a regulation establishing that Québec distributors of natural gas must inject a 5% minimum proportion of renewable natural gas into their distribution network for Québec customers. It's estimated that this move will have the effect of reducing citywide GHG emissions by 171 kt CO₂ eq. This estimate is based on the natural gas consumption data for 2014 for consumers in the Montréal agglomeration in the residential, commercial, institutional and industrial categories.

Conclusion

Geothermal energy seems to be poorly exploited on the agglomeration's territory, and solar energy is used even less. It is therefore difficult to come to a positive conclusion regarding this target based on the data we consulted, even though it's likely that the number of listed projects represents an under-estimation of the number actually carried out. In this context, we advise updating the Reduction Plan and the target for this potential solution in order to take into account the recommendation made for Potential Solution 2, which is to encourage the transition toward the use of renewable energy sources.

The Commission sur l'eau, l'environnement, le développement durable et les grands parcs⁸¹ (committee on water, the environment, sustainable development and large parks) noted the lack of a municipal bylaw structure regarding buildings' energy performance and use of renewable energy, and a lack of support and encouragement measures. With this in mind, we recommend that the Ville revise its objectives for reducing GHG emissions from both new and older elements of the built environment. This revision should consider the energy sources with the highest GHG emissions, the potential for reduction, the technical constraints of various renewable energy technologies, and the changes that should be made to the current set of bylaws in order to reach reduction targets.


EXCEPTÉ

EN RECHARGE


Circuit électrique
ALIMENTÉ PAR
HYDRO-QUÉBEC

Circuit électrique

Circuit électrique

Montréal 

Montréal 





Potential Solution 4

Appropriately fund projects to reduce GHG emissions in transport

2013-2020 target

- Ensure appropriate funding for projects that contribute to reducing GHG emissions in transport.

Indicators

Table 7 presents the indicators that show current citywide performance relative to the target.

Table 7
Indicators regarding the funding of projects to reduce GHG emissions in transport

Indicators	Data	Observations
General indicators		
GHG emissions from the transportation sector	4,616 kt CO ₂ eq in 2014 ⁸⁰	Increase of 568 kt CO ₂ eq since 1990 (+14%), including an increase of 494 kt CO ₂ eq in the road sub-sector
STM asset maintenance deficit	\$3.9 B in 2016 ^{65, 71, A}	Stable since 2013 ⁶⁹
Funding of public and active transportation		
Funding of public transit by the Montréal agglomeration	\$504.1 M in 2016 ¹⁰⁰	Increase of \$42.2 M (9%) from 2013 ⁹⁹
Spending and LTNF investments allotted to public and alternative transportation across Québec	\$808.8 M for the 2016-2017 financial year ^{45, B}	Increase of \$369.3 M (84%) as compared to 2013-2014 ^{44, 45, C}
Investments from SOFIL into public transit as part of the TECQ program across Québec	\$158.7 M on March 31, 2017 for 2014-2019 ³⁹	Increase of 103% to SOFIL's TECQ program envelope for 2014-2019 (\$1,149.7 M) ³⁹ as compared to 2010-2014 ³⁸
AMT revenue from registration fees and gas taxes	\$108.6 M in 2016	Increase of \$1.3 M (1.2%) from 2013
STM revenue from its share of the fuel tax	\$24.5 M in 2016 ⁷¹	Reduction of \$11.0 M (31%) from 2013 ⁷⁰
Funding for active transportation by the Montréal agglomeration		
Investments for the development of the agglomeration's bike path network	\$9.7 M in 2017 ⁹	Increase of \$6.7 M from 2013 (223%) Total investment of \$36.2 M from 2013 to 2017
Funding for the BIXI Montréal organization	\$6.9 M in 2016 ¹⁸	Increase of \$2.8 M (68%) as compared to 2014 ¹⁷
TEQ funding for transport electrification on the agglomeration's territory		
Acquisition of battery electric vehicles (BEV), plug-in hybrid electric vehicles (PHEV) and hybrid electric vehicles (HEV)	\$12.2 M from April 2014 to April 2017	Acquisition of BEVs (826), PHEVs (643) and HEVs (1,957) subsidized by the Drive Green program Annual avoided GHG emissions estimated at 4.6 kt CO ₂ eq
Installation of charging stations for BEVs and PHEVs at the workplace	\$1.2 M from April 2014 to April 2017	Installation of 368 charging stations at workplaces subsidized by the Branché au travail program (a workplace charging incentive program)
Installation of BEV and PHEV charging stations for residential use	\$0.4 M from April 2014 to April 2017	Installation of 582 charging stations subsidized by the Drive Green program

A. The STM expects the deficit to be \$3.1 B in 2026, while its target for 2030 is \$1 B.

B. This amount represents 24% of the LTNF's overall spending. In counterpart, the funding from the LTNF dedicated to developing and maintaining the road network was \$2.37 B for the 2016-2017 financial year, a 13% increase as compared to the 2012-2013 financial year.

C. Note that 70% of this increase, or \$258.2 M, corresponds to the transfer from the Green Fund to the LTNF for the 2016-2017 financial year, while no transfer took place in the 2013-2014 financial year.

D. The data include only the investments made by the Ville de Montréal's Division des transports actifs et collectifs (active and public transportation division), part of its Service des infrastructures, de la voirie et des transports (infrastructure, roads and transportation department). Investments are not included in these data when they have been made by other administrative units in Central Departments, the boroughs and the reconstituted cities into cycling-friendly works that are not part of the agglomeration's network.

Actions

Funding sources

» Additional acquisition and registration fees for large cylinder capacity vehicles

Since September 1, 2016, the Société de l'assurance automobile du Québec (SAAQ, Québec's automobile insurance board) has collected an acquisition fee at the time of license plate issuance for all large cylinder capacity vehicles. A predetermined portion of this amount is paid to SOFIL. This fee is on top of the additional registration fee on large cylinder capacity vehicles collected by the SAAQ since January 1, 2005, which is paid to SOFIL and the LTNF in keeping with the terms of the Highway Safety Code (CQLR c C-24.2).

Table 8 presents a summary of dissuasive fees in place for vehicles equipped with large cylinder capacity engines. The additional registration and acquisition fees represent 18% of SOFIL's revenue for the 2016-2017 financial year. The amount from fees for large cylinder capacity vehicles paid to SOFIL and LTNF was \$102.8 M for the 2016-2017 financial year.

Table 8
Additional acquisition and registration fees for large cylinder capacity vehicles

Additional fee	SOFIL	LTNF	Observations
Registration	\$89.6 M for the 2016-2017 financial year ³⁹	\$9.0 M for the 2016-2017 financial year ⁴⁵	Increase of \$19.2 M as compared to the 2012-2013 financial year ³⁸ Additional registration fee for 2017 based on cylinder capacity ⁶⁰ : <ul style="list-style-type: none"> • cylinder capacity of less than 4.0 litres: \$0 • cylinder capacity of 4.0 to 6.9 litres: \$35.75 to \$368.00 (depending on the volume of the cylinder capacity) • cylinder capacity of 7.0 litres and up: \$379.00
Acquisition	\$4.2 M for the 2016-2017 financial year ³⁹	Not applicable	New fee introduced in 2016 ³⁹ Additional acquisition fee for 2017 based on cylinder capacity ⁶⁰ : <ul style="list-style-type: none"> • cylinder capacity of less than 4.0 litres: \$0 • cylinder capacity of 4.0 to 4.9 litres: \$50.00 • cylinder capacity of 5.0 to 5.9 litres: \$100.00 • cylinder capacity of 6.0 litres and up: \$200.00

Main projects to expand the range of public transportation services

Table 9 presents funding information for the main projects concluded or underway on the Montréal agglomeration's territory since 2013. Alongside the investments shown in Table 8, the Québec government and its partners invested an estimated \$1.33 B before the 2017-2018 financial year for the public transportation projects listed in the 2017-2027 Quebec Infrastructure Plan (QIP)³⁷ for the administrative region of Montréal and for equipment maintenance centres, accessibility improvement and asset maintenance.

