

# REDUCING TRUCK EMISSIONS IN MONTREAL

Guiding principles and a policy  
toolbox for low-carbon urban freight

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## *Reducing truck emissions in Montreal: Guiding principles and a policy toolbox for low-carbon urban freight*

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### **About the Pembina Institute**

The Pembina Institute is a national non-partisan think tank that advocates for strong, effective policies to support Canada's clean energy transition. The latter employs multi-faceted and highly collaborative approaches to change. They convene diverse sets of stakeholders to identify and move toward common clean energy solutions.

### **About Jalon**

Jalon is a non-profit organization founded in 2017 by the City of Montreal. Jalon's mission is to ignite and support innovation and changing practices to make mobility more sustainable. Jalon is active in the fields of collective and shared mobility, active mobility, freight logistics and urban planning.

### **About Équiterre**

Équiterre is a non-profit organization that seeks to make the necessary collective transitions towards an equitable and environmentally sound future more tangible, accessible and inspiring by working with citizens, organizations and governments.

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# Executive Summary



The movement of goods in Montreal and the province of Quebec is a growing source of urban congestion, road safety concerns, and carbon emissions — fuelled by the growth of e-commerce and doorstep deliveries.

However, until recently, the movement of freight in cities and its congestion and climate-change implications have not received significant policy attention.

The Intergovernmental Panel on Climate Change released its Sixth Assessment Report in August 2021 confirming the near-linear relationship between human-activity-related CO<sub>2</sub> emissions and global warming. Emissions reductions plans, targets, carbon budgets, and sectoral strategies are needed now. The Province of Quebec has an overall greenhouse gas emissions (GHG) reduction target of 37.5% below 1990 levels by the year 2030, and the City of Montreal has set a target reduction of 55% from all sectors within the same timeframe.

The Pembina Institute, Jalon, and Équiterre set out to understand the contribution of urban freight on GHG emissions in the Montreal region and to specifically identify currently feasible solutions and practical tools to reduce urban freight emissions. In doing so, we hope to create more liveable and healthy communities.

Through best-practice research and interviews with stakeholders in the Montreal urban freight ecosystem, we identified guiding principles and four major strategic solutions that are practical steps to achieving transformational change by mid-century.

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## Four key solutions and recommended policy tools

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### SOLUTION 1

#### Increase the use of electric-assist cargo bikes and mini-hubs

Standard delivery vehicles can be replaced with much smaller and low-emission vehicles such as cargo bikes that would operate around mini-hubs.

- Provide provincial or municipal loans at 0% interest for updating fleets to electric-assist cargo bikes to help reduce the financial risk linked to early adoption of immature technology. Increasing the number of electric-assist cargo bikes used in urban deliveries will require acquisition incentives from the provincial government.
- Build and adopt an urban freight strategy at the municipal level to allow businesses to plan, prepare, and co-ordinate their transition to cargo bikes and mini-hubs. A freight strategy will help companies to determine potential locations for mini-hubs at some of the city's underutilized infrastructure, and will increase their understanding of how the bicycle network and curbside management will facilitate their cargo bike operations in the future.
- Implement low-emission zones or pedestrian streets in select areas of high density, high traffic congestion, and high freight activity to restrict access by larger polluting vehicles. Progressive restrictions on vehicle size and emissions will create conditions that favour the use of cargo bikes and provide additional operational advantages.



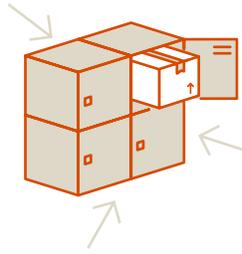
### SOLUTION 2

#### Optimize urban delivery systems and logistics

Optimization involves reducing the travel of empty or partially empty urban delivery vehicles, optimizing vehicle loading, and optimizing urban delivery hours of operation.

- Amend municipal bylaws and introduce provincial legislation to remove delivery prohibitions between 7 p.m. and 7 a.m. in central areas. Further, develop and operate an incentive program to help and encourage businesses to receive deliveries after hours as has been done in New York City.
- Investigate backhauling potential (using the typically empty return trip), and develop an initiative/program to co-ordinate delivery/hauling and backhauling between businesses in Montreal.
- Develop urban consolidation centres, as has been done in Paris, France, and possibly incorporate the proposed Montreal freight tram to help move freight within the city. Pilot a co-ordination platform for a freight and consolidation centre to facilitate sharing of building and vehicle space, including backhauling optimization.

### SOLUTION 3

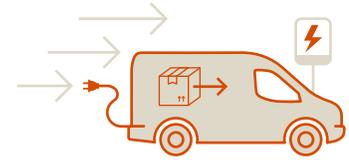


## Increase **direct delivery** to customers through **parcel lockers**

Direct deliveries to parcel lockers located in high-density residential and commercial areas can significantly reduce journeys made by delivery trucks to home addresses.

- Identify or create an organization in Montreal that could lend free or subsidized physical spaces to be used for parcel lockers through a lease with the owner of the lockers to ensure that this solution can rapidly scale and become widely available in the early phases of adoption. Use of this space should involve certain lease conditions for the delivery companies including non-exclusive use of lockers and data sharing with the city or the designated managing organization.
- Identify strategic locations throughout the city to deploy parcel lockers.
- Adopt municipal regulations that would require some high-density residential or commercial buildings to install parcel lockers in a secure location on the premises.
- Adopt online standards that would give customers the option to choose delivery directly to a parcel locker at checkout.

### SOLUTION 4



## Accelerate the deployment of **zero-emission delivery vehicles**

Standard delivery vehicles can be replaced with low- or zero-emission vehicles.

- Create preferred curbside access and loading zones for zero-emission delivery vehicles, paired with charging infrastructure where possible.
- Develop a simplified permitting process for charging infrastructure development including easily obtained applications and approvals.
- Consider implementing provincial vehicle registration tax exemptions for either all zero-emission vehicles (ZEVs), or ZEVs of certain weight classes. Consider a municipal vehicle registration levy, with exemptions for ZEVs.
- Plan and begin a rollout of a low- or zero-emission zone for city logistics in Montreal that aligns with decarbonization goals. To facilitate implementation, offer a menu of financial incentives for the acquisition of zero-emission delivery vehicles and the installation of charging infrastructure in co-ordination with Hydro-Québec. These incentives could include, but are not limited to, PACE (property assessed clean energy) finance and on-bill financing.

# Introduction



The movement of goods between regions and in urban areas is a growing source of carbon emissions as well as road safety issues and urban congestion.

On top of our growing population and expanding economy, e-commerce sales and demands for fast and same-day home deliveries are expanding.<sup>1</sup> That has led to a significant increase in freight traffic levels, especially in urban areas.

According to Statistics Canada, Canadians are buying online more than ever and, between 2016 and 2020, e-commerce sales grew by more than 350%.<sup>2</sup> During the first months of the COVID-19 pandemic, from February to May 2020, e-commerce sales grew by 99.3%.<sup>3</sup> The World Economic Forum predicts that such trends will result in 36% more delivery vehicles in inner cities by 2030.<sup>4</sup>

## Freight impacts

### Emissions

In Canada, the transport sector is the second largest source of GHG emissions, accounting for 25% of the country's total output.<sup>5</sup> Emissions from freight travel grew 153% between 1990 and 2019 (Figure 1), with emissions from freight trucks more than tripling.<sup>6</sup> Multiple factors explain this increase including population and economic growth, vehicle type, fuel efficiency, and fuel type.<sup>7</sup> Consumption is not slowing down, and the population is continuing to grow. For those reasons, the freight sector should be a priority when it comes to reducing carbon emissions in Canada.

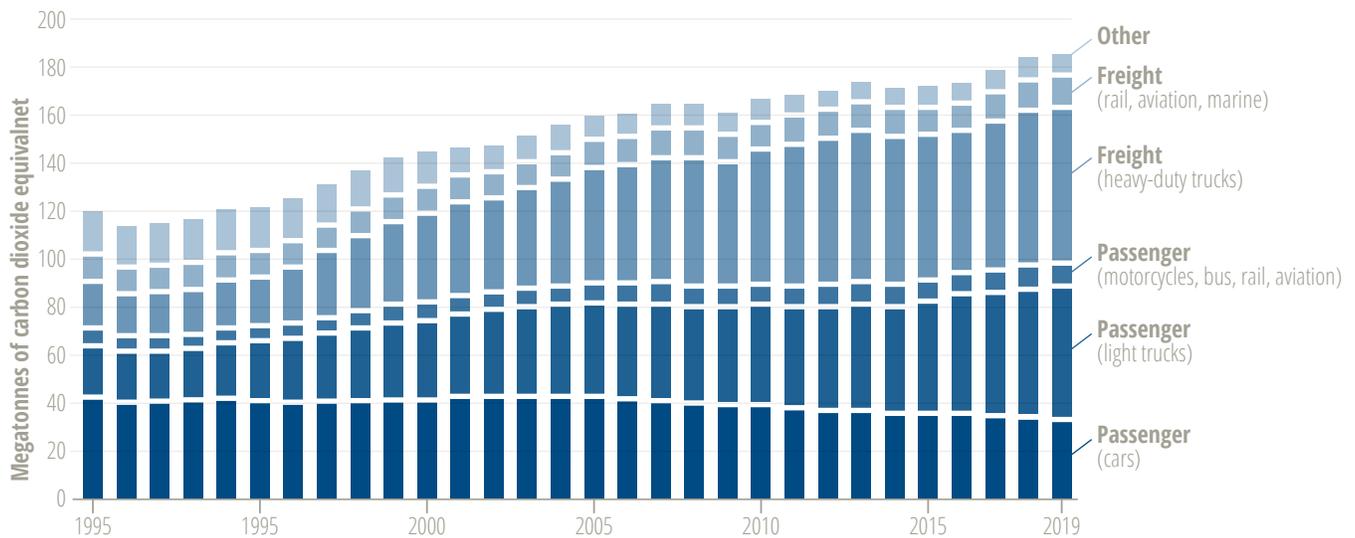


Figure 1. Transport sector greenhouse gas emissions in Canada

Source: Government of Canada<sup>8</sup>

In Quebec, freight carbon emissions grew by 190% between 1990 and 2018 (Figure 2). In 2018, emissions from this sector accounted for 45% of total emissions, and 80% of those transportation-related GHG emissions came from road transport specifically.<sup>9</sup>

In Montreal, emissions from the road transportation sector decreased by 4% between 1990 and 2017, while overall transportation activity emissions remained stable, mostly due to the fuel efficiency improvements in road vehicles. This sector is still the largest emitter in the Montreal agglomeration: it stands at 39%, well

ahead of industry, and commercial and institutional emissions, which represented 22% and 15% of overall emissions in 2017.<sup>11</sup>

Nevertheless, diesel consumption increased by 2% between 1990 and 2017, despite improvements in vehicle fuel efficiency. In addition, it is clear that emissions from the freight sector are a concern, as heavy-duty vehicles are on the rise: the number of registered vehicles of this type increased by 16% between 1990 and 2017, from 31,498 to 36,509.<sup>12</sup>

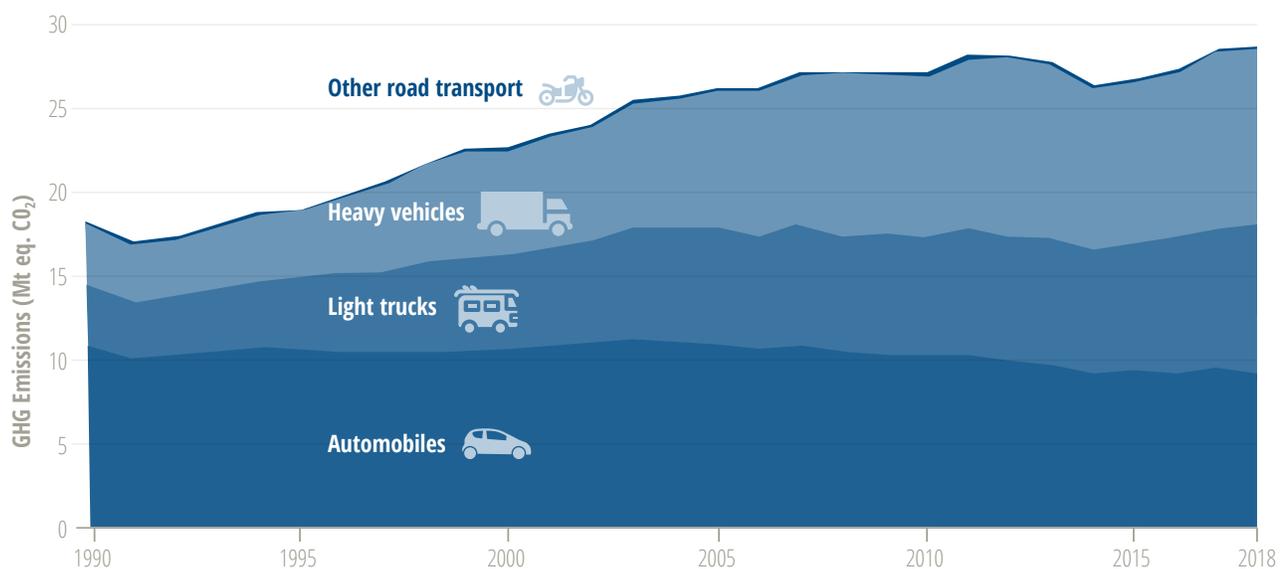


Figure 2. Road transport greenhouse gas emissions in Quebec

Source: Government of Québec<sup>10</sup>

## Traffic congestion

Montreal's key corridors are congested. In September 2019, peak travel time was nearly four times longer than off-peak time on Highway A-40 between Highway A-25 and Highway A-15 (Autoroute Décarie).<sup>13</sup> This renders the use of main corridors during peak hours inefficient for urban delivery (Figure 3). In one study commissioned by the Canadian Automobile Association, researchers found that Montrealers lose three million work hours annually due to traffic congestion.<sup>14</sup> The Ecofiscal Commission of Canada notes that traffic “is more detrimental to the transportation of goods than to the movement of commuters. Unlike car drivers,

who can choose their routes and travel times with some flexibility, truckers and companies often have inflexible delivery deadlines.”<sup>15</sup>

Congestion also drives important business decisions. For example, freight-dependent firms will choose to locate in a region based on its travel time and the availability of its service markets and sources of supply. But, whatever the costs of moving goods, they are substantial, widespread, and passed on to consumers in the form of higher prices. According to a Washington State Department of Transportation study of trucking companies, consumers would bear 60-80% of these costs.<sup>18</sup>

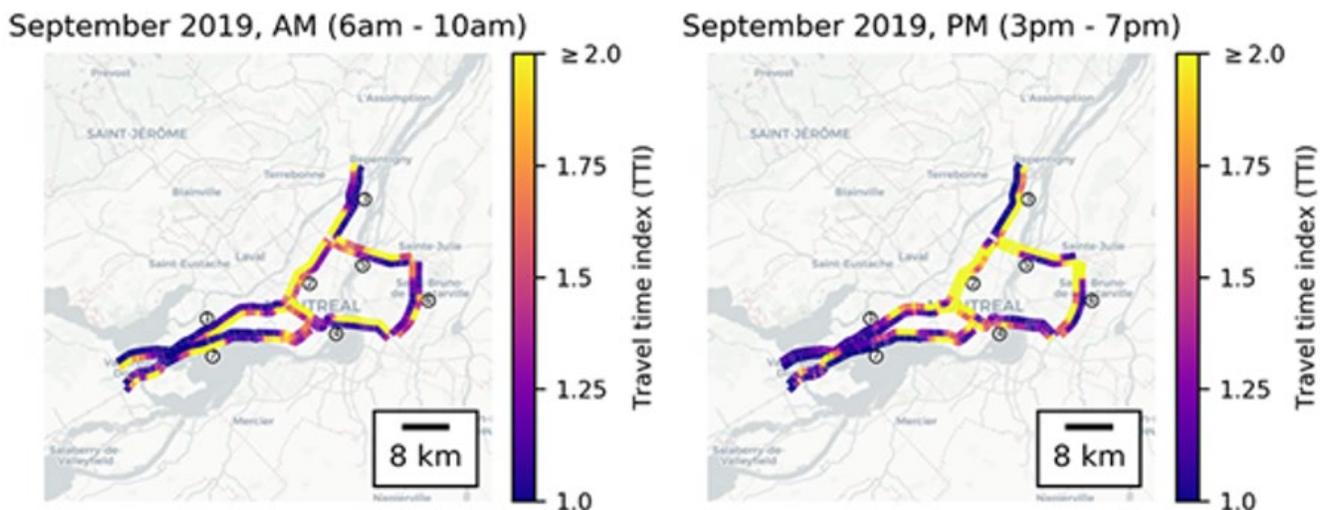


Figure 3. Congestion in Montreal's main corridors during peak hours

Source: Transport Canada and Statistics Canada<sup>16</sup>

*“The time value of consumer goods movement is estimated to range from \$40 to \$210 (2015 \$CAD) per hour per truck, depending on the size of the vehicles and whether both direct and indirect costs are included. When added together with the costs of lost time, missed deliveries, and lost productivity, congestion imposes high and rarely considered economic costs on the consumer-goods sector. These costs are further compounded by the uncertainty and unpredictability of travel, which requires firms to increase their financial reserves and inventories to mitigate the impact of delivery delays.”*

– Ecofiscal Commission of Canada<sup>17</sup>

## Safety and health

Managing urban freight activity well and ensuring that it is appropriately integrated with other road and public uses is also important from a road safety perspective. There are road safety issues in Montreal, like all Canadian cities. In fact, according to the Vision Zero 2019 Collision Report, the majority of road users killed in the city in that year were pedestrians. Twenty-eight people died while walking, the highest number in five years. Pedestrians were also the most seriously injured (51%).<sup>19</sup>

Furthermore, when the electricity mix is relatively clean, as is the case in the province of Quebec, replacing old diesel vans with new electric vans reduces CO<sub>2</sub> emissions by 93–98% and air pollutants by 85–99%.<sup>20</sup> The health benefits associated with the decarbonization of urban freight in Montreal could be significant.