Table 9
Main projects to increase the range of public transportation and help reduce transport-related GHG emissions

Projects	Contribution from the Québec government		Contribution from partners		Observations	
	Before 2017	2017–2027	Before 2017	2017–2027		
Train de l'Est (eastern train line) ³⁶	\$730.7 M	–	–	–	1.65 million trips in 2016	
Acquisition of AZUR metro cars ⁶⁶	–	\$317.8 M	–	\$107.4 M	Acquisition of 52 trains, including 14 to increase service ^A	
Construction of the Côte-Vertu garage ⁶⁶	\$13.3 M	\$292.4 M	\$4.9 M	\$107.5 M	Space to park the number of trains required to support the increased service	
Acquisition of 12-metre hybrid buses ⁶⁶	Addition	\$41.6 M	\$13.5 M	\$9.5 M ^B	\$3.0 M ^B	Addition of 74 hybrid buses
	Replacement	\$18.1 M	\$143.2 M	\$4.2 M ^B	\$33.7 M ^B	Replacement of 184 buses with hybrid buses
TOTAL	\$803.7 M	\$766.9 M	\$18.6 M	\$251.6 M		

A. Excludes the asset maintenance portion of the project, meaning the replacement of 38 MR-63 trains and projects to upgrade workshops and metro equipment

B. Montréal agglomeration and Société de transport de Montréal

C. Société de transport de Montréal

New public transportation governance in the Montréal metropolitan area

As discussed in Potential Solution 12, in May 2016 the National Assembly approved Bill 76¹², creating the ARTM, which is now responsible for public transportation planning, development, support and promotion across its entire territory, meaning the Communauté métropolitaine de Montréal (Montréal metropolitan community, or CMM), the Kahnawake Indian Reserve and the Ville de Saint-Jérôme.

The ARTM has exclusive jurisdiction to establish a strategic development plan for public transportation as well as a funding policy, both of which are subject to approval by the CMM. The law gives the ARTM the power to conclude contractual agreements with public transport authorities concerning, among other things, the performance and service quality objectives that the authorities must satisfy, as well as their remuneration. The law also gives the ARTM the power to require contributions from the municipalities to ensure its own funding, meaning the one based on standardized property value and the one that corresponds to the remaining deficit of regular and adapted public transport services.

As well, the adoption of Bill 137¹⁵, an *Act respecting the Réseau électrique métropolitain* (light rail network, or REM), gives the ARTM the power to impose, by regulation, a fee to fund public transportation services. The ARTM may levy this fee on works it identifies whose value exceeds \$750,000, which are carried out on its territory and which include the construction, modification or repurposing of a building.

Public transportation development projects announced but not carried out

This progress report aims to follow up on actions that have been carried out in regard to the Reduction Plan. The projects presented below should not be considered to be carried out; rather, we present them here for information purposes. As

such, the increased investments announced and the projects still being studied in order to develop public transportation modes will be observable only once these projects are fully put into action.

» *Réseau électrique métropolitain (light rail network, or REM)*

The expected investment for the REM light rail project is \$2.7 B from CDPQ Infra (the infrastructure arm of the Caisse de dépôt et placement du Québec, a major Québec institutional investor) and \$1.3 B each from the federal and provincial governments.³⁴ It is estimated that the Québec government will spend an additional \$758.7 M by 2022, including a payment of \$512 M to the ARTM as a land value compensation. As well, Hydro-Québec is expected to make a contribution of \$295 M to cover the costs of the stationary material necessary for electrifying the REM light rail.

» *Pie-IX bus rapid transit (BRT)*

The Québec government is expected to invest \$400 M for the Pie-IX BRT project.³⁵ The start of construction has been announced for fall 2018 and service should begin in the fall of 2022.⁵⁸

» *Extension of the metro's blue line*

The Québec government is expected to invest \$3.9 B to extend the metro's blue line by 5.8 km and add five stations.³⁵

» *Acquisition of 300 additional hybrid buses*

The expected investment for the STM's project to acquire 300 additional hybrid buses is \$422 M. Their delivery is scheduled to begin in 2020.^{62, 67}

Conclusion

As shown in Table 9, the main pre-2017 projects to expand the available public transportation modes, not counting investments toward asset maintenance and accessibility improvement, received investments totalling \$822.3 M. The investments planned for 2017-2027 add up to \$1.02 B. If we include the REM light rail project, the metro blue line extension, the Pie-IX BRT and the acquisition of 300 additional hybrid buses, the planned investments total \$12.6 B for the Montréal metropolitan area.

Note that the STM's asset maintenance deficit remains high, at \$3.9 B, and that the STM expects it to be \$3.1 B in 2026. What's more, as shown in Potential Solution 6, public transit ridership has remained stable since 2013 despite major investments before 2017. Based on this information, it is difficult to conclude that public transportation projects that help reduce GHG emissions are appropriately funded in order to reach objectives in the short term (2020), the medium term (2030) or the long term (2050). As well, there is also reason to question whether the current level of funding for public transportation will make it possible to provide a sufficiently high level of service to stimulate a significant modal shift toward public transportation.

The Québec government introduced new contribution mechanisms for public transportation to help diversify revenue sources for developing new projects (ex.: the fee to fund public transportation services that targets development work alongside stations and a financial contribution from the ARTM to CDPQ Infra to build the REM light rail as a land value compensation). It also introduced, in 2016, an acquisition fee for large cylinder capacity vehicles, an addition to the registration fee for large cylinder capacity vehicles which was introduced in 2005. However, this new fee made only a marginal contribution (less than 1%) to SOFIL's revenues for the 2016-2017 financial year.³⁹

In the short term, we recommend that the Ville continue to lobby the provincial and federal governments to implement effective dissuasive measures on large cylinder capacity vehicles and to shift its scope and parameters based on quantified GHG emissions reduction objectives from vehicles. We also recommend considering new funding methods for public transportation that both have a dissuasive effect on solo driving commuters and generate ongoing additional revenue dedicated to improving public transportation and active transportation services in order to stimulate a significant level of modal shift.

Lastly, the Québec government must further diversify revenue sources to ensure long-term funding for public transportation and road infrastructures. Note that 67% of the LTNF's revenues for the 2016-2017 financial year⁴⁵ come from the fuel tax and the Green Fund, both dedicated to the use of fossil fuels. The same is true for SOFIL's revenues, of which 81% come from the Federal Gas Tax Fund for the 2016-2017 financial year.³⁹ In a context where the medium-term emissions reduction targets for Québec are 37.5% by 2030 and 80% for both Québec and the Montréal agglomeration by 2050⁴⁸, we can see that the revenue sources for these funds may drop by that same measure as reduction targets are met.



Potential Solution 5

Gather data to help better evaluate the factors that influence GHG emissions in transport and ways to reduce them

2013-2020 target

- Put into place a data collection system to help better understand mobility behaviours and their impacts on GHG emissions.

Indicators

Not applicable

Actions

Agence métropolitaine de transport (AMT)

In 2015, the AMT released the results of the tenth Origine-Destination study carried out from September 3 to December 21, 2013 in the Montréal metropolitan area.³

Ville de Montréal

In 2017, the Ville added 23 permanent meters to count the number of cyclist trips in seven boroughs, including three smart meters that post data in real time.⁸²

In spring 2014, the Ville de Montréal created the Bureau de la ville intelligente et numérique (smart and digital city office, or BVIN). In January 2015, the BVIN proposed the Montréal, Smart and Digital City: 2014-2017 Montréal Strategy⁸⁶, and in May 2015 it adopted the 2015-2017 Action Plan.⁸⁵ In February 2017, the BVIN published an interim report on the 2015-2017 Action Plan.⁸⁷ Here are the main projects related to Potential Solution 5 that have been accomplished or are underway as part of this action plan and under the Faire Montréal⁷⁸ platform.

» Data exchange partnership between Waze and the Ville de Montréal

The partnership agreement signed in April 2016 allows the Ville de Montréal to obtain data about obstacles and incidents reported by users of the Waze mobile application. This application connects drivers with one another to improve the community's everyday driving routes. In return, the Ville de Montréal has committed to sharing information about its main obstacles with Waze. The Ville has also committed to publishing planned traffic obstacles in the form of open data.

» MTL Trajet

Formerly called mon RésoMobilité, MTL Trajet is a mobile application for smartphones that records users' travels so that the Ville de Montréal can better understand movement on its territory in order to improve mobility. The telemetry equipment installed on the territory does not currently show the full set of a route's characteristics (roads, speeds, time). For the moment, the application aims to be an additional tool to help us understand transit users' behaviours between their departure point and their arrival at their destination.

» Smart parking: real-time data collection and navigation app

Stationnement de Montréal (Montréal's parking authority) is working to fine-tune a tool to collect and report information about parking spot availability in real time. Sensors installed in the ground aim to provide data in real time, which will then serve to develop mobile apps to guide drivers toward available spots. Electronic information panels are also used to disseminate various kinds of information related to mobility (parking spaces, disruptions, detours, driving time and accidents). To reduce the congestion caused by cars searching for parking spots downtown, the Ville de Montréal has begun to install electronic information signs that post the location

and availability of off-street parking spaces in Vieux-Montréal and the Quartier des spectacles. The deployment begun in 2017 will continue in other areas.

» *Géo-Trafic and Montréal Open 511: urban mobility database and creation of a public API*

Real-time knowledge about the state of the road network is crucial for the Ville de Montréal. The dynamic Géo-Trafic database will use a real-time exchange platform to gather informational data about mobility (traffic, disruptions, obstacles, snow removal, etc.) supported by dynamic mapping. This access to the state of the road network as a whole will allow the Ville to provide high-quality information services to all workers, including first responders. Respecting our Open Data Policy⁹⁴, the data will be shared in order for third parties to use them, creating the conditions for new user tools and mobility solutions to emerge.

» *Traffic light coordination*

This Ville de Montréal project aims to optimize traffic light synchronization in order to make all mobility safer and better for users (people with reduced mobility, pedestrians, cyclists, drivers) and for merchandise on the Montréal territory. Among other things, this project includes the installation of smart traffic light controllers so that emergency services and buses equipped with the appropriate devices can be given priority at traffic lights.

» *Inventory and action plan for real-time mobility data collection*

In the coming years, the Ville de Montréal will continue to instrumentalize its road network by deploying sensor devices (cameras, sensors), control devices (lighting, traffic lights) and information devices (electronic information panels) in order to better understand mobility on our territory. The information gathered by these sensors will be used internally to improve traffic and will also be disseminated through the open data portal.

» *Integrated transit corridor*

Transit corridors represent the end point of integrated mobility because they draw on all the technologies deployed as part of other initiatives as well as on partners' collaboration. The use of smart transport systems will serve to manage certain strategic axes or areas of the road network in order to optimize traffic and reduce the scale of disruptions. Using decision-making assistance and prediction tools, the operators of various road transport and public transport networks (multi-agency) can jointly solve traffic problems on the spot. Some processes will be automated in order to gradually reduce human contribution. It is also possible to react quickly to incidents in a coordinated fashion by giving citizens alternatives using electronic information panels.

» *AGIR project*

This platform aims to bring together information about all construction sites and traffic obstacles from planning to execution.

» *Faire Montréal*

Faire Montréal is a collaborative platform built around projects that help improve the city. As a site for dynamic, transparent interaction between the Ville and its citizens, it gives users a chance to learn about projects, to follow their progress and to contribute to their development. Here is a list of projects related to Potential Solution 5 whose details are available on the platform:

- Mobility Montréal data collection action plan (testing phase);
- Smart Taxi (testing phase);
- Mobility Montréal 2.0 real time action group (discovery phase);
- iBUS (gradual deployment through 2018).

Conclusion

The five-year frequency at which the AMT's Origine-Destination study is conducted, and the additional two years required for its production and publication, limit the ability of transport decision-makers to see the effects of measures that have been implemented and to plan new ones. While the Ville de Montréal and its partners are making substantial efforts to implement solutions that will help us better understand and improve citizen mobility, it's difficult to conclude that the target has been reached.

For the Ville to be able to make better urban planning and mobility planning decisions in relation to climate change, we recommend that the Ville coordinate the aggregation and analysis of data relevant to the agglomeration that comes from the various transport-related decision-makers, including the STM and the RTM for public transportation, the MTMDET for road transportation, and the Ville for active transport means, urban design and so forth.

MaaS system

Mobility as a service, or MaaS, essentially consists of proposing personalized mobility solutions based on individual needs using the available modes of transportation. This way, all the possible transportation modes can be combined, and users can gain access to services using a single intermediary, which can offer a range of fees and memberships, similar to the business model used by wireless telephone service providers. The objective of a MaaS system is to facilitate transit by using the advances provided by information technologies and mobile telephone systems to provide an alternative to household car ownership. However, it does contribute to putting into place a transactional environment where some transport service operator data (public transit, taxis, car-sharing, etc.) must be shared.

In the collaborative context initiated by the BVIN regarding open data, it could be an opportune time to study the possibility of putting into place a transactional information platform that would make it possible to create a MaaS system. The Ville and the ARTM could look to the breakthroughs made by Finland's department of transportation, where policies and a regulatory framework have been adopted to facilitate the creation of a MaaS system.²⁸





Potential Solution 6

Develop public transit

2013-2020 target

- Create a modal shift of five percentage points from personal vehicles to public transportation.

Indicators

Public transportation ridership in the Greater Montréal area has remained relatively stable since 2013, as shown in Figure 1.

The indicators show that public transportation’s modal share is regressing in regard to trips on the agglomeration’s territory (Table 10). Note that the ARTM (formerly called the Agence métropolitaine de transport) produces regional Origine-Destination studies at five-year intervals; the last one was produced in 2013. Since the next one takes place in 2018 and the data will not be published until 2020, it is not possible to measure progress after 2013 at this time.

Figure 1
Public transportation ridership in the Greater Montréal area and of the STM^{6, 7, 8, 9}

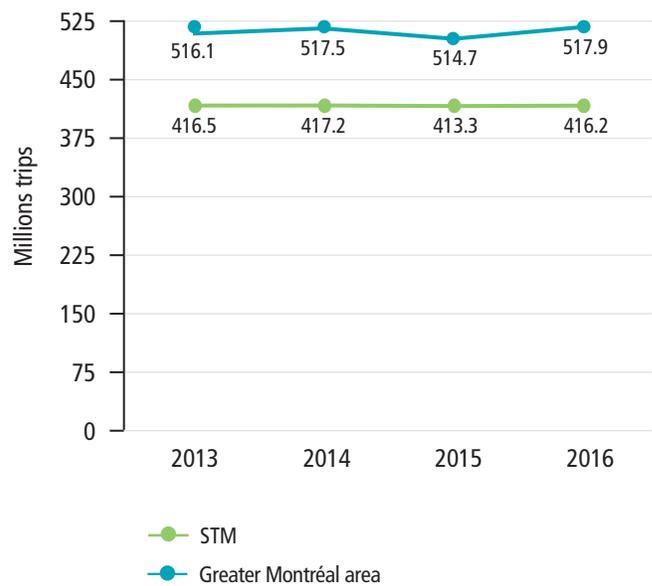


Table 10

Indicators regarding the usage and development of public transportation on the agglomeration’s territory

Indicators		Data	Observations
Mode of transportation	Period		
Portion of trips taken on public transportation in 2013 ^{2, 3}	24 hours	24.0%	1.4 pp drop from 2008
	Morning rush hour	30.4%	0.8 pp drop from 2008
Portion of trips taken in automobiles in 2013 ^{2, 3}	24 hours	57.9%	1.8 pp increase from 2008
	Morning rush hour	53.9%	1.9 pp increase from 2008
Distance of bus preferential measures (BPM)		308.2 km in 2017 ⁶¹	127% increase from 2011 (136 km) ⁶⁸

Actions

Below we have listed only the actions that contribute in a significant way to increasing the range of public transportation. Actions that aim to gain customer loyalty and maintain equipment, while important when it comes to maintaining service levels, are considered in this progress report only for information purposes.

Société de transport de Montréal (STM)

In December 2017, the STM had received 35 of the 52 AZUR trains it had ordered. Of these, 38 will replace MR-63 metro cars at the end of their useful lives, while 14 will increase the service range. Each AZUR car provides an 8% larger capacity compared to the MR-63 cars.

Agence métropolitaine de transport (AMT)

The new Train de l'Est (eastern train line), which links Mascouche to Montréal's Central Station, entered into service in 2014. On the agglomeration's territory, it includes seven new stations and, to create incentive, five commuter parking lots with 1,135 vehicle parking spaces. The line's daily usage reached 7,400 trips in 2016.⁹ The expected daily usage is 11,000 trips after five years of service, meaning by 2019.⁷ The annual avoided GHG emissions for the project as a whole were estimated at 2.5 kt CO₂ eq.⁴

In 2015, a third commuter train track was added between the Montréal-Ouest and Lucien-L'Allier stations, making it possible to add ten daily trains on the Saint-Jérôme line.

From 2013 to 2016, across the Greater Montréal area, 32 km of new reserved bus lanes were added. As well, a bus terminal, the Mansfield terminal, was added on the agglomeration's territory in 2016.*

In January 2017, the Du Canal station in the borough of Lachine was opened, including a commuter parking lot with 150 spaces to provide incentive.

* RTM, data obtained by email, January 2018

Conclusion

Despite the development projects carried out since 2013, public transportation ridership has remained relatively stable. This is cause to conclude that public transportation lost ground between 2013 and 2016 against other modes of transportation, considering the natural population growth and the related demand for transportation.

In the end, despite the announced REM light rail projects, the blue line extension and the Pie-IX BRT, the Ville de Montréal estimates that these projects' contribution to instant modal shift from cars toward public transportation will not suffice to reach the 2020 target (see box).