## ► Finding solutions

The goods movement and freight industry plays an important role in the province's economy. For example, the number of people employed in truck transport rose 20% between 1990 and 2018, in contrast to the 10% increase in jobs for the entire Quebec economy. In addition, GDP growth between 1990 and 2018, specific to trucking (35%) was almost twice as high as the real GDP growth in the overall economy.<sup>21</sup>

Businesses and delivery fleet operators stand to benefit from better-managed urban freight systems. It is imperative that policymakers create the right conditions for businesses of all sizes and types to adopt more sustainable logistical practices while also remaining competitive. This is particularly true for local and small businesses in Quebec.

For these reasons, now is the time to change how freight is moved and delivered within cities, especially when it comes to last-mile freight. And the Province of Quebec and its municipalities, including the City of Montreal, are responding. Through its Climate Plan 2020-2030, Montreal has committed that 25% of deliveries will be zero-emission.<sup>22</sup>

To support municipal climate action and guide future sustainable land use, transportation, energy and infrastructure planning, and policy development, the Pembina Institute, Jalon, and Équiterre set out essential principles to reduce urban freight emissions

and create more liveable and healthy cities. To bring these principles to life, we have identified strategic solutions and practical policy tools that focus on: 1) optimizing urban delivery systems and logistics, 2) increasing direct delivery to customers through parcel lockers, 3) increasing the use of electric-assist cargo bikes and mini-hubs, and 4) accelerating the deployment of zero-emission delivery vehicles.

This toolbox builds upon work by Jalon in the Montreal context over recent years such as *Repenser la stratégie de livraison urbaine* report (2018) in which interviews and round tables were used to devise freight solutions that are harmonized with the ecosystem. It also relies upon the *Colibri Final Report (2020)* which drew its conclusions from the pilot project that brought to life the first mini-hub and cargo bike solution in Montreal. This toolbox has been informed by stakeholder interviews, a jurisdictional scan, and literature review of successful sustainable urban freight practices around the world. It considers the needs and interests of businesses, technology readiness and applications, and the existing policy, legislative, and regulatory conditions.

## Study scope and method

To inform our policy analysis and to ensure that the recommended solutions and actions for reducing emissions from — and improving logistics for — urban freight are appropriate and sensitive to the unique conditions and context in the Montreal region, we deployed the following research method:

- Establish a nine-member advisory committee of local stakeholders in the public, private, and non-profit sectors.
- Host two workshops and conduct 35 research interviews with stakeholders in the Montreal-region urban freight ecosystem including local and large businesses from various sectors, shippers/senders, carriers, receivers, and government and non-governmental organizations.
- Assess current gaps in terms of urban freight decarbonization in Montreal, in Quebec and in Canada through a short policy overview and analysis.
- Research and synthesize global best practices as well as academic and grey literature on urban freight and logistics emissions reduction.
- Identify guiding principles based on common themes found in international best practices, literature review, and stakeholder interviews.
- Shortlist recommended solutions and tools based on their policy impact and alignment with principles.
- Develop and share an accessible and evidence-based toolbox of solutions to reduce emissions from urban freight, tailored for the Montreal and Quebec context.

# Policy gaps and opportunities



The Province of Quebec and its municipalities must support the economic growth and prosperity of the goods-movement sector while also bending the emissions curve from freight transport if climate targets are to be met. But clear weaknesses are evident in the climate and transportation plans of Quebec and of Montreal.

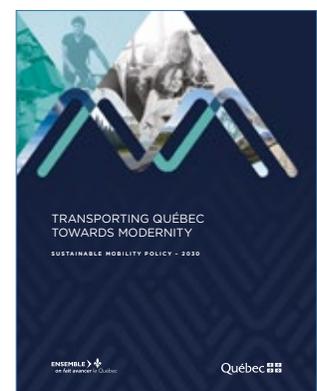
While the provincial and municipal plans do acknowledge the need to address freight emissions to reach their climate ambitions, neither of these levels of government have clear pathways or sufficient policy measures to create the right conditions that would support businesses to deliver goods more sustainably in the short, medium, and longer term. Stronger and more decisive actions, including technology readiness and support to businesses, need to be implemented to respond to current challenges.

incorporated into these strategies specifically target urban freight emissions, support to and collaboration with municipalities needs to be enhanced.

As the main pillar of its climate plan, the government wants to electrify the transport sector. This would apply to trucks used for delivery purposes, including lighter vehicles, especially in private truck fleets.<sup>23</sup> Urban densification and optimization are also part of Quebec's strategy to develop low-emission freight transportation.<sup>24</sup>

## Province of Quebec

Quebec has two main climate and mobility plans. The first is its Plan for a Green Economy 2030 and the accompanying Implementation Plan, which has a target of reducing Quebec's overall GHG emissions by 37.5% below 1990 levels by 2030. The second is its Sustainable Mobility Policy, an innovative subnational document adopted in 2018. While a few of the measures



In its 2018-2030 Sustainable Mobility Plan and the accompanying Action Plan, the Quebec government aims to reduce congestion in the regions of Montreal and the City of Quebec to facilitate businesses' deliveries and shipments. Improving logistic chains and reducing the number of vehicles in Quebec cities are said to be priorities to help companies send freight more easily, at a cheaper cost, and by prescribed deadlines to intermodal facilities and different markets.<sup>25</sup> A multisectoral Monitoring Committee has been set up to advise the government and ensure compliance with the Sustainable Mobility Plan's vision and the achievement of its objectives for 2030.

Programs of the Province of Quebec to address freight emissions include:

- *Écocamionnage* program: financial support to cover the additional purchase cost of e-trucks.<sup>26</sup> This program is being renewed. Its main objective is to promote the use of equipment and technologies aimed at improving energy efficiency while reducing GHG emissions from the transport of goods, and therefore goes beyond the sole aim of vehicle electrification.
- *Transportez vert* program: granted \$24.5 million for the 2021-2026 period, this program offers various benefits to municipalities and businesses, including 25% financial assistance up to a maximum of \$2,000 for each new cargo bike they purchase.<sup>27</sup>
- *Transportez vert* program: granted \$24.5 million for the 2021-2026 period, this program offers various benefits to municipalities and businesses, including 25% financial assistance up to a

maximum of \$2,000 for each new cargo bike they purchase. It includes offers financial support for training and awareness-raising activities relating to ecodriving among drivers of light- or heavy-duty vehicles.<sup>27</sup>

- Energy management program for road vehicle fleets: financial support to freight businesses to help them calculate their fleet's energy consumption and corresponding GHG emissions.

Other initiatives that will encourage action regarding intramodality and integration of transportation services<sup>28</sup> have been announced.

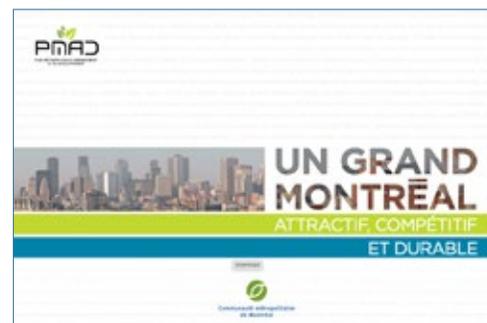
The 2021-2026 Implementation Plan of the Plan for a Green Economy provides for a budget of \$200 million over five years for the *Écocamionnage* program. The government also plans to adopt a ZEV standard for heavy vehicles, as has been done in California, to ensure that manufacturers develop and offer electric trucks in Quebec.

The Implementation Plan is also expected to be re-evaluated annually and will systematically cover the five years that follow each renewal, which will make it possible to benefit from an approach that is predictable, flexible, and pragmatic.

Finally, other forms of exchange and discussion exist for freight transport in Quebec, such as the Impulsion MTL forums held by Propulsion Quebec. Despite these programs and platforms for change, action to decarbonize the freight sector remains slow.

## ► Montreal region

The *Communauté métropolitaine de Montréal's Plan métropolitain d'aménagement et de développement* proposes to extend some major corridors and expand the road network to reduce congestion and improve freight mobility at a regional level.<sup>29</sup> The plan does not offer any other strategies and tactics to reduce freight demand, shift to low-carbon modes, or improve vehicle efficiency and operations.



## ► City of Montreal

The City of Montreal has developed several strategies and plans that include climate- and transportation-related actions. These work together to frame the City of Montreal's actions on ecological transition.

### Montreal 2030 - Citywide Strategic Plan



Montreal's Strategic Plan offers key insights into the City's vision for the next ten years, including the acceleration of the ecological transition.<sup>30</sup>

The Strategic Plan is the basis upon which the city's Climate Plan has been built. On urban freight, the document states that the City

of Montreal will "contribute to the modernization of freight transportation practices in order to strengthen the economic vitality of the metropolis while reducing the associated nuisances."<sup>31</sup>

### 2020-2030 Climate Plan



The City of Montreal released its 2020-2030 Climate Plan in December 2020. This plan aims to reduce the city's GHG emissions by 55% by 2030. When signing the One Planet Charter in 2018, the city committed to reaching net zero by 2050.<sup>32</sup>

While 40% of Montreal's GHG emissions come from the transport sector, its climate plan recognizes that "transportation is the sector in which the greatest GHG emission reductions are possible over the next 10 years."<sup>33</sup> As such, it adequately underlines urban freight as a key sector in which significant emissions reductions would accelerate decarbonization.

Key targets of the city's climate plan include:

- A 55% reduction in GHG emissions from all sectors
- A decrease in consumption of fossil fuels
- 47% of vehicles registered in the agglomeration of Montreal to be electric.<sup>34</sup>

There are two key actions aimed at reducing emissions from freight activities in Montreal.

#### 1. Electrification and the gradual implementation of a zero-emission zone

By 2030, the City of Montreal plans to increase the proportion of electric vehicles in its downtown by:

- Increasing public and private charging infrastructure for both personal and commercial vehicles in line with Hydro-Québec's initiatives
- Purchasing of electric vehicles for municipal purposes
- Supporting delivery companies that wish to electrify their vehicle fleets.

While electrification is a solution to reducing GHG emissions, a comprehensive strategy will have to be developed quickly. A zero-emission zone represents a significant opportunity to accelerate the electrification of vehicles but, as this policy is designed, the ways in which it will effectively reduce congestion and optimize delivery travels must be considered.

**2. Adoption of a strategy to reduce the carbon footprint of transportation of goods by road to ensure that 25% of deliveries are zero emission**

While acknowledging the fact that more “technological and operational avenues to reduce the carbon footprint of freight transport are emerging,”<sup>35</sup> the city asserts the need to develop a plan that will sort out these pathways and allow Montreal to reach its 2030 target by:

- Developing and deploying pilot projects and incentives to accelerate the electrification of the urban delivery industry or to make it more carbon efficient
- Sustaining and enhancing the deployment of local urban logistics spaces

- Working with affected businesses to accelerate the deployment of charging stations for freight-delivery vehicles.

Montreal’s interest in decarbonizing its freight activities is clear. To deliver on its promises, the need to align actions with other objectives, such as the reduction of road congestion and the creation of safer communities, will need to be rooted in urban planning, as well as in fiscal, regulatory, and exemplary solutions. The city’s desire to develop a formal and comprehensive strategy to reduce delivery emissions by 25%, as stated in the previous action, represents a unique opportunity for organizations to accompany and support the city in identifying the most suitable options for Montreal.

**Transportation Electrification Strategy 2021-2023**

The Montreal Transportation Electrification Strategy for the 2021-2023 period is part of the city’s Climate Plan and offers concrete actions to decarbonize last-mile deliveries at the municipal level.<sup>36</sup> The following measures from the strategy are expected to be implemented early in the decade.



Strategy orientation	Core target	Measures
Orientation 4: Intensify efforts to encourage the electrification of urban freight transportation	500,000 parcels delivered each year from local urban logistics spaces using electric modes of transportation	<ul style="list-style-type: none"> <li>• Ensure the sustainability of the Colibri pilot project (local urban logistics space)</li> <li>• Set up new local urban logistics spaces to serve a larger territory and more boroughs</li> <li>• Encourage the rollout of pilot projects to accelerate the electrification of the urban delivery sector or reduce its carbon footprint</li> <li>• Continue the large-scale study of electrification, decarbonization, and the negative external effects associated with freight transportation in urban areas and economic hubs.</li> </ul>
Orientation 5: Enhance the city’s exemplary, agile, open, and efficient approach to electrification	Draft and test specific clauses related to sustainable mobility for at least one call for tenders.	<ul style="list-style-type: none"> <li>• Conduct at least one experimentation project for an electric or low-carbon rolling stock prototype with a view to integrating it into the municipal fleet.</li> <li>• Strengthen GHG reduction parameters for procurement that require transportation activities.</li> <li>• Make training on the city’s Politique d’approvisionnement responsable et équitable [responsible and equitable procurement policy] mandatory for employees responsible for calls for tenders and preparing quotations.</li> <li>• Include energy efficiency and GHG reduction clauses in contracts that involve transportation activities.</li> </ul>

Strategy orientation	Core target	Measures
Orientation 6: Use Low Emission Zones (LEZ) and then Zero Emission Zones (ZEZ) to improve the quality of life of Montrealers and accelerate transportation electrification	Plan the deployment of an LEZ pilot project in Montreal.	<ul style="list-style-type: none"> <li>• Launch a public consultation process to specify the terms of introducing an initial LEZ in Montreal.</li> <li>• Work on rolling out an LEZ pilot project in Montreal.</li> <li>• Work on adapting planning tools for sectors eligible for requalification and certain innovative industrial sectors by taking inspiration from LEZ and ZEZ concepts</li> </ul>
Orientation 7: Develop an attractive, innovative business environment that is conducive to the growth of companies and institutions in the transportation electrification and energy efficiency sector	Make \$13M available to Montreal businesses linked to the electric mobility sector to support their development.	<ul style="list-style-type: none"> <li>• Organize or participate in technology and commercial showcase events to make the latest technologies and innovations in electric and smart vehicles accessible and promote the expertise of Montreal and Quebec businesses</li> <li>• Through the “Accélérer l’Entrepreneuriat” call for projects, train and support future businesses in transportation and mobility, including those in the electric mobility sector.</li> <li>• Support incubators and accelerators that help emerging businesses whose projects propose solutions to challenges related to sustainable mobility and the electrification sector in particular.</li> <li>• Support the deployment of sustainable mobility solutions in Montreal’s economic hubs through a financial assistance program.</li> </ul>

Finally, it is worth noting that the City of Montreal, as ambitious as it desires to be, will need support from provincial and federal governments. Montreal should request from them:

- More green taxation levers
- Support for the purchase electric vehicles and e-bikes
- Optimization of the federal legal framework for fuel and energy performance.<sup>37</sup>

### Other key documents

The City of Montreal’s Master Plan<sup>38</sup> and the *Schéma d’aménagement et de développement de l’agglomération de Montreal*<sup>39</sup> offer a long-term vision in urban planning.