As such, in order to prioritize the most efficient projects when it comes to GHG reduction, we recommend that the Ville de Montréal lobby the ARTM to quantify the number of solo driving commuters that will need to be removed from circulation in order to reach Montréal's citywide GHG reduction targets, and to have this information be an integral part of the directions taken in the public transport strategic development plan the ARTM must produce.

Estimate of instant modal shift for the REM light rail, Pie-IX BRT and blue line extension projects

The table below presents the daily modal shift estimates for the REM light rail, Pie-IX BRT and blue line extension projects. The data represent the "instant" effect of the projects. The impacts on longer-term modal choices, in combination with real estate development or redevelopment, for example, are not included in the evaluation.

Estimate of modal shift from cars to public transportation for public transportation projects that have been announced

Project	Daily modal shift from car to public transportation modes
REM light rail ^{7A}	1,360 trips at morning rush hour 2,100 bimodal trips, meaning car and public transportation
Pie-IX BRT ^A	3,500 trips
Blue line metro extension ⁹	5,300 trips

A. The estimate is based on the hypothesis provided by the ARTM, which is that 70,000 users (5% of expected daily traffic) are making a modal shift away from cars.



Potential Solution 7

Optimize parking

2013-2020 target

- Create a modal shift of five percentage points from personal vehicles to public transit.

Indicators

Table 11 presents the indicators specific to parking that show the influence of parking availability relative to the target.

Table 11
Indicators regarding parking

Indicators	Data	Observations
Paid street parking spaces	18,406 in 2014 ¹	9% increase from 2008
Park-and-ride facilities on the agglomeration's territory	8,341 spaces for cars and 1,256 spaces for bikes in 2016 ⁹	0.9% increase in the number of car spaces and 90.3% increase in the number of bike parking spaces between 2013 and 2016 ¹
Car-share parking stickers	1,340 in 2017 ^A Provision of 1,040 car-shares by service providers in 2017 ^A	Distribution of parking stickers based on vehicle type ^B : <ul style="list-style-type: none"> • Vehicles for at least four passengers (sticker 405): 40 • Electric vehicles (sticker 405): 200 • Gas and hybrid vehicles (sticker 403): 1,100

A. Car2Go and Communauto, data on car-share provision obtained by email, 2017.

B. The number of parking stickers is determined by an order from the Ville de Montréal.

Table 10, in Potential Solution 6, presents the indicators for the modal shares of public transportation and cars as compared to the target. Figure 1, also in Potential Solution 6, presents ridership data for the STM and all public transportation authorities operating in the Greater Montréal area between 2013 and 2016.

Actions

Parking policy

In 2016, the Ville adopted a Politique de stationnement (parking policy)⁹⁵ including a number of measures toward sustainable mobility. At the time of production of this progress report, the Ville had not gathered data on the policy's progress in relation to sustainable mobility, aside from the measures regarding the installation of parking spaces equipped with charging stations for electric vehicles.

Bylaw regarding parking of car-share vehicles (CSV)

The bylaw adopted regarding car-share vehicle parking is discussed in more detail in Potential Solution 10.

Municipal bylaws setting the maximum number of parking spaces

According to a study by AECOM¹ produced in 2015 to support creating the Politique de stationnement (parking policy)⁹⁵, 10 out of 19 boroughs* had adopted bylaws aiming to set a maximum number of parking spots across their territories. Note that the requirement in the Schéma d'aménagement et de développement de l'agglomération de Montréal (Land Use and Development Plan by the Montreal Urban Agglomeration)¹⁰⁶ says only that standards must be adopted to encourage the reduction of off-street parking spots built close to the public transit system's main access points in the related cities.

Note that in 2009, the borough of Saint-Laurent adopted a bylaw regulating the building of parking spaces with a focus on sustainable development.⁹⁶ It won the Ovation Municipale award from the Union des municipalités du Québec (UMQ) in 2013.¹⁰³ This same bylaw was also cited by the Bureau de normalisation du Québec (Québec's standards bureau) in its document Reducing the Urban Heat Island Effect – Parking Lot Development – Design Guide.²⁰ A number of strategies are suggested in the bylaw, including reducing the required minimum number of parking spaces, setting a maximum number of parking spaces (it was unlimited in the previous bylaw), eliminating the obligation to provide parking spaces, and requiring more underground parking for residential usage.

* Ahuntsic-Cartierville, Côte-des-Neiges–Notre-Dame-de-Grâce, Mercier–Hochelaga-Maisonneuve, Outremont, Plateau-Mont-Royal, Rosemont–La Petite-Patrie, Saint-Laurent, Sud-Ouest, Ville-Marie, Villeray–Saint-Michel–Parc-Extension.

Conclusion

The recent adoption of the Politique de stationnement (parking policy) in 2016 and the lack of monitoring data makes it difficult to come to any conclusions about the bylaw's influence on the modal shift from personal vehicles to public transit.

Despite a 9% increase in the number of paid (as opposed to free) on-street parking spots since 2008, it is difficult to conclude that the target for this solution could be reached by 2020 without implementing major dissuasive or ecofiscal measures for solo drivers, considering the following trends, among others:

- 31% increase in car ownership since 1990 (see Potential Solution 10);
- relative plateau in public transportation ridership observed since 2013 (see Potential Solution 6);
- 1.9 pp increase of the automobile's modal share in 2013 as compared to 2008 (see Potential Solution 6).

Since we know that free parking is one of the strongest factors encouraging commuters to use their personal vehicles, municipal parking management is of prime importance in reducing GHG emissions. If we do not put into place major bonus/penalty-type ecofiscal or dissuasive measures regarding parking in order to reset a balance between the attractiveness of personal vehicles and the social benefits of public and alternative transportation modes, we must face the question of whether the targeted modal shift toward public transportation can be reached.



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Potential Solution 8

Manage transport demand effectively

2013-2020 targets

- Create a modal shift of five percentage points from personal vehicles to public transit.
- Create a modal shift of three percentage points from personal vehicles to active transportation.

Indicators

Table 12 presents the urban planning indicators that show citywide current performance relative to the target.

Table 12
Indicators regarding urban planning

Indicators	Data	Observations
Estimated number of households in TOD areas for the agglomeration	60% in 2006 ²²	No more recent data available
Number of TOD areas located on the agglomeration's territory	103 TOD areas identified in 2011 in the Montréal agglomeration ²¹	155 TOD areas identified in 2011 in Greater Montréal ²²
Car occupancy rate for the Greater Montréal area	1.2 people per car in 2013 ³	On a downswing since 2008 (1.23 people per car) ²

Table 10 for Potential Solution 6 presents the indicators regarding the modal shares of public transportation and automobiles vis-à-vis the target, while the data about the modal share of active transportation are presented in Table 13 for Potential Solution 9. Figure 1 in Potential Solution 6 also presents ridership data for the STM and for all public transport authorities operating in the Greater Montréal area from 2013 to 2016.

Actions

Transit-Oriented Development (TOD)

The CMM's Metropolitan Land Use and Development Plan²² has two main objectives:

- to orient at least 40% of new households in 2011-2031 toward TOD neighbourhoods, meaning within a one-kilometre radius of current and projected transit stations, including the metro, commuter trains, LRT and BRT;
- to develop the metropolitan public transportation networks in order to increase public transportation's modal share at morning rush hour to 30% by 2021 and to 35% by 2031.

The Schéma d'aménagement et de développement de l'agglomération de Montréal (the Montréal agglomeration's land use and development plan)¹⁰⁶ was amended to include the PMAD's TOD approach, and it came into effect April 1, 2015. The changes related to TOD more specifically address the establishment of a minimum density for new residential constructions. The regulatory foundations are now in place in the vast majority of TOD areas. At the time this progress report is being produced, no indicators or reports are available regarding implementation or illustrating the recent inclusion of the Schéma requirements into various bylaws, so we cannot measure whether the densification objectives have been reached.

Action Plan for the Downtown Strategy

In 2017, the Ville adopted its Action Plan for the Downtown Strategy.⁸⁸ This plan, resulting from public consultation, determines eight actions whose implementation requires concerted commitments between the Ville and its partners. By 2030, the Ville plans, among other things, to increase public transit capacity to downtown by 100,000 trips per day, to equip downtown with four new primary schools and a new public high school, and to facilitate access to 1,000 three-bedroom apartments (or larger) for families downtown in the coming ten years; a significant proportion of these will be affordable for first-time home buyers.