# What we heard



The project team interviewed 35 relevant stakeholders to gain a clear picture of the existing urban freight situation and the current challenges faced by businesses in Montreal and the city itself prior to developing our solutions and a toolbox for reducing emissions.

This section brings together key information gathered through the interview process related to those challenges, as well as driving forces for change, current and future solutions, and levers to accelerate the adoption of these solutions.

## ► Summary of interview comments

### Challenges and issues

#### Stakeholder knowledge and engagement

While most businesses want to reduce their GHG emissions, the interviews suggest they are not fully aware of the role they can play in terms of climate action related to their freight activities. Most do not know about the range of solutions available, although a number expressed some awareness of the benefits of electrification.

This suggests that education remains a major obstacle to transition. Better guidance, support, and communication efforts from governments would help companies plan for the decarbonization of their business, while also ensuring that the transition goes beyond truck electrification.

#### Cost of transitioning

Cost and availability was the most recurring barrier mentioned, followed by technology and knowledge.

Major brands and small businesses agree that changing the way they operate requires time, money, and knowledge. They also said a rapid transition would force them to increase prices and make them less competitive. Some companies added that their margin was insufficient to implement important measures aimed at reducing their emissions, and said the costs would have to be passed along to their customers. In fact, companies expect new solutions to be as efficient as the ones they currently operate with.

The anticipated negative effect is that, once the cost of environmentally sustainable delivery becomes too expensive, their clients might look for alternative retailers who can offer lower shipping fees.

Companies also voiced reluctance to change their practices if those changes would complicate their operations or make them less efficient. In the meantime, some solutions are being deployed on a small scale through pilot projects to allow measurement and collection of data. These are great mechanisms for companies to test solutions and to help them understand how those solutions can

be scaled up to have significant impacts on freight emissions and logistics, but the costs of transitioning can put pressure on the scaling and constrain initiatives to smaller projects.

### Timing

While most businesses understand the importance of environmental issues, many say the implementation of solutions to reduce GHG is not a current priority. Additionally, the required technologies are not always ready for larger adoption or even available in vast quantities. For example, companies that have recently purchased diesel trucks in the last few years may need to wait many years before purchasing new trucks again – this time ZEV trucks.

## Regulation, incentives and disincentives

As the technology matures, most non-governmental organizations argue that ‘sticks’ should be implemented, and their stringency should increase over time. Those organizations tend to recommend ecofiscal measures. Representatives of businesses, on the other hand, implied that the government should focus on bonuses and incentives and said penalties and restrictions should not be the main strategy since emissions-reductions solutions are not yet sufficiently mature or efficient.

Some businesses expressed concern that low-emission equipment evolves so fast that the companies who are willing to make operational changes to electric trucks today will find themselves outperformed within a couple of years. Many companies said the cost of transition remains too high, even with subsidies and other forms of support currently available. This emphasizes the need for further government assistance. Some also said they think the efficiency of electric trucks and cars is too low to meet their needs. While that might be true for some businesses, it is not necessarily true for all, and the expressed concern confirms the need for more education about available solutions in urban freight.

## Driving forces to adopting low-emission solutions

When asked what they believe to be the driving force behind the adoption of low-emission solutions, most businesses mentioned governments. Some pointed to technology. Some major players in the delivery sector said companies themselves are the drivers of change. The improvement of existing solutions, as well as customer requests for green actions also received recurrent mention. But companies say that when it becomes more economically viable for businesses to make changes, changes will be made. This serves to emphasize that assistance from different stakeholders within government spheres is both expected and required to accelerate a transition.

## Solutions considered to be ready for today’s market

The interviewees were questioned about existing solutions for reducing GHG emissions in the urban freight sector. Companies, for the most part, are aware change will be inevitable at some point, but until more constraints are imposed on unsustainable freight transportation practices, interview responses suggest their activities are unlikely to evolve even when current practices are not the most cost-efficient. This could explain why a majority of interviewees mentioned the electrification of trucks as being the key solution to reducing emissions, despite the fact that it comes with important upfront costs and does not resolve socioeconomic issues such as traffic. Indeed, transitioning to electric trucks probably is the most known solution to decarbonizing freight activities and while costs for infrastructure, vehicles and staff training are significant, thorough restructuring of operations is avoided.

More than half of interviewees had a favourable view of electric-assisted cargo bikes or other light vehicles as a key solution, including several actors of the shipping sector and from governmental bodies.

Many businesses expressed interest in learning other ways of optimizing their operations, including the exploration of solutions that are not yet available in today’s market. A majority of interviewees, including

those in the shipping sector and government, said cargo bikes or light vehicles could also be key options for reducing emissions. Lighter packaging and loading optimization were mentioned by representatives of the retail sector.

## Most common key levers

Interviewees were asked to evaluate some regulatory measures that could be put in place to reduce GHG emissions related to urban freight transportation.

What emerges from the analysis is a desire for change that is progressive. For instance, the majority of interviewees expressed the view that a feebate system would be effective because it could first provide benefit incentives and then impose penalties for late adopters. Fiscal or ecofiscal levers (feebate system, 0% loan for the purchase of electric vehicles) as well as regulatory levers (use of curbside management) were the most trusted solutions to reduce emissions and to implement from all sectors.

With a majority of respondents saying the electrification of trucks will be a key solution to urban emissions, it follows that there was much support for the lever of 0% loans for electric vehicles.

Furthermore, several respondents said changing the regulatory measures regarding the use of sidewalks would be a more effective lever than sustainable transportation. And some expressed support for government-funded experiments around low- or zero-emission zones.

Interestingly, new levers were identified by experts and representatives from businesses. Among these were special or increased incentives for small merchants to decarbonize their vehicle fleet (increased subsidies for e-trucks or free road tolls), on-street delivery permits, and increased best practices among governments.

## Who should address the issue?

The interviewees indicated that companies, working alone or with governments, must play a leading role in addressing challenges of urban freight.

## Key interview learnings and analysis

The Pembina Institute, Jalon and Équiterre therefore argue that:

- A sustainable decarbonization of urban freight should have a positive impact on consumer purchases in the mid- to long-term as governments introduce fees and other restrictions for unsustainable delivery practices; financial support from governments is therefore needed.
- Action is needed to increase the supply of alternatives to traditional trucks: even if all businesses were ready to make major operational changes, supply of both e-trucks and e-cargo bikes, as well as charging infrastructure, is insufficient as of 2021. The provincial and federal governments therefore must play a key role in this regard.
- More data needs to be collected to bring solutions that are realistic and impactful to the table. Data collection mechanisms need to be systematically included in the discussions on the decarbonization of urban freight in Montreal.
- Governments should absorb the risk at the beginning of the adoption curve and progressively require solutions to be implemented as technology matures and supply increases. Support to businesses – financial, technical, and educational – needs to be enhanced.
- This support should come from municipalities, but also from the provincial and federal levels of government.

Since urban freight solutions are still relatively new, it appears that the market is not ready for a quick transition. Consequently, the need for progressive changes is reiterated. More “carrots” – or rewards – should be implemented by the City of Montreal. That said, the ability of municipalities to implement such incentives in the private sector can be limited given their relatively low fiscal capacity and the fact that some monetary tools remain underused.

# Guiding principles for low-carbon urban freight



Based on our research and engagement with relevant stakeholders, we offer six principles that should guide the development of policies and programs to reduce emissions from urban freight. These principles reflect the unique regional context of Montreal, acknowledge the challenges and opportunities ahead, and respond to local needs.

They have guided the development of our recommended solutions and policy tools, and will lower the negative impacts and implications of city logistics on the natural environment, creating sustainable neighbourhoods that will improve the daily lives of residents.

**1. Put people first and prioritize systemic change in the economy for better public health and social outcomes.<sup>40</sup>**

Components of the existing urban freight and urban transport systems currently do not prioritize the wellbeing of citizens and businesses; this includes, for example, the abundance of motor vehicles travelling on wide urban corridors that are difficult to traverse on foot, and large trucks competing for limited and unpriced downtown curb space. Urban freight solutions should aim to rapidly decrease

greenhouse gas and air pollutant emissions to mitigate negative public health impacts and nuisances. Low-carbon freight strategies and efforts should complement other public policy objectives and initiatives (e.g., *Vision Zéro*, climate change strategies) that serve to protect the public interest, improve health and safety, reduce costs, improve efficiencies, and promote equity.

**2. Prioritize early, deep, sustained, and technologically feasible direct emissions reductions to achieve net-zero goals.<sup>41</sup>**

Achieving climate mitigation and transportation decarbonization goals requires a multi-pronged approach. Efforts should aim to reduce freight-trip demand, shift to near-zero or zero-emission modes of transportation options where feasible, and/or improve vehicle and operational efficiency along the supply chain.

**3. Help businesses adapt over time with a mix of incentives and penalties.**

Change for businesses is also influenced by situational and external factors, like new technology availability on today's market, that are often out of the control of most transporters. Early adoption of low-carbon freight operations and practices should be encouraged through regulatory measures. Over time, the stringency of regulations should be increased along with penalties to discourage business-as-usual tactics that are carbon intensive and fuel inefficient. Regulatory measures can be complemented with incentives (financial or non-financial) to support desired outcomes. Figure 4 illustrates how a mix of incentives and penalties can be introduced to support a widespread transition to low-carbon practices.

As part of the plan targeting zero emissions by 2035, it is important that the City of Montreal builds a clear vision with achievable goals. The vision should include emission reduction targets over 5-, 10- and 15-year periods, so that delivery and logistics activities can become 100% zero emissions by 2035.

- 2025 - 25% reduction in emissions
- 2030 - 50% reduction in emissions
- 2035 - 100% reduction in emissions

Emission reduction targets can be updated to accelerate with the availability of technology and stakeholder buy-in.

**4. Solutions should remain future-forward and flexible**

The solutions presented in this report are based on global best practices and on technologies that are readily available and feasible, and should be implemented in a context-sensitive manner. We recognize that there are a multitude of external forces and global trends that impact urban freight activities on the ground. Over time, as our built environment and the needs of our communities change, and advances in technology bring better tools and ways of working to mitigate climate change, our planning approach should also change accordingly.

**5. More needs to be done to make data public and easy to use**

The availability of public data remains low. It is therefore difficult to characterize the normal course of business of trucking in Montreal, just as it is difficult to characterize it in Quebec and elsewhere in Canada. There is a clear need for administrations at the municipal, provincial, and federal levels to improve the collection of data about road freight transport trips and GHG emissions from trucking across Canada, as well as in urban areas such as Montreal. This would lead to better documentation and would allow for more convincing quantitative analysis on the transport sector. It would allow better observation of the evolution of Montreal freight, its associated economic activity, and its impact on

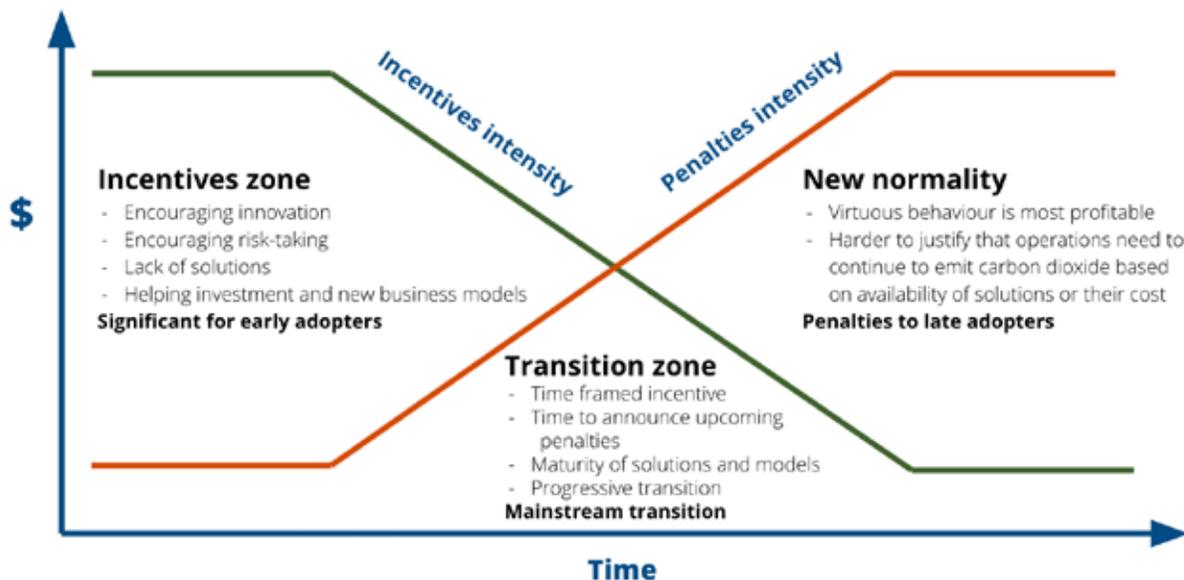


Figure 4. Progressivity in incentives and penalties

Source: Jalon

GHG emissions. This data would also help support the implementation of aid programs as well as provide opportunities to assess their performance based on real indicators.

6. **Fiscal and ecofiscal tools can be used to fund pilot projects to identify funding opportunities**<sup>42</sup>

Because many of the solutions presented in this report will require public investments, it is essential to understand the main monetary levers that cities can use to support businesses in the decarbonization of their freight activities.

A report by the Quebec Commissioner for Sustainable Development, which was published in June 2020, points out that ecofiscal solutions are underused in Quebec. In fact, revenue raised through the gas tax is forecast to decrease in the upcoming years, due to the electrification of transportation. That makes this the right time to explore possible options to fund sustainable mobility programs and policies at the provincial level.<sup>43</sup>

Additionally, according to the *Loi visant principalement à reconnaître que les municipalités sont des gouvernements de proximité et à augmenter à ce titre leur autonomie et leur pouvoir*, municipalities are able to impose any direct tax within their boundaries by way of bylaws, which allows them to go beyond the traditional property tax. They are also enabled “to establish regulatory fees to fund a regulatory regime within their jurisdiction.” These fees are implemented with the aim of changing behaviours and, thus, to achieve the municipality’s objective.<sup>44</sup> In short, Quebec cities now have a general taxation ability, as well as a regulatory taxation ability. See sidebar for examples of ecofiscal tools that could be used in Montreal. An overview of traditional and new monetary levies accessible to municipalities is presented in Appendix 2.

## Example of municipal ecofiscal tools

### Taxation of off-street parking spaces in the non-residential sector of downtown Montreal

Applied directly to parking owners in a specific area through the general taxing power of municipalities, the additional fees are internalized through parking prices. While this tax landed the City of Montreal in court for its “abusive component,” the *Cour d’appel du Québec* ultimately deemed it reasonable because it was applied consistently following the bylaw’s standards.<sup>45</sup> It later led to the dismantling of numerous parking lots to further densify the downtown area, which served GHG emission reduction purposes.

### Congestion pricing

Congestion pricing, which must be planned by municipalities in collaboration with the provincial government, is “an eco-fiscal policy

that charges for road use or parking to reduce the excessive costs of congestion.”<sup>46</sup> Evidence and experience demonstrate the effectiveness of congestion pricing and show this efficiency is increased when it is part of a coherent policy package: “Carefully designed, it reduces congestion and produces net economic benefits for motorists and the economy as a whole.”<sup>47</sup>

It also has two objectives when it comes to urban freight. First, it helps optimize practices and choices. Businesses and individuals will choose how to react to this pricing: they will choose an alternative route or vehicle (i.e. e-cargo bikes), skip unnecessary trips or optimize them, etc. For those who are willing to pay the tax, this spending will be offset by the overall lower costs associated with congestion. Second, congestion pricing helps fund sustainable projects (road transportation infrastructure, electrification infrastructure, public transit) and reduce taxes.

## SOLUTION 1



# Electric-assist cargo bikes and mini-hubs



Standard delivery vehicles are gradually replaced with much smaller and low-emission vehicles that radiate around mini-hubs. Strategically located mini-hubs deployed throughout urban areas will help to decentralize temporary storage and can be used as transshipment locations (Figure 5). They can also be used as a shared space between several complementary logistics players.

**Mini-hub:** Real estate infrastructure, located in the city and close to delivery areas, used for unpacking pallets, preparation of deliveries, transshipment (moving cargo from a truck of large size and weight to smaller vehicles), temporary storage of goods, recharging of vehicles, and vehicle maintenance.

**Cargo bike:** Includes several variants: bicycles with or without electric assistance, with two or three wheels, with front or rear loading, towing a trailer or not.

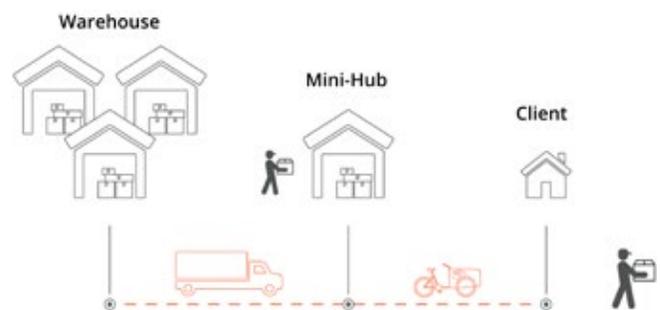


Figure 5. Mini-hubs and cargo bikes

Source: Jalon

## Why is this important?

Cargo bikes associated with mini-hubs have a higher gross efficiency than conventional truck-based modes of delivery, allowing, on average, 15% more stops per hour than traditional trucks. This translates to a time saving of more than an hour per day and compensates for the loss of time due to the preparation of the bike routes and the transport of the packages to the mini-hub. However, due to their low carrying capacity, the maximum potential of a fleet of cargo bikes is reached when the bikes are combined with classic vans or electric minivans which will transport the most bulky parcels. By integrating all the elements of the chain, each cargo bike replaces one traditional cube truck.

For any city and its inhabitants, replacing delivery trucks with cargo bikes leads to a major reduction in pollution. Such a mode of delivery is proven to be fast and reliable within congested urban areas, as couriers can go quickly from one place to another in the city. It also contributes to more diversity in mobility and impacts noise and air pollution levels, since cycling is more environmentally friendly. Therefore, the mini-hub-and-cargo-bike mode improves quality of life and preserves the city's infrastructure and space.

Most urban freight transportation plans prioritize safety and reduced pollution. Some do not rule out developing more central stores in locations that would allow them to implement more sustainable solutions such as cargo bikes.

## Key benefits

- Efficiency. While a delivery truck is like a rolling warehouse — it is more efficient when it has many packages and few destinations — the cargo bike with mini-hubs is the opposite, working most efficiently with few packages and many destinations.
  - In view of a bike's available carrying capacity (around 1 cubic metre), loading must be well-organized in the trailer or the box. During stops, the delivery person must be able to quickly reach the package to be delivered.
  - Large-volume packages that occupy all of its cargo space are impractical because the bike may have to recharge after a single drop-off and return to the hub.
- Ability of the cargo bike to move quickly. The delivery person often has the choice between cycle paths and the streets. They can choose the fastest route depending on the traffic situation. Some dedicated cycle lanes can even reduce distances. On urban streets, cargo bikes go, on average, as fast as trucks/cars which is close to 15 km/hour.
- Compatibility of the use of cargo bikes with pedestrian zones. Cargo bikes were given exemptions to travel in pedestrian areas as part of test projects on Sainte-Catherine Street in 2019 and Mont-Royal Avenue in 2020. No negative incidents or even inconveniences were reported. And because cargo bikes are noise-free vehicles, they can quietly deliver goods outside of authorized hours.
- Speed of parking. The cargo bike can, like any bicycle, park in a car space, on the sidewalk (provided it does not obstruct foot traffic), and double park without causing traffic obstructions.
- Capacity and range. Existing electric cargo bikes can carry up to 200 kg of goods and travel an average of 50 km per battery charge.
- Year-round use. The Colibri pilot project conducted by four operating partners compared stops per hour in non-winter months with stops

made in the period from January to mid-March (winter period) and found no noticeable seasonal differences. The main takeaway regarding winter conditions was that it was difficult to deliver during extremely cold days, but the snow and normal winter temperatures did not have significant repercussions on operations.

- Good quality equipment for the workers ensures their comfort and it is key to ensure they will want to continue working in winter conditions. Financial incentives could be an interesting lever for the workers during particularly harsh winter conditions.
- The bicycle market today is strongly dependent on foreign suppliers and their vehicle design is based on different regulations and climates. This reality makes these bikes, for the most part, not ideally suited to Montreal climate conditions.

## Desired outcomes

More urban freight is moved via cargo bikes, especially in the under-10 km delivery range, as a percentage of freight delivered in Montreal.

*“There are barriers in city legislation, because when we talk about cargo e-bikes and different types, different ways to use e-bikes like having trailers, the rules are different in different cities. This does not make it easy for us to scale this solution.”*

*– Stakeholder interviews*

## Conditions for success

- Financial and operating support to minimize or avoid risk at the beginning of adoption.
- Suitable and affordable e-bikes that meet the needs and preferences of businesses.
- Increased access to public charging infrastructure for e-bikes, especially at mini-hubs/home bases during reloading.
- Access to maintenance and repair services for the on-site operations.
- Appropriate training and support for delivery drivers transitioning from operating trucks to e-bikes, for example best practices regarding winter cycling.
- Infrastructure availability and competitive prices on rent at strategic locations for mini-hubs.
- Adequate cycling infrastructure; as dedicated and well-maintained cycling infrastructure improves the value proposition for cargo bikes.
- Consistent and harmonized bylaw regulations of cargo bikes across the city.
- Consistent and harmonized regulations of delivery cargo bike usage across the province. As a part of this, clear standards and labelling are encouraged to ensure consumer product safety of imported and domestic e-cargo bikes.
- Systematic data collection operations to assess the performance of these cargo bikes and mini-hubs. These need to be shared to the municipal governments.
- Promotion of social, environmental, and economic benefits of participating in a mini-hub/e-bike program by local champions that have already implemented this solution.

## → Policy toolbox

### Short-term

- Provide provincial or municipal 0% interest loans to upgrade fleets for electric-assist cargo bikes (reducing the financial risk linked to early adoption of immature technology). (municipal and/or provincial)
- Implement curbside management with advantages for cargo bikes and other sustainable modes. (municipal)
- Develop a better understanding of the location of the city's underutilized infrastructure which may benefit from this type of use. (municipal)
- Conduct a pilot project: dedicate a team to plan and oversee a pilot project at the municipal level, and forge partnerships with delivery companies and local consultants. The city should absorb some of the operational costs for the mini-hub in exchange for data. (municipal)

### Mid-term

- Provide increased curbside advantages for cargo bikes and other sustainable modes of transportation. (municipal)
- Promote the results from initiatives with the Montreal urban freight ecosystem to give credibility to the solution and attract new players. Furthermore, establish a mentorship program with expert companies that adopt this solution, sharing insights with new companies to facilitate their transition. This can be orchestrated by the city, a municipal organization, or a non-profit organization. (municipal)

### Long-term

- Implement low-emission zones or pedestrian streets in select areas with high density, high traffic congestion, and high freight activity to restrict access by larger polluting vehicles. These areas, with progressive restrictions on vehicle size and emissions, will favor the use of cargo bikes and provide additional operational advantages to this solution. (municipal and provincial)

## Relevant actors

- City of Montreal
  - *Service d'urbanisme et de mobilité (SUM)*
  - *Service du développement économique (SDE)*
  - *Bureau des projets et programmes d'immobilisations*
  - *Service des finances*
- Businesses that deliver or receive shipments who are willing to participate in pilot programs.
- Non-governmental organizations that can help co-ordinate, share information, and accompany businesses looking to operate with cargo bikes.

## Additional policy considerations

- A definition of mini-hub would need to be added to the municipal zoning regulation, to allow for its specific use in certain zones.
- Mini-hubs should be located in mixed-use spaces, possibly in partnership with local businesses, that are compatible with the identity of the neighbourhood in which they are located.
- Municipal bylaws should be amended to allow cargo bikes in pedestrian-only zones for deliveries.

## Rebound effects and mitigating strategies

Potential effects	Mitigation strategies
It may be expensive to rent space privately for a mini-hub, or suitable space may be difficult to find.	The City should: <ul style="list-style-type: none"> <li>• consider buying buildings or land in viable locations and leasing it to partner organizations to set up mini-hubs.</li> <li>• develop a good understanding of the locations of its strategic unutilized and low-cost infrastructure that would benefit this type of use. The Colibri project spotlighted unutilized and low-cost infrastructure that served as a perfect location for a mini-hub for more than two years.</li> </ul>
Road safety conflicts may occur between cyclists and larger cargo bikes on bike lanes, in mixed traffic, and on public boulevards.	<ul style="list-style-type: none"> <li>• Clear rules around where cargo bikes will be allowed to operate and who has the right-of-way should be established.</li> <li>• Education and awareness campaigns, both among businesses and citizens, should be deployed to teach road users how to share the road with these new vehicles.</li> <li>• Behaviour of cargo bikes and other road users should be monitored for safety.</li> <li>• Municipal planners need to account for the growing use of cargo bikes in their urban strategies and planning designs.</li> </ul>
Mini-hubs may require financial subsidies from the municipality, depending on their location, until the viability of the financial model is secured.	<ul style="list-style-type: none"> <li>• Financial incentives or tax reduction might help alleviate some narrow gaps between viable and not viable models.</li> </ul>

## Performance evaluation

Metric	Measurement indicators
Delivery results	<ul style="list-style-type: none"> <li>• Tonnage of freight or tonne-kilometres of freight moved via cargo bike</li> </ul>
Truck replacements	<ul style="list-style-type: none"> <li>• Number of trucks entirely replaced by e-cargo bikes and the associated decrease in GHG emissions</li> <li>• Traffic counts of cargo bikes on select corridors</li> <li>• Origin-destination information of each cargo bike trip</li> </ul>
Square metres of mini-hubs	<ul style="list-style-type: none"> <li>• Area dedicated within the urban area to privately or publicly managed mini-hubs.</li> </ul>
Satisfaction of cargo bike riders	<ul style="list-style-type: none"> <li>• Qualitative appreciation of safety</li> <li>• Qualitative appreciation of comfort</li> <li>• Qualitative appreciation of training</li> </ul>
Cargo bikes purchased	<ul style="list-style-type: none"> <li>• Number of bikes subsidized by government (either municipal or provincial)</li> </ul>
Road safety	<ul style="list-style-type: none"> <li>• Number of accidents with cargo bikes in Montreal</li> </ul>

## Case examples

### Berlin, Germany

Berlin initiated an electric-assist cargo bike and mini-hub project in 2018 called KoMoDo. Funded by the federal government’s Ministry for Environment, Nature, Conservation and Nuclear Safety, the project provided a 14-square-metre shipping container to each of five national delivery companies (DHL, DPD, GLS, Hermes, and UPS) for use as a mini-hub. The shipping containers were stationed in an underused

public parking lot. Packages were delivered to the site via truck and were delivered to the destinations via electric-assist cargo bikes. During the pilot project, more than 160,000 parcels were delivered by cargo bike, replacing nearly 28,000 km of truck delivery trips.<sup>48</sup>

## SOLUTION 2



# Optimize urban delivery systems and logistics



The optimization of urban delivery systems and city logistics is an essential area of focus when looking for solutions, but a broad one; there are many issues to resolve and possible strategies to optimize in order to reduce emissions from city logistics efficiently.

Because of this, this section focuses on several subcomponents:

- Reducing travel by empty or partially empty urban delivery vehicles
- Optimizing vehicle loading through consolidation and other strategies
- Optimizing urban delivery hours of operation, using quieter-performing ZEVs

### Why is this important?

Optimizing some of the constituent parts of city logistics and the movement of freight to enhance operational and energy efficiency is one way to reduce

emissions, while also saving businesses money. This offers potential win-win situations for both society and businesses.

For example, optimizing delivery hours to the off-peak has clear climate value, even when the deliveries are conducted with internal combustion engine vehicles. Optimized off-peak delivery routes can run over longer distances with the same emission levels as regular daytime deliveries, shown in Figure 6 from New York City.<sup>50</sup>

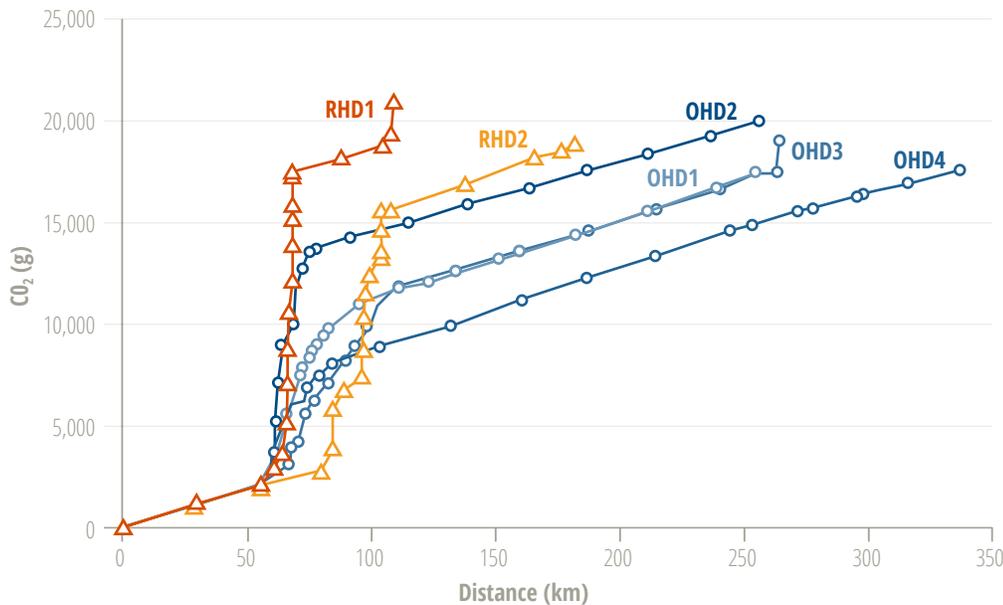


Figure 6. Emissions and distance travelled for off-peak delivery vs daytime delivery

Note: OHD is off-hours delivery; RHD is regular-hours delivery  
Source: Holguin-Veras<sup>51</sup>

In all cities, main corridors are an essential part of the designated urban delivery network.<sup>52</sup> In the City of Montreal, there are designated delivery routes, as shown in Figure 7. Freight routes that are permitted at all hours are shown in green, delivery routes permitted except from 7 p.m. to 7 a.m. are shown in orange, and the white routes are for local deliveries only.

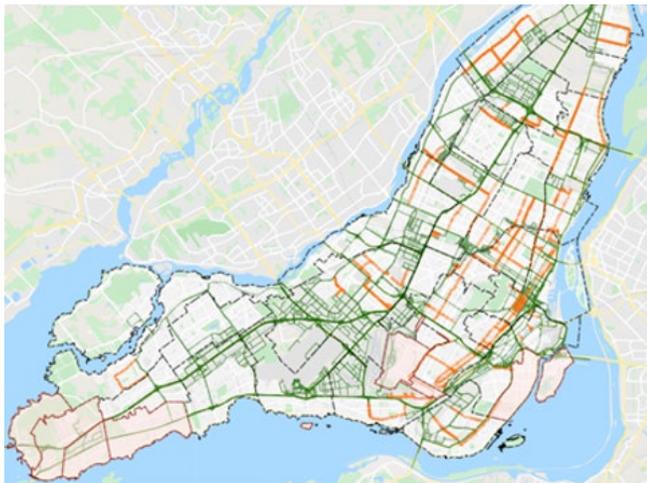


Figure 7. Designated delivery routes in Montreal.

Source: City of Montreal<sup>53</sup>

Further to off-peak delivery, freight vehicles running empty is an issue: according to the International Energy Agency, 25-30% of truck vehicle-kilometres are travelled by empty vehicles.<sup>54</sup> Coordination within and among companies will be needed to reduce the number of empty vehicles.