Other urban design bylaw actions

In 2014, the Sud-Ouest borough amended its urban design bylaw to remove the obligation to include a minimum number of parking spaces for new buildings; they also enhanced the requirements concerning the materials used for constructing such spaces.⁹²

In 2016, the borough of Saint-Laurent adopted a bylaw requiring all projects with more than 100 parking spaces to produce a travel management plan.⁹¹

Local travel management plans

At the time this progress report is being produced, ten boroughs had adopted or were in the process of developing local travel management plans.*

OPUS & Cie, OPUS+ and Mobility Montréal programs

The STM and the RTM offer the OPUS & Cie⁶³ and OPUS+ entreprise⁵⁷ incitement programs to encourage employers to contribute financially to purchasing their employees' public transport passes and thus contribute to increasing the modal share of public transportation. The amounts contributed by employers and public transport authorities directly reduce the amounts that employees must spend to purchase their transit passes. In 2017, about 10,000 employees from nearly 365 companies benefited from the RTM's OPUS+ program, and about 10,000 employees from nearly 300 companies benefited from the STM's OPUS & Cie program.**

Lastly, note that the Ministère des Transports, de la Mobilité durable et de l'Électrification des transports (Québec's ministry of transport, sustainable mobility and transport electrification, or MTMDET) currently offers a supplementary benefit equivalent to one month's membership in the OPUS programs through the Mobility Montréal group, whose objective is to plan and coordinate various efforts and attenuation measures relative to the various roadwork projects and other major projects underway in the Greater Montréal area.

* Saint-Laurent, Ville-Marie (in process), Saint-Léonard, LaSalle, Rosemont–La Petite-Patrie, Montréal-Nord, Mercier–Hochelaga-Maisonneuve (in process), Verdun, Villeray–Saint-Michel–Parc-Extension (in process), Rivière-des-Praires–Pointe-aux-Trembles (in process).

** STM, data obtained by email, January 2018.

Observations

Efforts that reduce transport needs are the most effective way to sustainably reduce GHG emissions and to reach citywide reduction objectives in the medium and long term. As such, urban planning choices that aim to increase urban density and mixed-use spaces around TOD neighbourhoods are crucial for reducing GHG emissions. The corollary to this principle is that all urban development outside TOD neighbourhoods should be avoided, or should be done in conjunction with the creation of new TODs.

Beyond the trends in the modal share of public transportation, in general, citywide GHG emissions reduction objectives are not taken into account when the Ville prioritizes its actions. For example, the subsidy programs that are in place to meet the goals of the Plan de fidélisation des familles (plan to keep families in Montréal)⁸⁹ do not include location within a TOD area as a criterion, so as to help reduce the demand for car transportation. This means that since 2013, 32% of the 2,623 financial aid grants awarded for the purchase of new units have been given for residences located outside TODs.

Conclusion

For 2008-2013, the modal share of public transportation has seen a backslide of 0.8 pp for morning rush hour^{2,3}, which goes against the targeted 5 pp increase. For the same period, despite a 0.3 pp increase in the modal share of active transportation for the morning rush hour, the target has not been reached (see Potential Solution 9).

To improve the management of transport demand within the Ville, we recommend that, in its future urban design planning exercises, the city systematically set itself reduction objectives specifying the targeted number of fewer car trips—a number which should flow from its GHG emissions reduction objectives, along the same lines as what is recommended for Potential Solution 6.

It is also crucial that the planning decision-makers that have say over urban design and transportation—meaning the Ville, the ARTM, the CMM, the Québec government, the STM, the RTM, school boards and the business milieu—put into place a coordination mechanism in order to jointly implement incentives and dissuasive measures to help reduce the demand for transportation on the agglomeration's territory. These must be prioritized and executed in a sustainable way to maximize carpooling and the modal shift toward public, active and alternative transportation.



Potential Solution 9

Develop active transportation

2013-2020 target

- Create a modal shift of three percentage points from personal vehicles to active transportation.

Indicators

Table 13 presents the indicators that show citywide performance from 2008 to 2013 regarding the transit mode shift toward active transportation.

Table 13
Indicators regarding active transportation for the agglomeration's territory

Indicators		Data	Observations
Portion of non-motorized trips produced and attracted	24 hours	17.5% in 2013 ³	Increase of 0.4 pp from 2008 ²
	Morning rush hour	14.5% in 2013 ³	Increase of 0.3 pp from 2008 ²
Number of trips made by bicycle	24 hours	116,000 in 2013 ⁷⁶	57% increase from 2008 ⁷⁶
Extent of bike path network		846 km in 2017 ⁸³	13% increase from 2015 and 54% increase from 2010 ⁷⁵
Available self-serve bikes ^A		6,250 bikes spread over 540 stations in 2017	19% increase in number of bikes and 17% increase in number of stations from 2013
Number of trips made by self-serve bikes ^A		4,099,898 in 2016	8% increase from 2013

A. BIXI Montréal, data obtained by email, 2017.

Actions

Ville de Montréal Vision Zero strategy

On September 14, 2016, the Ville adopted Montréal's Vision Zero strategy¹⁰⁹, which includes nine elements to guarantee the safety of all road users: pedestrians, cyclists, drivers and passengers of all ages and all conditions.

AMT

In 2016, across the Greater Montréal area, more than 500 bike parking spots were added in stations, incentivized parking lots and city terminals.*

Conclusion

For 2008 and 2013, the modal share of active (non-motorized) transportation options progressed slightly: by 0.4 pp for the average 24-hour period and by 0.3 pp for morning rush hour. Bicycle use is also clearly up from 2008. However, the modal shift toward car use was higher than that toward active transportation for 2008-2013.

On September 28, 2017, the agglomeration council adopted the Cycling Master Plan⁸⁴, whose main objective is to increase the modal share of bikes to 15% in the central neighbourhoods within 15 years. In 2015, Vélo-Québec⁷⁶ estimated the modal share of bikes in the central neighbourhoods at 4% from May to September, 3% in October and 2% in November. Achieving the main objective of the Cycling Master Plan would increase the modal share of active transportation by 9 pp in the central neighbourhoods, but it is difficult to estimate what impact that will have on the modal share for the agglomeration as a whole by 2020.

* RTM, data obtained by email, January 2018.



Potential Solution 10

Develop other methods of transportation as alternatives to solo driving (car-sharing and taxis)

2013-2020 target

- Stabilize the rate of car ownership at 0.79 vehicles per household.

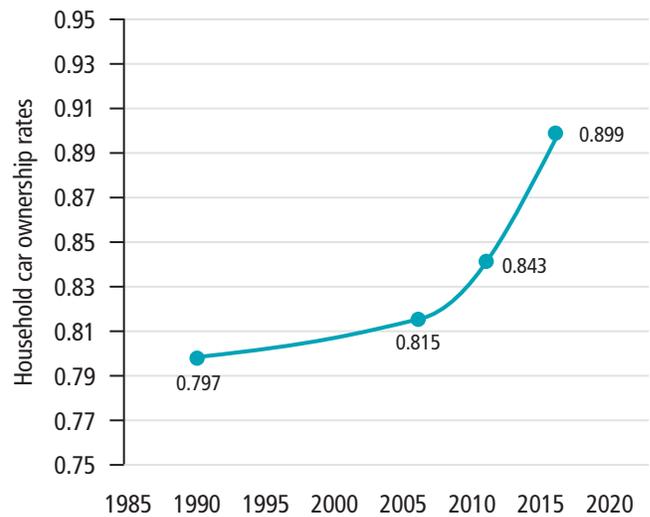
Indicators

The number of licensed passenger vehicles on the agglomeration’s territory was 782,171 at December 31, 2016*, which is a 9% increase from 2011 and a 31% increase from 1990. Considering the number of households present on the agglomeration’s territory in 2016⁹⁷, which was 870,370, this means the average car ownership rate is 0.8999 vehicles per household.

Figure 2 presents the trend observed since 1990, which is an increase in the car ownership rate and an acceleration of this increase since 2006.

Also, Figure 1 from Potential Solution 6 presents usage data for the STM and all public transportation authorities operating in the Greater Montréal area for 2013-2016.

Figure 2
Household car ownership rates in the Montréal agglomeration from 1990 to 2016



Source: SAAQ and Statistics Canada

* Passenger, institutional, professional and commercial use.

Table 14 presents other indicators that show the current citywide performance relative to the target.