Typically, delivery companies travel between consolidation centres located in distant suburban industrial areas and the doorstep of each delivery destination. This tends to maximize the total distance traveled to deliver online purchases, in addition to increasing congestion and emissions. Consolidation centres closer to the urban core can reduce the distances travelled between the consolidation centre and the delivery destination, which also reduces GHG emissions.<sup>55</sup>

*“What is starting to be done in European cities, Brussels in particular, are distribution hubs, that is to say distribution centers, outside the city center. From there, we can distribute with smaller trucks, tailor-made. It can be done outside of rush hour.”*

– Florence Junca-Adenot, professeure d’études urbaines et touristiques at Université du Québec à Montréal (UQÀM)<sup>49</sup>

*“It is important that we keep our eyes on the prize of congestion reduction also; we could electrify everything, but the streets would still be unpleasant, congested, and slow.”*

– Stakeholder interviews

## Desired outcomes

### Optimized vehicle loading/empty delivery

**vehicles:** Lowered energy intensity of the movement of goods in urban areas, measured in fewer, cumulative MJ/tonne km, achieved through fewer vehicles, vehicles of appropriate size to the load, and/or well-loaded (non-empty) vehicles moving goods, and/or co-ordinated vehicle movements using backhauling for other goods/businesses/freight needs.

**Off-peak deliveries:** Reduced energy consumed and emissions generated from urban freight because of better routing and timing. Routing is assessed through average speed analysis of real truck movements (higher average speeds are better and less polluting). Timing is assessed through percentage of total goods shifted to evenings and night delivery in a zero-emission, quieter vehicle.

## Conditions for success

### Off-peak deliveries

- Businesses willing to test the shift to evening and night time deliveries. Identifying interested businesses through local business associations may be one strategy.
- Legal authorization to travel on routes at night.

### Optimized vehicle loading

- Urban consolidation centres in central areas of Montreal, possibly with city support.

### Avoid empty delivery vehicles

- A vehicle-loading-sharing online platform to allow communication and co-ordination between companies that need truck capacity and those willing to share capacity.

## → Policy toolbox

### Short-term

- Invest in research and development for improved IT knowledge to help optimize all companies' operations, including deliveries, notably as part of the “Plan pour une économie verte” 2030 funding opportunities, which include programs to help businesses decarbonize their activities. (all levels of government)
- Identify sectors that should and should not be part of pilot projects for off-peak deliveries and hold consultations in their neighborhoods. (municipal)
- **Off-peak deliveries:** Amend municipal bylaws and/or introduce provincial legislation to remove off-peak delivery prohibitions between

7 p.m. and 7 a.m., at least on selected streets and/or urban zones. It would be helpful if the Quebec government regulated to allow night-time delivery hours as the Ontario government did at the start of COVID-19, and not leave this to a patchwork of municipal bylaws.<sup>56</sup> These prohibitions should be removed in areas of high pedestrian volumes and where there is high demand for curbside uses. For example, in the borough of Ville-Marie, the urban streets of Sainte-Catherine and René-Lévesque may benefit from noise-controlled night-time deliveries — freeing the curbside for restaurant patios, parking, and other uses. (municipal or provincial)

- **Off-peak deliveries:** Develop an incentive program to help and encourage businesses to receive deliveries after hours. New York City gave out \$2,000 incentives to encourage more than 400 businesses in the food, retail, and accommodation sectors to participate in an off-peak delivery pilot program.<sup>57</sup> (municipal)

### Medium-term

- **Empty delivery vehicles:** Investigate backhauling potential in Montreal (i.e. through a cost-benefit analysis and a feasibility study) as part of the urban freight strategy currently under development and announced in the city's climate plan, and develop an initiative/program to accompany businesses in their optimization process (i.e. to co-ordinate delivery/hauling and backhauling between businesses in Montreal.)<sup>58 59</sup> (municipal)
- **Empty delivery vehicles:** Reduce the time pressure on deliveries to facilitate backhauling and more co-ordination through a public/industry education campaign. Time pressure is often cited as a factor that encourages empty-vehicle travelling, versus waiting to pick up other deliveries on the return trip.<sup>60</sup> (municipal)
- The Montreal agglomeration and the provincial government should consider increasing the fuel tax to favour route optimization and reduction of empty travel according to ENGOs interviewed. (municipal and provincial)

### Long-term

- **Optimize vehicle loading:** Invest in urban consolidation centres, possibly incorporating the proposed Montreal freight tram concept. The tram could connect with an urban consolidation centre and move freight within the city producing fewer emissions.<sup>61</sup> The City of Montreal, and/or a real estate developer, could partner with a delivery company(ies) early in the development process to optimize the location in terms of cost and logistics site needs. An urban consolidation centre in Paris, France, has a partnership with DPD, the second largest parcel delivery company in Europe. Further, consider site locations with good street network accessibility and possibly with rail or water connections, consistent with, or similar to, the work of the City of Paris.<sup>62</sup> (municipal)
- **Optimize vehicle loading:** Pilot a freight and consolidation centre co-ordination platform to facilitate sharing of building and vehicle space, including backhauling optimization. This would contribute to reducing kilometres travelled and the number of empty delivery vehicles on the street. If this was established first in the Montreal region, it could be rolled out to Quebec City, other cities in Quebec, and outside the province. (municipal)

## Relevant actors

- The City of Montreal
  - *Service d'urbanisme et de mobilité* (SUM) should be urged to amend municipal bylaws that impose nighttime delivery prohibitions, develop program(s) to provide incentives to businesses to receive off-peak deliveries, and investigate backhauling potential.
  - *Service du développement économique* (SDE) should be urged to support urban consolidation centres initiatives and offer funding.
  - The *Bureau de la transition écologique et de la résilience* (BTER) should be urged to offer new, sustainable perspectives when developing the upcoming urban freight strategy.
- The provincial government could legislate to allow province-wide off-peak deliveries rather than a patchwork of municipal bylaws.
- Businesses (receivers) who could initiate backhauling optimization programs, load consolidation efforts, and receive nighttime deliveries.
- Businesses (delivery companies) who are willing to work with other organizations to reduce empty vehicle travelling and the optimization of loading.

## Additional policy considerations

- It will take time to influence expectations around same-day, next-day, and delivery times in general to create a more co-ordinated urban delivery system.
- Businesses will need flexibility to receive shipments later in the day than usual. They may need to revise employee shifts and working conditions (compensation), and set up ways to manage locked facilities, sensitive items or items under climate control.
- Bringing industrial freight consolidation centres into urban areas, potentially near residential neighbourhoods, will require sensitivity in blending land uses that are traditionally considered to be incompatible.

## Rebound effects and mitigation strategies

Potential rebound effects	Mitigation strategies
Off-peak deliveries: Noise generation in the evenings from the delivery activities. <sup>63</sup>	Existing strategies to reduce or eliminate noise include implementation of quiet delivery practices for drivers and receivers, and use of low-noise delivery equipment. Examples of these directives for drivers include: do not idle trucks, do not slam doors, avoid non-essential use of the horn, park close to the receiver when doing curbside loading to minimize noise from moving pallet jacks from truck to receiver doors. Selecting neighborhoods carefully is key.
Off-peak deliveries: This has advantages for large chains, but it could add complexity for small businesses in relation to parcel reception.	Any bylaw modification should ensure that small businesses are not disadvantaged. This could be assessed through consultation and ongoing monitoring of the off-peak deliveries program.
Optimized vehicle loading: Introducing freight consolidation centres in urban areas could create neighbourhood tensions as a result of the additional noise and/or traffic and/or building appearance.	Appropriate neighbourhood integration will be important. Solutions include: sensitive site and building design that respects the area in terms of building height, massing, and materials; acoustic building envelope design to limit noise; co-ordination of delivery vehicle traffic at certain times of day and/or use of alternative modes between centre and delivery destination like the proposed Montreal freight tram mentioned in the policy toolbox.

## Performance evaluation

Metric	Measurement indicators
Off-peak volume	<ul style="list-style-type: none"> <li>Percentage of goods or tonnes of cargo (or number of delivery vehicles) in Montreal region delivered off-peak</li> <li>Number of additional participating businesses</li> <li>Quantitative and qualitative survey among participating businesses (cost efficiency, workers' satisfaction)</li> </ul>
Empty vehicle kilometres travelled	<ul style="list-style-type: none"> <li>Vehicle kilometres travelled empty estimate in Montreal region</li> </ul>
Urban consolidation volume	<ul style="list-style-type: none"> <li>Number of participants in urban consolidation centres or volume moving through urban consolidation centres</li> <li>Qualitative and quantitative survey of neighborhood residents and merchants</li> </ul>

## Case examples

### Peel Region, Ontario

Peel Region, in the Toronto area, has conducted an off-peak deliveries pilot project with 14 retail locations of three large businesses. Results were promising. Of the 30% of deliveries made during the off-peak period at night (7 p.m. to 7 a.m.), average trip speed was almost 20% higher than for deliveries made during the day, total GHG emissions per km dropped by slightly more than 10%, and other air pollutants experienced even greater reductions.<sup>64</sup> The pilot was very well received by participants and no noise complaints were registered.

### United States

The Voluntary Inter-industry Commerce Solutions Association is one American example of an organization that is reducing the number of empty backhauling delivery vehicles on the streets.<sup>65</sup> Through the Association's program "Empty Miles," individual trucking companies list their empty truck routes on a website and other companies then fill the empty trucks with their cargo. The U.S. retailer Macy's posted 328 of its truck routes on the Empty Miles website and filled 70 of them with the goods of other companies. This provided significant financial savings for Macy's and also reduced carbon emissions.

### Paris, France

In 2013, Paris opened its first urban distribution and consolidation centre called the Beaugrenelle "logistics hotel".<sup>66</sup> The Beaugrenelle facility is a two-floor, 3,000-square-metre building where packages under 30 kg are processed before being delivered by ZEVs. With the ability to handle 6,500 parcels a day, it shortened driving distances by 52%, reduced noise from delivery vehicles by 8% with use of electric vans, and cut delivery-related CO<sub>2</sub> emissions by half.<sup>67</sup> In 2018, Paris launched a second facility, the Chapelle International logistics hotel, a 41,500-square-metre, four-floor urban logistics hub built on top of an abandoned railway to allow for multimodal consolidation by road or rail.<sup>68</sup> Commercial uses at Chapelle International go beyond logistics. The building includes data centres, offices, sports facilities, and an urban farm. The proximity of these consolidation centers to residential neighbourhoods required a change in the Paris zoning ordinance to reintroduce commercial facilities from the city outskirts back into the city centre.

## SOLUTION 3



# Direct delivery in parcel lockers



Deliveries to parcel lockers located in high-density residential and commercial areas can reduce journeys made by delivery trucks to home addresses. By consolidating deliveries in one place, they significantly reduce the potential of stolen parcels and they collect potential shipments or customer parcel returns in a single location.

In response to the coronavirus pandemic, and to enhance public health and safety measures, companies have moved to contactless deliveries and protocols to ensure consumers can easily accept deliveries. The human-machine interfaces of the lockers should ideally make deposits of parcels by carriers a quick and easy process. Parcel lockers can play a part to reduce the vehicle kilometers travelled in urban delivery and consequent GHG emissions resulting from fewer doorstep deliveries.



Figure 8. Parcel locker deliveries

Source: Jalon

## Why is this important?

City planners and policy practitioners are motivated to increase delivery density and enhance delivery efficiencies, which help to facilitate more packages per kilometre of driving. This can be done by consolidating deliveries at one collection point in a multi-unit residential or commercial building or at a convenient neighbourhood location, eliminating the need for couriers to make time-consuming, door-to-door or floor-to-floor deliveries. Instead, package recipients can complete their own last mile of delivery and be a part of the solution. In this way, parcel lockers have a direct, positive impact on the surrounding area. By cutting the number of truck deliveries, they alleviate congestion and increase parking availability in the nearby streets, they reduce air pollution, and they reduce illegal or double parking and conflicts between delivery trucks and other road users such as cyclists and pedestrians.

Some businesses are also motivated to install parcel lockers to heighten service expectations of customers. Easy to implement, parcel lockers are accessible around the clock for self-service, which reduces operating costs associated with conventional delivery.

Finding good locations for parcel lockers is key to success. Parcel lockers can be positioned close to additional services and facilities, allowing the customer to collect their goods at the same time as completing other errands. Adequate security levels for public use of lockers is important to ensure that no dangerous or illicit materials are deposited within them. Also, lockers should not be located in sensitive areas that could be prone to fire, theft, or robberies at pick-up. Grocery stores might be ideal locations for parcel lockers, since these stores they have parking space for delivery trucks and an ever increasing number of them have charging infrastructure. Their lots tend to be well-lit and accessible, and they are well-dispersed in dense neighbourhoods. They may be interested in creating space for parcel lockers that would bring more people to their stores more

frequently. Fire stations could also be considered, as they are evenly distributed based on local population density. However, more attention may have to be given to parcel lockers when setting them up in order to ensure that they would not slow down the fire services' operations in case of emergency. Furthermore, the efficiency of parcel lockers is increased when they serve recipients who live within a 500-metre radius and can collect their parcel on foot, cycling or by public transportation, or when they are situated near a public transit station in order to minimize the use of cars for pick up.

Parcel lockers also offer a good backup for missed deliveries. If home delivery fails, a carrier should be able to drop off the package within approximately 500 metres of the initial delivery location. This distance approximation is based on the 15-minute city model.<sup>69</sup> Furthermore, people with reduced mobility should have the option, at no additional cost, to receive deliveries directly at home.

When making any online purchase, a consumer should always be able to easily choose to have it delivered to a locker or directly to their home, as is the case in Singapore<sup>70</sup>.

Having different companies share the parcel locker infrastructure is important. Any locker deployed in the city's residential or commercial buildings must be "universal" and therefore potentially usable by any delivery company (under conditions of agreement), similar to the universality of interaction with ATMs. This also make deposits of parcels by carriers a quick and easy process.

Parcel lockers have proven to be efficient and sustainable alternative solutions to home deliveries in many jurisdictions.<sup>71</sup> The methods used, and lessons learned, in Montreal will speed implementation in other Canadian cities. In fact, large scale deployment is needed for significant results.

## Desired outcomes

**Less delivery stops:** Reduced number of delivery stops is expected, thereby reducing distance travelled, delivery times, energy consumed, and emissions generated.

**Delivery cost reduction:** A reduction in the number of doorstep deliveries can save significant money on an annual basis. A study in the Netherlands projected savings of more than 120,000 euros per year using 430 home stops plus 47 parcel locker stops – rather than the alternative of 1,475 doorstep delivery stops.<sup>72</sup>

*“Collect points or parcel lockers are easy and affordable. The municipal level could co-ordinate the implementation. It’s a good way to partner with local businesses.”*

*– Stakeholder interviews*

## Conditions for success

- Dedicated space for parcel lockers at a low cost.
- Collection points located in strategic areas that are convenient for both delivery drop-off and customer pick up, with easy access for customers to additional services and facilities.
- Universal application programming interface for ease of use by carriers and users, and to allow more than one company to use the same parcel lockers to ensure their scalability and financial viability.
- Delivery in lockers offered as an option for online shopping.
- A dense urban environment.
- Adequate security and visibility of location, ideally in well-lit, open areas in view of video cameras and close to paths of heavy pedestrian traffic.
- Integration with sustainable modes of transportation, i.e. cargo bikes or small electric trucks, for deliveries to parcel lockers.

## → Policy toolbox

### Short-term

- Identify or create an organization in Montreal that could offer free or subsidized physical spaces to be used for parcel lockers through a lease with the lockers’ owner. Use of this space should involve certain lease conditions for the delivery companies, such as non-exclusive use of lockers and data sharing with the city or the designated managing organization. Fees could also be capped. This could be done as part of a pilot project to gather information that would help optimize a future larger scale deployment. (municipal)
- Organize an advertising and awareness-raising campaign targeting businesses and

citizens and showcasing the use of parcel lockers, as well as their benefits. It could be done using an approach similar to what is seen for recycling and composting. (all government levels)

- Deploy a pilot project to gather data and scale up the results. It could target only missed deliveries at first, so it could be located in neighborhoods where they are particularly recurring. (municipal)
- Implement dual-use parcel lockers that would enable individuals and businesses to ship or return parcels via the lockers. (municipal and federal)

### Mid-term

- Scale up and improve the pilot project in collaboration with the *Service de l'urbanisme et de la mobilité* (SUM) of the City of Montreal according to first pilot project results. (municipal)
- Identify strategic locations throughout the city to deploy parcel lockers. (municipal)
- Offer incentives to customers who choose the parcel locker option at checkout, possibly including rebates on delivery. (municipal, provincial, and federal)
- Arrange the pooling and consolidation of deliveries in lockers between carriers, similar to what happens in consolidation centers, in an upstream manner. (municipal)

### Long-term

- Adopt municipal regulations that would require some high-density residential or commercial buildings to install parcel lockers in a secure location on their premises. (municipal)
- Adopt online standards that would give customers the option to choose delivery directly to a parcel locker at checkout. This option should always be paired with information on CO<sub>2</sub> reduction and delivery cost reductions. Additionally, customers should be able to define their delivery preferences universally with an authority or a trusted third party, ensuring that delivery in lockers is almost automatic. (municipal, provincial, and federal)

## Relevant actors

- City of Montreal
  - *Service d'urbanisme et de mobilité (SUM)*
  - *Service du développement économique (SDE)*
  - *Bureau des projets et programmes d'immobilisations*
  - *Service des finances*
- Businesses that deliver or receive shipments.
- Delivery companies
- Para-public organizations that could collaborate with delivery companies and parcel-locker manufacturers to:
  - Make public space available for lockers that will accommodate the delivery companies.
  - Cover parcel locker lease cost at strategic public locations to ensure the financial model is viable from the start.
  - Support the initiative by publicly announcing the goal and formally inviting key players to employ this solution.
  - Mobilize building managers and tenant companies.
- The federal government, insofar as it regulates postal services and freight delivery.

## Additional policy considerations

- Development regulations will need to include new minimum and maximum ratios for requiring the installation of parcel lockers in existing or new buildings, along with guidelines for architectural integration of lockers in the public or private domain, and standards for security, accessibility, and usability of lockers.
- Legal analysis is required at the municipal and provincial levels to cover considerations of confidentiality for the users, responsibility in case of theft, and security to avoid the transfer of illicit materials through the lockers.
- The collaboration between the municipal and provincial governments would help unify standards for parcel lockers across the Montreal region and, in the longer term, across all cities in the province.

## Potential rebound effects and mitigating strategies

Potential effects	Mitigation strategies
Businesses might use parcel lockers for all online orders to avoid renting a physical space on a commercial street.	For a local purchase, delivery to a locker instead of a home should not cost the customer more. In fact, it could even be cheaper. Location of lockers should be near local stores to stimulate use for local retailers and attract users to the commercial area.
People with mobility issues might not be able to use locker pickups.	Citizens with demonstrated disability could receive a discount on home deliveries, similar to the special parking permits that are provided to disabled people.

## Performance evaluation

Metric	Measurement indicators
Sustainability	<ul style="list-style-type: none"> <li>Comparison of delivery truck mileage, distance traveled, diesel used and GHG emissions before and after the implementation of parcel lockers.</li> </ul>
Accessibility	<ul style="list-style-type: none"> <li>Accessibility of parcel lockers at all times (self-service 24/7) to all users including people with reduced mobility</li> <li>Accessibility to all carriers</li> <li>Distance of the locker from the initial delivery location</li> </ul>
Service performance	<ul style="list-style-type: none"> <li>Number of deliveries made via lockers compared to home deliveries.</li> <li>Number of failed deliveries from home deliveries averted</li> <li>Qualitative and quantitative appreciation survey of this solution by local businesses and residents.</li> </ul>
Cost	<ul style="list-style-type: none"> <li>Overall cost efficiency</li> </ul>
Infrastructure durability	<ul style="list-style-type: none"> <li>Assessment of the state of lockers after a certain period of time (resistance to weather, vandalism, theft, etc.).</li> </ul>
Carrier efficiency	<ul style="list-style-type: none"> <li>Delivery time of a parcel to the locker including ease of use, scanner, keyboard, handling, etc. for different usage cases.</li> </ul>
Locker usage	<ul style="list-style-type: none"> <li>Operation of the locker in real time, user choices, user-friendly application, participation rates, and parcel withdrawal time.</li> </ul>
User experience	<ul style="list-style-type: none"> <li>Qualitative and/or quantitative surveys to be completed by users</li> </ul>
Carrier experience	<ul style="list-style-type: none"> <li>Qualitative and/or quantitative surveys to be completed by carriers.</li> </ul>

## Case examples

### Singapore

Singapore has succeeded in deploying a substantial network of lockers across its territory by creating the “Locker Alliance” with the following principles:

- Imposed technological standards and universal IT integration
- Deployment and operation contracts with two initial local partners (Blu and SinPost)

In 2021, Singapore will have a network of more than 1,000 lockers. These lockers are owned, deployed, and operated by Pick Network, which is a subsidiary of the Infocomm Media Authority (IMDA), a statutory board of the Singapore government, under the Ministry of Communications and Information. Lockers were to be located within a five-minute walk of the 10,000 public housing complexes in Singapore.<sup>73</sup> This allows the residents to collect their purchases around the clock at their own convenience.<sup>74</sup>

## SOLUTION 4



# Zero-emission vehicles for urban delivery



ZEVs are defined as vehicles that have the potential to produce zero tailpipe emissions when in use. This includes battery-electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and hydrogen fuel cell vehicles.

Co-benefits associated with this solution are better air quality and noise reduction, which will help Montreal work more effectively towards its public health goals.

This solution entails facilitating and deploying more charging infrastructure strategically for urban delivery.

### Why is this important?

Many elements, from choice of vehicle size and propulsion technology to delivery scheduling and routing and a wide range of other factors, influence energy consumed and emissions generated in cargo movement. Converting urban freight fleets to ZEVs is a clear way to reduce emissions and their effects on climate change.

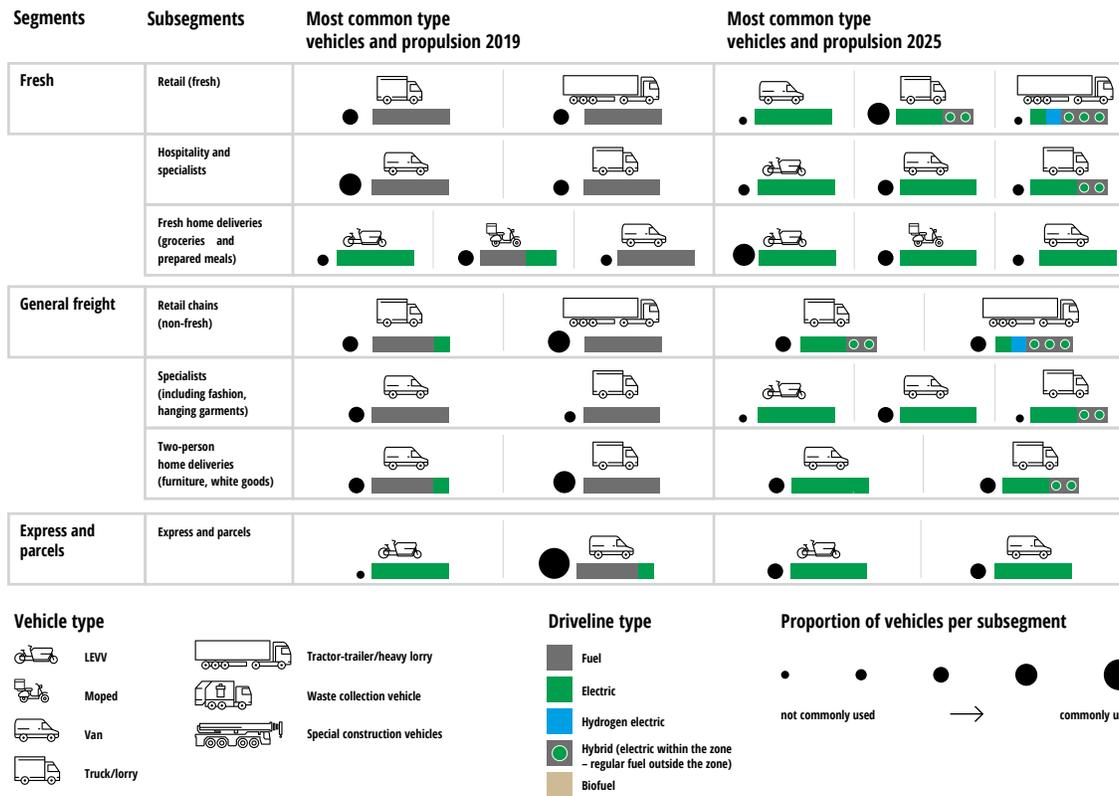


Figure 9. Example of Rotterdam’s 2025 urban freight ZEV targets<sup>75</sup> by segment, subsegment, vehicles, and propulsion type. Montreal could set comparable targets and achieve a similar transformation with clear and effective policy tools.

## Key benefits

- This solution is strongly compatible with the Montreal Climate Plan Action 16: “Formulate a strategy to reduce the carbon footprint of transportation of goods by road to ensure that 25% of deliveries are zero emission.”<sup>76</sup>
- ZEVs have the potential to significantly reduce the emissions from urban freight in Montreal.
- The lower daily ranges of urban delivery (under 100 kilometers) combined with the low average speeds, compared with interregional trucking, make electric vehicles well suited to urban delivery.<sup>77</sup>
- Electric trucks have the potential to reduce total life cycle costs and are often more efficient and cheaper to operate than conventional diesel trucks.<sup>78</sup>
- High, and growing, demand for delivery and for reduced-emissions delivery have already caused many shippers and carriers to make environmental commitments: Amazon, for instance, has made a Shipment Zero commitment. The company therefore aims to have all of its shipments be net-zero carbon (50% shipment net zero by 2030).
- Electric-freight vehicle options are expanding quickly, but the supply is limited, the technologies used evolve quickly and their price are still high.<sup>79</sup>
- EV charging stations and their funding/financing options are growing rapidly.<sup>80</sup> As of summer 2021, there are approximately 3,100 public charging stations, including 466 fast chargers, in Quebec.
- Adding to this rationale is the ability of companies like Lightning Systems and Motiv to retrofit existing Class 2-6 vehicles to become plug-in and hybrid electric vehicles — potentially cost-effective without replacing the entire vehicle while also promoting a circular economy and limiting resources needed to undertake this transition. These companies retrofit existing vehicles from Ford, Chevrolet, GMC, Isuzu and others.<sup>81</sup>

## Desired outcomes

Motorized delivery vehicles are mostly electric, with some plug-in-hybrid-electric.

## Conditions for success

- Increased charging infrastructure and zero-emission vehicle maintenance businesses
- Support for local businesses in this transition with information on costs and benefits, etc.
- Reliance on the Calstart Drive to Zero program and the *Institut du véhicule innovant*'s initiative in Quebec to facilitate peer-to-peer learning of commercial ZEV deployment
- Provincially funded demonstration projects (similar to AZTEC in Alberta or California-based demonstration projects)
- Additional charging stations, local government examples in other Quebec municipalities

### → Policy toolbox

#### Short-term

- Continue the large-scale study of electrification, decarbonization and the negative external effects associated with freight transportation in urban areas and economic hubs, as suggested in the Montreal Transportation Electrification Strategy for 2021-2023.<sup>82</sup> (municipal)
- Increase production subsidies or loan guarantees to increase domestic supply of zero-emission MHDVs. (all levels)
- Invest in labour market programs and resources to help with ZEV deployment. (all levels)
- Create preferred curbside access and loading zones for ZEV delivery vehicles, paired with charging infrastructure where possible.<sup>83</sup> The zones, with preferred access, and possibly with fast charging infrastructure, could be located in existing, high-demand, curbside loading zones, for example in areas of the *Ville-Marie* borough. (municipal)
- Amend municipal or borough bylaws to allow and facilitate commercial loading zone pricing. The City of Vancouver has recently completed a pilot program on curbside electric vehicle charging for residential and non-residential purposes.<sup>84</sup> (municipal)
- Lead a pilot project allowing and encouraging freight deliveries in dense, urban areas with quiet(er) zero-emission delivery vehicles during off-peak (evening and night) hours, 7 p.m. to 7 a.m. (municipal)
- Identify and offer additional incentives to businesses located and operating in the Montreal region. (municipal)
- Explore and leverage municipal financing tools (see appendices). (municipal)
- Develop a simplified permitting process for charging infrastructure development/building applications and approvals.<sup>85</sup> (municipal)
- Amend Montreal municipal procurement rules and acquire only zero-emission delivery vehicles where possible.<sup>86</sup> (municipal)
- Consider implementing a provincial vehicle registration tax exemption program for all ZEVs, or for zero-emission delivery vehicles of certain vehicle weight classes, as with the Netherlands national motor vehicle tax exemption.<sup>87 88</sup> (provincial)
- Consider a municipal vehicle registration levy, with exemptions for ZEV vehicles. (municipal)

### Mid-term

- Plan and begin a rollout of a low- or zero-emission zone for city logistics in Montreal aligning with decarbonization goals, as planned in the Montreal climate plan and the Transportation Electrification Strategy 2021-2023.<sup>89</sup> (municipal)
- Announce a ban on diesel trucks by a certain date in the province of Quebec and apply a ZEV mandate on medium-duty vehicles. (provincial)
- Offer a menu of financial incentives working with Hydro-Québec including, but not limited to: property assessed clean energy (PACE) finance and on-bill financing.<sup>90 91</sup> (municipal)
- Announce a ban on diesel trucks by a certain date in the province of Quebec and apply a ZEV mandate on medium-duty vehicles. (provincial)

- Adopt progressively stringent policies such as an increase in the carbon tax on gas, the implementation of a scrappage program, more curbside management incentives, etc. and develop new ecofiscal measures such as an additional tax on diesel fuel, a congestion fee and a feebate system for trucks. (all levels)

### Long-term

- Implement additional fees on provincial registration of diesel/internal combustion engine vehicles/delivery vehicles (provincial)
- Ban diesel/internal combustion engine delivery vehicles according to predetermined date (provincial)

## Relevant actors

- City of Montreal
  - Incentives for ZEV deliveries in loading zones, Service du développement économique
  - Streamlined permitting for charging infrastructure, Service d'urbanisme et de mobilité
  - Procurement policy on ZEVs, Bureau de la transition écologique et de la résilience
  - Other business initiatives and funding, Service du développement économique
- Province of Quebec
  - Continue with ZEV purchase subsidies
  - Offer vehicle registration tax exemptions for ZEVs
- Businesses (delivery companies)
  - Work with Hydro-Québec on tools to fund charging infrastructure facilitation and installations, etc.

## Additional policy considerations

- Zero-emission urban freight vehicles are in short supply.<sup>92</sup> Policymakers will need to establish flexibility in expectations of program rollout timeframes and end dates, eligible vehicles based on performance, etc.
- Special fees or incentives for zero-emissions vehicles should take into account the size and annual revenues of a business, to ensure equitable impacts.

## Possible rebound effects and mitigating strategies

Potential effects	Mitigation strategies
Used batteries will need to be managed	An advanced system of reusing and recycling of batteries will have to be implemented in cooperation with the battery producer. <sup>93</sup>
ZEVs operate more quietly than internal combustion engines	Urban road safety will have to be assessed, especially in highly trafficked pedestrian areas
The use of ZEVs does not reduce congestion on city streets and arteries	Policymakers need to advance both emissions-reducing and congestion-reducing urban transport policies.