Table 14
Indicators regarding household car ownership and alternative modes of transportation

Indicators	Data	Observations
Car-sharing on the agglomeration's territory		
Number of in-station vehicles available ^A	1,101 in 2017 ^B	3% increase from 2013
Number of boroughs and reconstituted cities without a station ^C	12 in 2017 ²³	Stable since 2013
Number of stations located on land belonging to the Ville de Montréal and paramunicipal organizations	226 ^B	No trends available
Car-share vehicles available	1,040 in 2017 ^{B, D}	278% increase from 2013 (275 vehicles) Distribution of availability based on vehicle type in 2017 ^B : <ul style="list-style-type: none"> • Electric vehicles: 60 • Gas or hybrid vehicles: 980
Parking stickers available for car-share vehicles	1,340 in 2017 ^E	Distribution of sticker availability by vehicle type (determined by ordinance from the Ville de Montréal) ¹⁰¹ : <ul style="list-style-type: none"> • Vehicles for at least four passengers (sticker 405): 40 • Electric vehicles (sticker 405): 200 • Gas or hybrid vehicles (sticker 403): 1,100
Taxi		
Taxis operating on the agglomeration's territory	5,187 owner permits in 2016 ^F	7% increase from 2011 ⁹⁸
Sustainable mobility hubs		
Number of sustainable mobility hubs ^G	1	Inauguration of the first sustainable mobility hub on September 20, 2017, at the foot of the Stock Exchange Tower, by the Ville de Montréal

A. The term "in-station vehicle" designates vehicles available in station for round-trip use.

B. Communauto, data obtained by email, 2017.

C. L'Île-Bizard–Sainte-Geneviève, Pierrefonds-Roxboro, Baie-D'Urfé, Beaconsfield, Dollard-Des Ormeaux, Dorval, Hampstead, Kirkland, Montréal-Est, Pointe-Claire, Sainte-Anne-de-Bellevue and Senneville.

D. Car2go, data obtained by email, 2017.

E. Ville de Montréal, Service de la mise en valeur du territoire (land development department), data obtained by email, 2017.

F. Bureau du taxi de Montréal, data obtained by email, 2017.

G. A mobility hub is a strategic connection space within the city where there is a concentration of one or more hubs that generate travel and that provide users with multiple modes of transportation as alternatives to solo driving.

Actions

By-law concerning the parking of self-service vehicles (16-054)

On December 22, 2016, the *By-law concerning the parking of self-service vehicles (16-054)*¹⁰¹ came into effect. This bylaw defines the terms for issuing universal stickers and the gradual deployment of electric car-share vehicles. Table 11 from Potential Solution 7 shows the maximum number of universal parking permits issued by the Ville by ordinance for 2017.

Multimodal carpooling

In 2015, a multimodal transport platform to help people combine carpooling and public transit was launched for the general public on the agglomeration's territory. In 2016⁵⁶, a pilot project was launched by the borough of Saint-Laurent to encourage employees working in the borough, at Cégep Saint-Laurent and Collège Vanier, to use the platform application to reduce their solo driving.

Conclusion

The target for this solution is considered not reached. It is difficult to conclude that it could be reached by 2020 without the implementation of major dissuasive measures against solo driving, considering, among other things, that the car ownership rate is up since 1990, that it has accelerated since 2011 on the agglomeration's territory, and that the renewal rate for vehicles province-wide in 2016 was estimated at 9%.^{73, *}

Car ownership increased between 2011 and 2016 despite a number of factors that could have helped stabilize it:

- a relative stability of STM usage from 2013 through 2016;
- a 7% increase in the number of taxi ownership permits between 2011 and 2016;
- a 67% increase in car-sharing service from 2011 to 2016 with the arrival of 750 car-share vehicles.

It seems that citywide efforts to support alternative modes of transportation beyond solo driving were insufficient to compensate for the growth of household transportation demands in the agglomeration, of which the upswing in car ownership is a symptom.

It is estimated that we would need to reduce the number of vehicles on the agglomeration's territory by 88,108 in order to reach the target. This number of vehicles is equivalent to the annual average daily traffic flow the MTMDDET has observed on Pont Jacques-Cartier.⁴² Lastly, we estimate that eliminating 88,108 vehicles could help avoid the emission of 397 kt CO₂ eq, or 38.5% of the necessary reduction (1,032.5 kt CO₂ eq) to reach the 2020 objective.^{**}

* Passenger, institutional, professional and commercial use.

** Hypotheses: average consumption rate for vehicles 9.6 L/100 km, annual distance traveled of 20,000 km and regular gas.



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Potential Solution 11

Reduce GHG emissions per vehicle

2013-2020 targets

- Reduce the average consumption of vehicles sold in 2020 to 6.0 L/100 km for light vehicles and to 2.1 L/100 tonnes-km for heavy vehicles.
- Bring the percentage of taxis using hybrid engines up to 50% on the island of Montréal.

» *Projections from Environment and Climate Change Canada (ECCC)*

Originally, the targets for the average consumption for vehicles sold were developed in keeping with the projections from ECCC in 2012.²⁶ Since the publication of the Reduction Plan, the ECCC projections have been revised to take into account, among other things, the changes made to the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations³¹ and to the Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations.³² The ECCC projections concerning average consumption in 2020 are²⁷ :

- 6.4 L/100 km for light passenger vehicles;
- 9.1 L/100 km for light passenger trucks;
2.2 L/100 tonnes-km for heavy vehicles.

Indicators

Table 15 presents the indicators that show the current citywide performance relative to the targets.

Table 15
Indicators regarding vehicles

Indicators	Data	Observations
Electrification of transportation on the agglomeration territory		
Number of electric vehicle charging stations	389 charging stations as of October 26, 2017 ^A	Installation of 123 charging stations by January 2018 ^B
Number of BEV ^C	1,216 vehicles in 2016 ^D	0.14% of licensed vehicles
Number of PHEV ^C	669 vehicles in 2016 ^D	0.07% of licensed vehicles
Number of HEV ^C	8,590 vehicles in 2016 ^D	0.9 % of licensed vehicles
Number of taxis with hybrid or fully electric engines	1,288 vehicles in 2017 ¹⁰⁵	30% of the taxi fleet
Average consumption for light vehicles		
Estimated average city-road consumption weighted based on new vehicle sales	9.6 L/100 km in 2016 ³³	50 most sold vehicles in Québec ^{11, E}
Average consumption for heavy vehicles		
Average energy performance of trucks	2.3 L/100 t-km in 2012 ²⁷	Objective to improve energy performance ^E
Average fuel consumption of SmartWay road transporters	38.13 L/100 km in 2016 ⁵⁹	1% reduction from 2014
Use of the average capacity by SmartWay road transporters	87.23% in 2016 ⁵⁹	Increase of 1.64 pp from 2014
Number of SmartWay partners on the agglomeration's territory	26 in 2016 ⁵⁹	No trend available

- A. 277 charging stations belong to the Ville de Montréal.
 B. Hydro-Québec, data obtained by email, 2018.
 C. Passenger, institutional, professional and commercial use.
 D. SAAQ, vehicle licensing data obtained by email, 2017.
 E. See the ECCC projections.

Actions

Public charging stations for electric vehicles

As of October 26, 2017, the agglomeration had 389 publicly accessible charging stations, of which 277 were operated by the Ville de Montréal. The Ville de Montréal plans to install 123 additional public charging stations by January 2018, bringing the total number to 512 on the agglomeration's territory. Based on the hypothesis that the average consumption per station during the month of September 2017 for the Ville's stations was 178.6 kWh, and that this applies to all of the agglomeration's public charging stations, we estimate that these 512 stations will help prevent the emission of 1.0 kt CO₂ eq each year.*

The avoided emissions presented here do not consider recharging that uses private-use charging stations, since the consumption data specific to them is not available. While the proportion of electric vehicle charging that occurs using a public station as opposed to a private one is low, a network that presents good spatial coverage gives electric vehicle users the option of charging up close to the various places they travel to, thus minimizing the risk of an outage.

STM acquisition of hybrid and electric vehicles

The STM acquired 51 hybrid engine 12-metre buses in 2016 and three fully electric buses in 2017 as part of the City Mobility project. It also acquired five hybrid engine service vehicles in 2016.

Fuel conversion for heavy vehicles

Because it was not possible to extract data specific to the agglomeration, we present the province-wide data here. According to the available data, 690 trucks were equipped with natural gas engines in 2017 in Québec. As well, for 2015-2016, the reduction of GHG emissions based on substituting natural gas for diesel fuel is estimated at 21.3 kt CO₂ eq for the province as a whole.**

Norme VZE

In October 2016, the National Assembly adopted *Bill 104: An Act to increase the number of zero-emission motor vehicles in Québec in order to reduce greenhouse gas and other pollutant emissions*.¹³ When the bill was adopted into law, two regulation drafts were published in the Gazette officielle du Québec on July 5, 2017, and the Cabinet approved the related regulations on December 13, 2017⁵⁰, which constitute the ZEV standard. This standard came into effect in January 2018 and requires car manufacturers that sell or lease more than 4,500 new vehicles on average per year to respect the sales targets for ZEV or for low-emission vehicles (LEV). The objective of this regulation process is to stimulate the automobile market to develop more models and to use efficient, low-carbon technologies to reach, among other things, the target of 100,000 licensed rechargeable vehicles by 2020 as set out in the MTMDET's Transportation Electrification Action Plan 2015-2020.⁴³

* We presume that the compact vehicles substituted consume an average of 7.0 L/100 km and emit 163 g CO₂/km over a distance of 20,000 km per year. Electric vehicles, for their part, consume 18.6 kWh/100 km; indirect GHG emissions from electricity consumption are considered negligible.

** Énergir Inc., data obtained by email, 2017.

SmartWay transport partnership

Administered in Canada since 2012 by Natural Resources Canada, the SmartWay transport partnership is a collaboration designed to help businesses reduce their fuel costs while transporting merchandise in the cleanest and most efficient way possible. Across North America, 45,111 trucks were registered in 2016.* On the agglomeration's territory, 26 businesses have joined the partnership. The number of trucks registered for these businesses was not available at the time of production for this progress report. In total, 25,333 trucks or road tractors were licensed on the island of Montréal in 2016*, meaning 17.9% of the fleet in Québec. In comparison, nearly 142,000 trucks and road tractors were licensed in Québec in 2016.

Conclusion

The targets for this solution are not considered to have been reached, and it would be difficult to reach them by 2020 considering, among other things, the target of the MTMDET's Transportation Electrification Action Plan 2015-2020, which is insufficient to lower the average consumption of vehicles sold to 6.0 L/100 km, and trends observed with regard to new vehicles. For example, sales of standard or hybrid engine SUVs surpassed those of cars in 2016, but none of these SUVs appears on the list of 15 standard or hybrid engine vehicles with a combined consumption rate of 6.0 L/100 km or less.³³ Also note that ECCC increased its efficiency projections following the amendments made to the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations³¹ and the Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations.³²

Beyond the measures set out in the Ville de Montréal's Transportation Electrification Strategy 2016-2020¹⁰⁴, considering the Ville's scope of authority, we must admit that limited actions are possible toward reaching the average vehicle consumption targets, which are primarily angled toward technological progress and the standards imposed on the automobile industry. We recommend that the Ville pursue its efforts to facilitate the use of electric vehicles, among other things by installing charging stations in reserved parking spaces.

As proposed in Potential Solution 4, we also recommend that the Ville pursue its lobbying of the provincial and federal governments to accentuate the energy efficiency targets for vehicles and to pair that with significant dissuasive measures against the acquisition and operation of gas-guzzling vehicles. The same idea applies to the electrification of heavy transport, for which technologies appear to be emerging.

* SAAQ, data about licensed trucks and road tractors in the institutional, professional and commercial categories obtained by email, 2017.



Potential Solution 12

Facilitate the governance of transport projects

2013-2020 targets

- Clarify and simplify transportation governance in the Montréal agglomeration.

Indicators

Not applicable

Actions

Creation of the Agence régionale de transport métropolitain (ARTM) and the Réseau de transport métropolitain (RTM)

In May 2016, the National Assembly signed into law *Bill 76: An Act to modify mainly the organization and governance of shared transportation in the Montréal metropolitan area*.¹² Two new metropolitan bodies thus entered into operation on June 1, 2017: the ARTM and the RTM. The ARTM is responsible for all planning and funding of public transportation, while the RTM is responsible for the operation of the commuter train service on its territory and for bus transportation services among the local municipalities of the North and South Shores. As well, this law reduces the number of public transportation organizations in the Greater Montréal area to four: the Société de transport de Laval (STL), the Réseau de transport de Longueuil (RTL), the STM and the RTM. Lastly, it brings them all together under the ARTM.

» ARTM

Since June 1, 2017, the ARTM has been responsible for public transportation service planning across its territory. The law gives the ARTM exclusive authority to establish a strategic development plan for public transportation and a rate schedule for public transportation that applies on its territory. It also grants them the authority to receive all the revenues from the sale of transit tickets and other revenue sources for public transportation on its territory. The law also grants the ARTM the power to conclude contractual agreements with public transportation authorities regarding, among other things, performance and service quality objectives that authorities must satisfy, as well as their remuneration. The ARTM's funding mechanisms are discussed in greater detail in Potential Solution 4.

The ARTM's board of directors is made up of fifteen members. The president and the six independent members are appointed by the government. The eight other members are designated by the CMM board, including three independents.¹⁶

» RTM

Since June 1, 2017, the RTM has been responsible for operating part of the public transportation services on the territory that matches the ARTM's territory as a public transportation body. The law grants it exclusive authority to provide public commuter train service on the territory.

Role of the CMM

The law subjects a number of the ARTM's decisions to the CMM's approval, including those regarding the adoption of the strategic development plan for public transportation, the building program and the funding policy.

Changes for the Montréal agglomeration

With the new powers conferred to the ARTM, the Ville can no longer determine its contribution to the STM as in the past (see the "Funding of public and active transportation" section in Table 7). As well, since the ARTM has exclusive authority over fares, the Ville will need to set up an agreement mechanism with the ARTM in order to change the fares applicable on the agglomeration's territory. The same is true for public transportation development projects. Since the ARTM has exclusive authority to establish a strategic plan, all decisions in this area will need to be done in concert with the ARTM. All requests to enhance the STM's service will also need to be made through the ARTM, with which the STM is linked by contractual agreement.

Conclusion

The governance and planning framework for public transit projects was simplified in 2017 by the adoption of Bill 76 in 2016. This will allow the ARTM to establish simplified and more flexible fare strategies, tailored to customers' needs. This change will also make it possible to establish priorities and to coordinate and fund public transportation projects that fall under its strategic plan, with the CMM's approval. As well, henceforth the ARTM has exclusive authority over public transportation development and planning, such that the agglomeration's powers in this area have changed.



CONCLUSION

The follow-up to the Reduction Plan revealed a number of observations about the sources of growing GHG emissions, the progress achieved and the efforts that remain to be made.

According to the collected indicators, the Montréal agglomeration is not on track to achieve its 30% reduction target by 2020. In fact, since 2013, we have seen an acceleration of household car ownership, an increase in cylinder capacity and a drop in the modal share of public transportation, despite major investments made since 2013 to maintain and increase the availability of public transportation modes. It is therefore reasonable to assume that the transportation sector's emissions have grown since 2014 and that this trend is maintaining, accentuating the gap with the reduction target for 2020. As well, the data we consulted do not predict that substantial further reductions will materialize by 2020, nor that such reductions could sufficiently compensate for the impact of the expected increases in the transportation sector.

Since the Reduction Plan was adopted by the agglomeration council on September 26, 2013 (resolution CG13 0416), the Montréal administration has endorsed the declaration from the Climate Summit for Local Leaders held in December 2015 in Paris as part of COP21 (the 21st annual Conference of Parties, also known as the Paris Climate Conference). This commitment targets the reduction of GHG emissions, among other things, by setting new objectives, including an 80% reduction in GHG emissions for 2050 and an intermediate target for 2030.

To reach these targets, we strongly recommend an update to the Reduction Plan. As well, a sine qua non condition is necessary to maximize the chances of success: we must work actively, citywide, to define and implement the most effective measures. This update should therefore be put into place in parallel with the creation of a coordination mechanism piloted by the Ville that involves all the key players citywide.* It should also take into account the directions established based on the interim observations for the various solutions.

» Choose the most efficient investments for the fight against climate change

The Montréal administration as well as all citywide players should systematically choose the most efficient actions toward the fight against climate change. This means choosing the least costly actions for society as a whole in terms of tonnes of GHG emissions avoided (\$/t CO₂ eq avoided).

» Assess the recommendations resulting from public consultations on building design from the perspective of sustainable development and fossil fuel dependency

Various recommendations were submitted at the public consultations held by the Commission sur l'eau, l'environnement, le développement durable et les grands parcs (committee on water, the environment, sustainable development and large parks), which addressed building design from a sustainable development perspective on the Ville de Montréal's territory,⁸¹ and by the Office de la consultation publique de Montréal (Montréal's public consultation office, or OCPM), which dealt with reducing Montréal's dependency on fossil fuels.⁵³ A number of recommendations, pertinent to reducing GHG emissions, concern the improvement of buildings' energy efficiency, land use planning and the use of renewable energy.

* By key players citywide, we mean citizens, citizen groups, community groups, NGOs, institutions, the business and energy milieus, transport organizations (public, active and alternative), and the various levels of government.

POTENTIAL DIRECTIONS: TOWARD 2030

Based on the conclusions about the progress for each solution, we propose 11 potential directions. These take into account, among other things, current emissions and reduction targets for 2030 and 2050.