## Performance evaluation

Metric	Measurement indicators
Vehicles	<ul style="list-style-type: none"> <li>• Number of ZEV delivery vehicles in operation/acquired and on order in Montreal</li> <li>• Number of diesel-fueled trucks removed over a certain period of time</li> <li>• Overall number of delivery trucks in Montreal (to compare with cargo bikes)</li> </ul>
Sustainability	<ul style="list-style-type: none"> <li>• GHG emissions avoided</li> </ul>
Infrastructure	<ul style="list-style-type: none"> <li>• Commercial loading zones occupancy and turnover</li> <li>• Survey or other reported evidence of double-parking occurrences</li> </ul>
Charging stations	<ul style="list-style-type: none"> <li>• Number of private and public electric vehicle charging stations, including the number of DC fast chargers</li> </ul>
Zero-emission zones, and financial incentives	<ul style="list-style-type: none"> <li>• Physical area covered by a low- or zero-emissions city logistics zone</li> <li>• Total, combined budgets for financial incentives for vehicle acquisition and installation of charging infrastructure</li> </ul>
Satisfaction	<ul style="list-style-type: none"> <li>• Qualitative and quantitative appreciation survey of truck drivers, other business staff, residents of neighborhood and other stakeholders, etc.</li> </ul>
Cost efficiency	<ul style="list-style-type: none"> <li>• Expenses on transportation (vehicle purchasing, fees, maintenance, etc.) for businesses with or without electric trucks</li> </ul>

## Case examples

### San Francisco

San Francisco has an electric-vehicle-ready bylaw that stipulates 100% of commercial and residential parking in new buildings and major improvement projects must have the infrastructure to accommodate electric vehicles.<sup>94</sup> This bylaw also stipulates that 10% of parking must be turnkey electric-vehicle ready with outlets and panel capacity, and that there must be sufficient electrical capacity to charge 20% of parking spaces at the same time.

### California

The State of California Assembly's Bill 1236 requires all municipalities to develop a clear, streamlined process for permitting electric-vehicle charging stations, to accelerate deployment of zero-emission vehicles in California.<sup>95</sup>

### Los Angeles

The Los Angeles city government has a target to make the municipal vehicle fleet composed entirely of zero-emission vehicles by 2028 — where possible with available models.<sup>96</sup> They also have a simplified permitting process for charging infrastructure development including easily obtained applications and approvals.<sup>97</sup>

# Conclusion



The movement of goods in Montreal and the province of Quebec is a growing source of urban congestion, road safety concerns, and carbon emissions fuelled by the growth in e-commerce and doorstep deliveries.

Even so, the movement of freight in cities and its congestion and climate-change implications have not received significant policy attention until recently. With increasing urgency, emissions reduction plans, targets, carbon budgets, and sectoral strategies need to be developed and implemented.

Now is the time to change how delivery services operate within cities, especially when it comes to last-mile freight. In this report, the research team identified feasible solutions and practical tools to reduce urban freight emissions through best-practice research and interviews with stakeholders in Montreal.

The Pembina Institute, Jalon, and Équiterre urge policymakers and corporate citizens in the Montreal freight ecosystem to continue work on reducing emissions from last-mile urban freight and to leverage this toolbox to accelerate action toward a net-zero urban economy.

## Further opportunities

In solving the issues related to urban freight, there is an opportunity to advance systemic change that benefits large numbers of people. Our research of global and local best practices shows that sub-national governments are contemplating, or have already implemented, bold systemic policy changes that create the right conditions for building more sustainable and healthy cities. More specifically in this context, we see these general initiatives as accelerants of an array of different and exciting low-carbon freight solutions.

- **Enhanced consumer awareness on low-emission deliveries:** could, in the long-term, influence consumers at online checkout to select a delivery method that is low in carbon emissions, if that option is offered.
- **Ecofiscality measures for home delivery:** can provide repercussions for inefficient practices, such as a cost paid by companies that deploy carbon-emitting vehicles to provide at-home, same-day deliveries.
- **Pedestrian zones and/or low emission zones:** can be applied at different scales, allowing only less emitting and less polluting vehicles into certain areas. Pedestrian zones and low-emission zones can bring pedestrian activities back to local streets and support lower-carbon freight activities such as cargo bikes and electric vehicle deliveries, and use of parcel lockers.
- **Government support for experimentation:** providing resources such as infrastructure, data, knowledge, and/or removing regulatory barriers to help pilot projects by convening stakeholders. This will accelerate the adoption of solutions such as cargo bikes and mini-hubs, which are considerably different from conventional delivery. This recommendation is in line with the City of Montreal's commitment to "[encourage] the rollout of pilot projects to accelerate the electrification of the urban delivery sector or reduce its carbon footprint".<sup>98</sup>

# Appendix 1

## Implementation strategy process

This report presents some detailed considerations and points of attention for specific solutions to the problem of emissions from urban freight in Montreal, but it is not intended to be a comprehensive list of remedies, policy considerations, indicators, etc. Other solutions that were not detailed in this report can also be deployed to answer specific issues, as those issues are identified.

To facilitate the implementation of any urban freight project that aims to reduce carbon emissions, there are common strategies that could be followed by the appropriate parties. This process, as illustrated in Figure 10, is a general guideline that will help the reader understand what important milestones are to be achieved before a solution can be fully implemented.

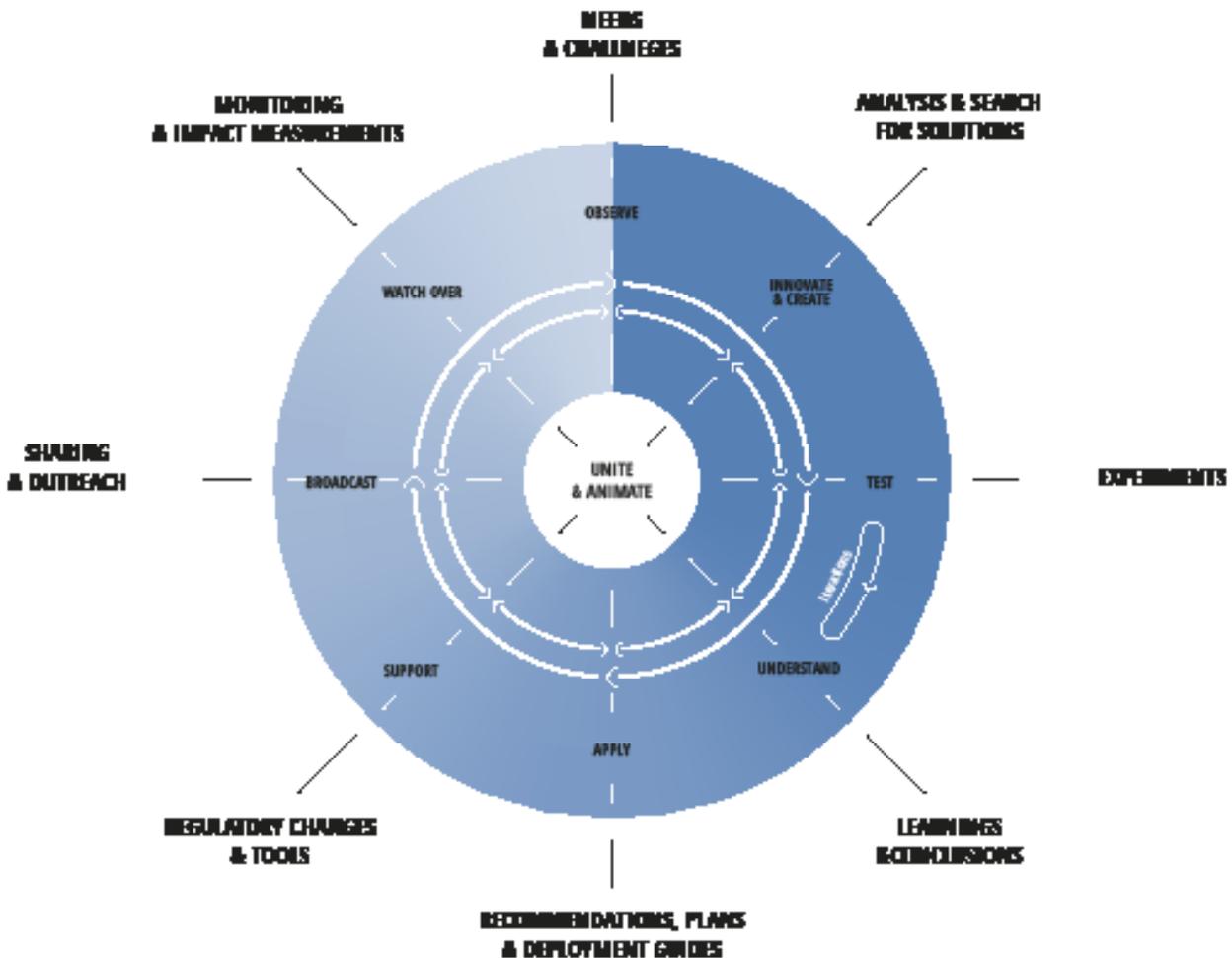


Figure 10. Implementation strategy process

Source: Jalon

## Public education

The results of the interview process conducted throughout this research project demonstrate that more education and awareness-raising efforts are needed when it comes to urban freight, both among business actors and the general public. As such, before and throughout the implementation of the various measures, communicating the reasons for change and the benefits that can be reaped will be key for social acceptability.

## Needs and challenges

Any project implemented to address the issues posed by urban freight should identify and characterize the needs that are being addressed and the challenges that are presented to better understand which solution would be appropriate to the given situation. These solutions must answer real issues that citizens and companies face when it comes to urban freight transportation.

## Analysis and research for solutions

No solution will solve all the challenges. The right solution should be selected based on the local context in which it will be implemented, and then further adapted to meet even more specific needs. For example, the implementation of a cargo bike and mini-hub solution might not be the best solution in low density or rural areas.

## Experiments

This phase will be important for a real-life application of program design. It will lead to important conclusions about solution implementation. For instance, data started being gathered when the Colibri pilot project was deployed in 2019, and is still being collected today. The project has evolved and changes were implemented gradually. Experiments like Colibri are important to understand which operating mode will be best in the long haul.

## Learnings and conclusions

At the end of the experiment phase of a project, conclusions will be drawn about whether it was successful, and what were the right conditions for that success. This will be important for future recommendations that will be part of municipal urban plans and strategies.

## Recommendations, plans and deployment guides

Based on the conclusions, a model should be developed to help the solution's replicability and scalability across different areas of the city or elsewhere in the province.

## Regulatory changes and tools

Once a solution has been tested, operational recommendations made, and guidelines established, recommendations for regulation and bylaw changes should be presented to a city and/or other levels of government. The goal at this stage is to ensure that the solution is in line with the legal framework of the city or the province, and does not face limitations. This phase can also provide an opportunity for policymakers to establish conditions for regulatory change, which could impose penalties or offer incentives, to ensure the principles of progressivity illustrated in section 5 can be met.

## Sharing and outreach

After the experimental phase, conclusions from model solutions must be shared with different stakeholders including cities or provinces, to encourage replicability and scalability. Explain the strategy through communication campaigns for both businesses and citizens.

## Monitoring and impact measurements

Data should be collected and knowledge should be gained at multiple points throughout a project. The solution should be a living and evolving entity; data obtained through regular monitoring will help shape that evolution into the future. For this reason, ensuring accountability also means setting up stringent evaluation and monitoring practices.

## Unite and animate

There are three elements to sustainable urban logistics planning: collaboration, consolidation and coordination. Montreal should create a city logistics managing department and build a dedicated team that can collaborate and co-ordinate with the urban freight ecosystem to execute the long-term vision.

# Appendix 2

## Monetary levies for municipalities

### Traditional monetary levies

The following three types of levies will likely continue to be the main modes of taxation across Quebec municipalities. They each offer different possibilities with regard to the ecological transition.

#### General property tax

A general property tax, applied to all owners, is based on the real value of a building and represents 55% of municipalities' funding on average. They have the effect of incentivizing urban sprawl, which discourages the conservation of green spaces.

#### Local improvement tax

The local improvement tax, applied to owners of a specific sector of a municipality, can fund maintenance or construction of new roads serving the area and can be based on the size of land, the real value of a building, etc. It is not usually recommended to fund initiatives that aim to reduce GHG emissions such as cycling infrastructure, since such initiatives could be used by businesses and citizens from other neighborhoods and could therefore raise discontent and reduce public support.

#### Service fees

Applied in concordance with the “polluter-pays” principle, fees for service users can either be a flat rate (i.e. public transit tickets) or based on consumption (i.e. drinking water, garbage pick-up). Money collected from such systems never represent more than 10% of municipal revenues, but further research and pilot projects might find opportunities for using such fees.

### New monetary levies relating to transportation

Showing that Quebec laws offer great potential to develop ingenious funding strategies to decarbonize urban freight and transportation more generally, these additional monetary levies are examples of successful fiscal or ecofiscal policies at the municipal level in Quebec.

#### General taxing power

In 2008, the City of Montreal was granted a general taxing power in 2008, which allows it to “impose [...] any direct tax on its territory, and share the details necessary for its calculation, namely its purpose, the rate or amount imposed.”<sup>99</sup> As part of this power, municipalities can limit the implementation of the tax, whether according to the area or to certain uses.

According to the *École nationale d'administration publique* (ENAP), “unlike a general tax, whose main purpose is to raise money for general municipal services and which [...] may encourage urban sprawl, this new power is recognized as having a real capacity to positively influence urban planning and the transportation (or consumption) habits of citizens.”<sup>100</sup> When it was first debated at the National Assembly, it was suggested that “municipalities could use this new power to promote public policy goals in urban planning, densification and the environment, clearly establishing the hope that it would be a tool for the energy transition.”<sup>101</sup> As such, Quebec municipalities were invited to “identify and occupy the fiscal gaps that may be available and appropriate for their [planning] and management,”<sup>102</sup> but it is worth noting that all fields already under the authority of the provincial level are excluded from the municipal field.

## General regulatory levy power

In 2009, the City of Montreal was granted a general regulatory levy power, which is distinct from classic taxation since it is based on the idea that jurisdictions can use monetary levies that would not normally comply with the taxation powers granted by the Constitution if they finance activities that fall under their responsibilities.

Regulatory levies may be paid by those who benefit from them (user pays) and those who create the need for the levy (polluter pays): “Because of its broad and non-specific nature, the general power of the regulatory levy represents a significant potential for municipalities [...] to improve their contribution to the fight against climate change and towards the energy transition.” In fact, it appears that all municipal responsibilities involved could benefit from the regulatory levy, especially transportation, urban planning, nuisance reduction, etc.<sup>103</sup>

It is recommended that such a monetary levy incorporates an explicit reference to the use of funds, showing that it acts as an indirect fee through a regulatory system. Various conditions to use this tool apply (i.e. a dedicated fund must be created and the generation of extra money is forbidden) and it is twofold: to fund the regulatory regime (which is most common) and/or to encourage changes in the behaviour of the person who has to pay for it<sup>104</sup> through the fee’s level of stringency.<sup>105</sup>

This ecofiscal tool is interesting in that urban agglomerations can implement it. Also, it “has no specific purpose, no specific base, and no targeted municipal regulatory regime”<sup>106</sup>, which is positive compared to the levy on quarries and pits (see below), a tool that leaves almost no flexibility to municipalities that use it. A famous example of the use of this general regulatory levy power is the beverage container levy, aimed at encouraging individuals to recover their containers to reduce the volume of waste sent to landfill.

## Agreement with promoters for municipal work

This type of monetary levy works with permit holders’ contributions in funding new public infrastructure that is required for municipal development. It constitutes a tool for accelerating

the energy transition, because it focuses on re-establishing a certain balance between developments in areas that are already urbanized and developments located on the periphery.

Ensuring that “a municipal authority acquires a compliant building with a reasonable expectation of longevity for the benefit of the community”<sup>107</sup>, offers several advantages such as internalizing the costs of public infrastructure into the acquisition price of new private properties, allowing the city to adapt the proportion of cost internalization according to the location (whether the infrastructure is within denser areas, close to them or far from them). It allows better integration of projects in terms of urban planning and development, as well as improved monitoring of the quality of public infrastructure built by promoters and ceded to municipalities. Therefore, it helps holding the promoters accountable.<sup>108</sup> Lastly, it discharges the city from funding public work through loan bylaw and allows more equitable sharing of infrastructure costs relating to real estate development.

## Levy on quarries and sandpits in the Greater Montreal Region

This type of monetary levy is intended to fund an associated regulatory regime. As such, a municipality that has a quarry or sandpit on its territory must adopt a bylaw that requires the collection of a fee from its owners to contribute to the maintenance of municipal roads used by heavy haulage from its operations or to alleviate inconvenience it causes, and the deposit of the revenues in a dedicated fund.