Mobility and land use planning

Direction 1

Include quantified objectives for reducing the number of solo driving commuters within targets for urban planning and for public and active transportation development

On-road transportation is the sector that generates the most GHGs in absolute terms. As well, it shows no sign of dropping since 1990, in fact quite the reverse. To simplify progress monitoring, all ARTM cities could include quantified objectives for reducing the number of solo drivers in order to reach the GHG emissions reduction objectives from the Paris accord. It would also be useful for the ARTM to take into account the data about the number of solo drivers that need to be eliminated in developing their strategic development plan for public transportation.

Direction 2

Implement significant dissuasive measures against large cylinder capacity vehicles and against excessive household car ownership

To counter the growth of GHG emissions in the transportation sector, the Ville could take steps with the provincial and federal governments with a view to enhancing and expanding the bonus/penalty systems that penalize purchasers of gas-guzzling vehicles and that reward purchases of zero-emission and low-emission vehicles across Québec. This system could also, for instance, penalize excessive household car ownership, meaning the licensing of more than one non-electric vehicle per household. These measures would help accelerate behaviour changes with regard to vehicle purchasing.

As an example, let's consider the average consumption of the 50 best selling vehicles in 2016, meaning 9.6 L/100 km. The adoption of dissuasive measures that reduce this average to 6.0 L/100 km, which corresponds to the typical consumption rate of hybrid and energy-efficient vehicles, would create a 37.5% reduction in GHG emissions for road transportation resulting from the use of personal vehicles, or the equivalent of 842.7 kt CO₂ eq for the agglomeration or 5.6% of GHG emissions in 1990 (see box).

Estimated impact of best-selling vehicles' consumption rates on GHG emissions

The calculations are based on the following data and hypotheses:

- on-road transportation emissions on the agglomeration's territory in 2014: 3,567 kt CO₂ eq⁸⁰;
- proportion of on-road transportation emissions coming from the use of personal vehicles: 63.0%;*
- proportion of the reduction resulting from a drop in the average consumption of personal vehicles: 37.5%.**

* This estimate was prepared based on energy use proportions in the transportation sector per vehicle type set out in "État de l'énergie au Québec 2018," a 2018 study on the state of energy in Québec produced by the HEC Chair in Energy Sector Management.¹¹⁰

** This estimate was obtained by using the difference between the consumption target of 6.0 L/100 km set in the Reduction Plan and the indicator for the average consumption rate of the 50 best selling vehicles in Québec in 2016, or 9.6 L/100 km.

Direction 3

Adopt ecofiscal measures regarding free parking

All car trips start and end with parking. The availability of free parking acts as a major catalyst for solo driving. The portion of commuters that take the car to work can be two to six times higher when there is parking available on site at work. As such, the availability of parking is the biggest factor in people's choice to use cars as their mode of transportation.²⁵

The agglomeration can take steps with the provincial government toward adopting significant ecofiscal or dissuasive measures regarding the availability of free parking in areas served by public transportation in order to reduce the number of spaces and, in so doing, reduce GHG emissions. These measures could also contribute to growing and diversifying the revenues allotted to increasing the availability of public transportation in order to facilitate a modal shift for commuters.

Direction 4

Consider putting into place a Mobility as a Service (MaaS) system

To facilitate travel and reduce household car ownership, the Ville could approach the MTMDET and the ARTM to ask them to assess the possibility of implementing a MaaS system in the Greater Montréal area, in order to reduce the rate of car ownership.

Direction 5

Accelerate the production frequency of mobility-related data

Considering the seven-year interval that can occur between the production of an Origine-Destination study and the planning of mobility and urban design initiatives, the Ville notes that it is necessary to consider other avenues in order to obtain mobility characterization data more frequently. To help the Ville make the best possible decisions in urban planning and mobility planning in relation to the fight against climate change, it could coordinate the aggregation and analysis of data relevant to the agglomeration from various transportation agencies, meaning the STM and the RTM for public transportation, the MTMDET for on-road transportation, and the Ville for active transportation, urban design and so forth.

Direction 6

Diversify revenue sources dedicated to funding public transportation

Since 67% of revenues for the LTNF and 81% of revenues for SOFIL come from fuel taxes, and since the funding for public transportation projects comes mostly from these two funds, if the medium- and long-term fossil fuel reduction objectives are reached, we must expect that the revenue sources for these funds may drop accordingly. To ensure the longevity of public transportation funding and to diversify revenue sources, the Ville could work with the provincial government. Funds could come, among other things, from dissuasive measures against solo driving, large cylinder capacity vehicles and excessive household car ownership. The provincial government could, in doing this, create a separate fund for the LTNF dedicated to funding public transit in order to facilitate its governance and transparency.

Stationary energy

Direction 7

Target GHG emissions from stationary energy in order to reach short-term objectives

As shown in potential solutions 1 and 2, the emissions that come from stationary energy have been significantly reduced since 1990. Based on estimates for 2014, fossil-based energy sources in residences, businesses, institutions and industry facilities emit nearly 4,000 kt CO₂ eq. Since reductions of slightly more than 1,000 kt CO₂ eq were required to reach the 2020 objectives, a conversion of about 25% of these fossil energy sources toward renewable sources would make it possible to reach the 2020 reduction objectives, as long as emissions from other sectors remain constant.

Direction 8

Consider GHG reduction targets in the Ville's housing subsidy programs

For the moment, no mechanism exists to help the Ville's various citizen subsidy programs systematically take into account GHG reduction targets. For example, since 2013, 32% of the 2,623 financial aid grants allotted by the Ville for the purchase of new units were given to residences located outside TODs, which may have contributed to increasing these households' car ownership rates. With this in mind, it would be wise to consider climate change objectives within the objectives of existing programs and when developing new programs.

In a similar vein, we could plan to implement programs that specifically target the transition toward renewable energies as a replacement for fossil-based energy sources. To achieve this, the Ville could offer financial mechanisms to citizens to help them spread out the reimbursement of their investments over longer periods of time. This could stimulate quicker citywide action.

Direction 9

Accelerate the adoption of supply requirements for renewable natural gas

Emissions from natural gas combustion are estimated at 3,441 kt CO₂ eq, or 29.9% of the agglomeration's total emissions for 2014. Fossil-based natural gas is thus a major source of GHG. While the intensity of GHG emissions from natural gas combustion is lower than that of petroleum products such as fuel oil and diesel, this difference alone will not make it possible to reach medium- and long-term reduction objectives. As a result, the Ville questions the usefulness of considering this energy source as a substitute for other sources of fossil energy, insofar as it does not contain renewable natural gas.

To reduce GHG emissions from fossil-based natural gas combustion, the Ville could ask the provincial government to set requirements for renewable natural gas supply based on GHG emissions reduction targets. For example, according to the Ville's estimates, a supply made with 5% renewable natural gas would help reduce the agglomeration's GHG emissions by 171 kt CO₂ eq, or 1.1% as compared to 1990.

Other sources

Direction 10

Include new sources in the GHG emissions inventories and reduction plans

In October 2017, the federal government adopted the Regulations Amending the Ozone-depleting Substances and Halocarbon Alternatives Regulations.³⁰ They prescribe the gradual reduction of the production and consumption of hydrofluorocarbons (HFCs) by 85% for 2036, following the requirements of the Kigali Amendment⁵⁵, ratified by Canada in 2016.

As well, under measure 21.1 (Réduction des émissions de GES en provenance des systèmes de réfrigération, a measure to reduce GHG emissions from refrigeration systems) of the PACC 2013-2020, nine projects targeting the reduction of GHG emissions from refrigeration systems were carried out from 2014 to 2016 on the agglomeration's territory. None of the 12 solutions proposed in 2013 target the reduction of emissions from the use of halocarbons, refrigerant gases used as substitutes for ozone-depleting substances, whose emissions are estimated at 476 kt CO₂ eq, even though they were negligible in 1990 (0.5 kt CO₂ eq). An update to the Reduction Plan would be advisable in order to take into account halocarbons.

GHG emissions related to the third application field of the agriculture, forestry and other land use sector, meaning those generated outside the agglomeration's geographical limits, are not quantified in the agglomeration's GHG emissions inventories. However, there is reason to believe that these emissions, related in part to citizens' eating habits, could be significant across the agglomeration. In fact, they represented 9.4% of the province's emissions in 2014⁴⁹, or 0.94 t CO₂ eq/resident. It would thus be wise to quantify them and include them in the inventories in order to confirm their relative importance and suggest new reduction approaches.

Awareness-raising

Direction 11

Produce a GHG reduction guide for citizens

Citizens' everyday choices and actions have a direct impact on citywide GHG emissions. This is why citizen participation is fundamental in ensuring the success of GHG emissions reduction work. For the moment, the agglomeration provides no support to help guide citizens' actions. A guide would make it possible to both educate citizens and involve them in changing their habits and life choices to assist in the fight against climate change.

APPENDICES

APPENDIX I

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APPENDIX II

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