Many aspects of this type of regulation are useful. First, it applies the “polluter-pays” principle that is based on the amount of matter extracted to internalize the costs of negative consequences. Second, it includes a data collection component relating to the fact that quarries and sandpits need to submit a declaration to municipalities regularly. This type of practice should include data on more sectors, such as GHG emissions and fuel consumption. More generally, the existence of this levy confirms the increased authority that Quebec municipalities have when it comes to regulatory levies. Third, an increase in the use of this specific levy may allow more money to go to green initiatives.

## Development charges

When included in a municipality's bylaw, development charges are fees that an owner must pay to cover part of the cost of work in order to obtain a permit that the municipality is required to take on to provide additional services. More clearly, these revenues, gathered into a special fund created by the municipality, are used to fund the expansion and modification of existing municipal infrastructure and facilities to respond to the increased demand in services. In contrast with the agreement between municipalities and promoters, which requires the latter to sign the agreement before having the permit handed to them, the development charges must be paid before the permit is delivered.

These charges are relevant since they allow a better cost recovery for the development of municipalities and can potentially fund additional cycling lanes, park and green-space areas, etc. In fact, when it was first discovered that urban growth increased

the burden on taxpayers rather than diminishing it, municipalities considered new sources of financing “in order to ensure fairer and more equitable development [and to] internalize public costs in the price of houses and stop the tax shift that real estate development causes to other taxpayers.”<sup>109</sup> This fiscal tool also considers the offsetting of negative externalities (pollution, traffic, overuse of municipal services, and reduction of quality of life) as its core strategy. In short, the real costs of development choices are calculated to implement fee charges, a practice that should be more widely used when it comes to decarbonizing society.

# Endnotes

1. <https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00064-eng.htm>
2. <https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00064-eng.htm>
3. <https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00064-fra.htm>
4. <https://www.weforum.org/reports/the-future-of-the-last-mile-ecosystem>
5. <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html>
6. <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html>
7. <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html>
8. <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html>
9. <https://www.environnement.gouv.qc.ca/changements/ges/2018/inventaire1990-2018.pdf>
10. <https://www.environnement.gouv.qc.ca/changements/ges/2018/inventaire1990-2018.pdf>
11. [https://portail-m4s.s3.montreal.ca/pdf/inventaire\\_ges\\_collectivite\\_2017\\_vf\\_0.pdf](https://portail-m4s.s3.montreal.ca/pdf/inventaire_ges_collectivite_2017_vf_0.pdf)
12. [https://portail-m4s.s3.montreal.ca/pdf/inventaire\\_ges\\_collectivite\\_2017\\_vf\\_0.pdf](https://portail-m4s.s3.montreal.ca/pdf/inventaire_ges_collectivite_2017_vf_0.pdf)
13. <https://www150.statcan.gc.ca/n1/pub/23-26-0001/2021001/montreal-eng.htm>
14. <https://montrealgazette.com/news/traffic-costs-montreal-millions-in-lost-work-hours-wasted-fuel-study>
15. <https://ecofiscal.ca/wp-content/uploads/2015/10/Commission-Ecofiscalite-Tarifer-Congestion-Routiere-Rapport-novembre-2015.pdf>
16. <https://www150.statcan.gc.ca/n1/pub/23-26-0001/2021001/montreal-eng.htm>
17. <https://ecofiscal.ca/wp-content/uploads/2015/10/Commission-Ecofiscalite-Tarifer-Congestion-Routiere-Rapport-novembre-2015.pdf>
18. <https://ecofiscal.ca/wp-content/uploads/2015/10/Commission-Ecofiscalite-Tarifer-Congestion-Routiere-Rapport-novembre-2015.pdf>
19. <https://montreal.ca/en/articles/vision-zero-2019-state-road-safety-report-14599>
20. <https://doi.org/10.1016/j.trd.2017.10.003>
21. <https://www.environnement.gouv.qc.ca/changements/ges/2018/inventaire1990-2018.pdf>
22. [https://portail-m4s.s3.montreal.ca/pdf/climate\\_plan\\_2020\\_2030\\_vdm.pdf](https://portail-m4s.s3.montreal.ca/pdf/climate_plan_2020_2030_vdm.pdf)
23. <https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/environnement/publications-adm/plan-economie-verte/plan-economie-verte-2030.pdf?1605540555>, 40
24. <https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/environnement/publications-adm/plan-economie-verte/plan-economie-verte-2030.pdf?1605540555>, 42
25. [https://www.transports.gouv.qc.ca/fr/ministere/role\\_ministere/DocumentsPMD/politique-mobilite-durable.pdf](https://www.transports.gouv.qc.ca/fr/ministere/role_ministere/DocumentsPMD/politique-mobilite-durable.pdf), 15
26. <https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/environnement/publications-adm/plan-economie-verte/plan-mise-oeuvre-2021-2026.pdf?1608760053>, 12
27. <https://transitionenergetique.gouv.qc.ca/en/transport/programmes/transpotez-vert>
28. [https://www.transports.gouv.qc.ca/fr/ministere/role\\_ministere/DocumentsPMD/PMD-plan-action.pdf](https://www.transports.gouv.qc.ca/fr/ministere/role_ministere/DocumentsPMD/PMD-plan-action.pdf), 33
29. [https://cmm.qc.ca/wp-content/uploads/2019/03/pmad\\_plan\\_metropolitain\\_aménagement\\_developpement.pdf](https://cmm.qc.ca/wp-content/uploads/2019/03/pmad_plan_metropolitain_aménagement_developpement.pdf), 8-9
30. [https://portail-m4s.s3.montreal.ca/pdf/montreal\\_2030\\_strategic\\_plan\\_vdm.pdf](https://portail-m4s.s3.montreal.ca/pdf/montreal_2030_strategic_plan_vdm.pdf)
31. [https://portail-m4s.s3.montreal.ca/pdf/montreal\\_2030\\_strategic\\_plan\\_vdm.pdf](https://portail-m4s.s3.montreal.ca/pdf/montreal_2030_strategic_plan_vdm.pdf), 51
32. [http://ville.montreal.qc.ca/portal/page?\\_pageid=5798,42657625&\\_dad=portal&\\_schema=PORTAL&id=30648](http://ville.montreal.qc.ca/portal/page?_pageid=5798,42657625&_dad=portal&_schema=PORTAL&id=30648)
33. [https://portail-m4s.s3.montreal.ca/pdf/climate\\_plan\\_2020\\_2030\\_vdm.pdf](https://portail-m4s.s3.montreal.ca/pdf/climate_plan_2020_2030_vdm.pdf), 59
34. [https://portail-m4s.s3.montreal.ca/pdf/climate\\_plan\\_2020\\_2030\\_vdm.pdf](https://portail-m4s.s3.montreal.ca/pdf/climate_plan_2020_2030_vdm.pdf), 25
35. [https://portail-m4s.s3.montreal.ca/pdf/climate\\_plan\\_2020\\_2030\\_vdm.pdf](https://portail-m4s.s3.montreal.ca/pdf/climate_plan_2020_2030_vdm.pdf), 66
36. <https://montreal.ca/en/articles/transportation-electrification-strategy-2021-2023-toward-sustainable-mobility-17859>
37. [https://portail-m4s.s3.montreal.ca/pdf/strategie\\_electrification\\_des\\_transports\\_2021-2023\\_ang\\_finale.pdf](https://portail-m4s.s3.montreal.ca/pdf/strategie_electrification_des_transports_2021-2023_ang_finale.pdf), 40-41
38. [http://ville.montreal.qc.ca/portal/page?\\_pageid=2762,3099656&\\_dad=portal&\\_schema=PORTAL](http://ville.montreal.qc.ca/portal/page?_pageid=2762,3099656&_dad=portal&_schema=PORTAL)
39. [http://ville.montreal.qc.ca/portal/page?\\_pageid=9517,133997570&\\_dad=portal&\\_schema=PORTAL](http://ville.montreal.qc.ca/portal/page?_pageid=9517,133997570&_dad=portal&_schema=PORTAL)

40. <https://www.pembina.org/reports/how-to-get-net-zero-exec-summary.pdf>
41. <https://www.pembina.org/reports/how-to-get-net-zero-exec-summary.pdf>
42. The monetary tools presented in this section are detailed in the report
43. Vérificateur général du Québec (2020) Rapport du commissaire au développement durable - Rapport du Vérificateur général du Québec à l'Assemblée nationale pour l'année 2020-2021. Juin.
44. [http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2\\_TEQ.pdf](http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2_TEQ.pdf), 5
45. [http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2\\_TEQ.pdf](http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2_TEQ.pdf), 30
46. <https://ecofiscal.ca/wp-content/uploads/2015/10/Commission-Ecofiscalite-Tarifer-Congestion-Routiere-Rapport-novembre-2015.pdf>, IV
47. <https://ecofiscal.ca/wp-content/uploads/2015/10/Commission-Ecofiscalite-Tarifer-Congestion-Routiere-Rapport-novembre-2015.pdf>
48. [https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en\\_US](https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en_US)
49. <https://ici.radio-canada.ca/nouvelle/1122023/congestion-routiere-interdiction-camions-heures-pointe>
50. <http://dx.doi.org/10.1016/j.trd.2016.10.013>
51. <http://dx.doi.org/10.1016/j.trd.2016.10.013>
52. <https://donnees.montreal.ca/ville-de-montreal/camionnage-reglements>
53. <https://donnees.montreal.ca/ville-de-montreal/camionnage-reglements>
54. <https://iea.blob.core.windows.net/assets/a4710daf-9cd2-4bdc-b5cf-5141bf9020d1/TheFutureofTrucksImplicationsforEnergyandtheEnvironment.pdf>
55. <https://citylab.soton.ac.uk/posters/paris.pdf>
56. [http://smartfreightcentre.ca/wp-content/uploads/2020/02/SFC-OPDPeelPilot-FinalReport-January30\\_2020.pdf](http://smartfreightcentre.ca/wp-content/uploads/2020/02/SFC-OPDPeelPilot-FinalReport-January30_2020.pdf)
57. <http://dx.doi.org/10.1016/j.trd.2016.10.013>
58. <https://lot.dhl.com/glossary/backhaul/>
59. <https://iea.blob.core.windows.net/assets/a4710daf-9cd2-4bdc-b5cf-5141bf9020d1/TheFutureofTrucksImplicationsforEnergyandtheEnvironment.pdf>
60. <https://iea.blob.core.windows.net/assets/a4710daf-9cd2-4bdc-b5cf-5141bf9020d1/TheFutureofTrucksImplicationsforEnergyandtheEnvironment.pdf>
61. <https://www.lapresse.ca/actualites/grand-montreal/2021-01-14/lachine-veut-un-tram-cargo-dans-son-parc-industriel.php>
62. <https://www.apur.org/fr/nos-travaux/sites-logistiques-actuels-potentiels-contribution-groupe-travail-immobilier-strategie-logistique-parisienne>
63. <https://ohdnyc.com/noise-management>
64. [http://smartfreightcentre.ca/wp-content/uploads/2020/02/SFC-OPDPeelPilot-FinalReport-January30\\_2020.pdf](http://smartfreightcentre.ca/wp-content/uploads/2020/02/SFC-OPDPeelPilot-FinalReport-January30_2020.pdf)
65. <https://www.sogaris.fr/fiche/beaugrenelle/>
66. <https://citylab.soton.ac.uk/posters/paris.pdf>
67. <https://www.sogaris.fr/fiche/chapelle-international/>
68. [https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/statistics/docs/truck-empty-back-haul-final-report-2018.pdf?sfvrsn=8efaa9c\\_0](https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/statistics/docs/truck-empty-back-haul-final-report-2018.pdf?sfvrsn=8efaa9c_0)
69. <https://www.cnu.org/publicsquare/2021/02/08/defining-15-minute-city>
70. <https://www.straitstimes.com/tech/tech-news/govts-pick-parcel-delivery-locker-network-launched-with-over-200-lockers-deployed>
71. <https://doi.org/10.1016/j.trpro.2020.03.161>
72. <https://doi.org/10.1016/j.trpro.2020.03.161>
73. [https://www.hdb.gov.sg/about-us#:~:text=The%20Housing%20%26%20Development%20Board%20\(HDB,is%20Singapore's%20public%20housing%20authority.&text=HDB%20flats%20are%20home%20to,households%20proudly%20owning%20their%20home.](https://www.hdb.gov.sg/about-us#:~:text=The%20Housing%20%26%20Development%20Board%20(HDB,is%20Singapore's%20public%20housing%20authority.&text=HDB%20flats%20are%20home%20to,households%20proudly%20owning%20their%20home.)
74. <https://www.straitstimes.com/tech/tech-news/govts-pick-parcel-delivery-locker-network-launched-with-over-200-lockers-deployed>
75. <https://www.rotterdam.nl/wonen-leven/stappenplan-zero-emissie/Roadmap-ZECL.pdf>
76. [https://portail-m4s.s3.montreal.ca/pdf/climate\\_plan\\_2020\\_2030\\_vdm.pdf](https://portail-m4s.s3.montreal.ca/pdf/climate_plan_2020_2030_vdm.pdf)
77. [https://business.edf.org/files/EDF023\\_Zero-Emissions\\_v3.pdf](https://business.edf.org/files/EDF023_Zero-Emissions_v3.pdf)
78. <https://nacfe.org/emerging-technology/medium-duty-electric-trucks-cost-of-ownership/>
79. <https://theicct.org/publications/canada-race-to-zero-oct2020>
80. <https://nouvelles.hydroquebec.com/fr/communiques-de-presse/1724/4-500-nouvelles-bornes-pour-faciliter-la-recharge-des-vehicules-electriques-dans-les-centres-urbains/>
81. [https://business.edf.org/files/EDF023\\_Zero-Emissions\\_v3.pdf](https://business.edf.org/files/EDF023_Zero-Emissions_v3.pdf)
82. [https://portail-m4s.s3.montreal.ca/pdf/strategie\\_electrification\\_des\\_transports\\_2021-2023\\_ang\\_finale.pdf](https://portail-m4s.s3.montreal.ca/pdf/strategie_electrification_des_transports_2021-2023_ang_finale.pdf), 46
83. <https://www.pembina.org/reports/building-a-zero-emission-goods-movement-system-report.pdf>
84. <https://vancouver.ca/streets-transportation/curbside-electric-vehicle-pilot-program.aspx>
85. [https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en\\_US](https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en_US)
86. [https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en\\_US](https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en_US)

87. [https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en\\_US](https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en_US)
88. <https://nacfe.org/emerging-technology/medium-duty-electric-trucks-cost-of-ownership/>
89. <https://www.rotterdam.nl/wonen-leven/stappenplan-zero-emissie/Roadmap-ZECL.pdf>
90. <https://www.pembina.org/pub/pace-financing-canada>
91. <https://www.climatefinancelab.org/project/pay-save-clean-transport/>
92. [https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en\\_US](https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en_US)
93. <https://propulsionquebec.com/wp-content/uploads/2020/11/ETUDE-REP-EN-FINAL-WEB.pdf?download=1>
94. [https://theicct.org/sites/default/files/publications/EV\\_charging\\_guide\\_03162020.pdf](https://theicct.org/sites/default/files/publications/EV_charging_guide_03162020.pdf)
95. <https://businessportal.ca.gov/wp-content/uploads/2019/07/GoBIZ-EVCharging-Guidebook.pdf>
96. [https://plan.lamayor.org/sites/default/files/pLAn\\_2019\\_final.pdf](https://plan.lamayor.org/sites/default/files/pLAn_2019_final.pdf)
97. [https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en\\_US](https://www.c40knowledgehub.org/s/article/Zero-emission-freight-Vehicle-market-and-policy-development-briefing-for-C40-cities?language=en_US)
98. [https://portail-m4s.s3.montreal.ca/pdf/strategie\\_electrification\\_des\\_transports\\_2021-2023\\_ang\\_finale.pdf](https://portail-m4s.s3.montreal.ca/pdf/strategie_electrification_des_transports_2021-2023_ang_finale.pdf), 46
99. [http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2\\_TEQ.pdf](http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2_TEQ.pdf), 27
100. [http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2\\_TEQ.pdf](http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2_TEQ.pdf), 31
101. [http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2\\_TEQ.pdf](http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2_TEQ.pdf), 31
102. [http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2\\_TEQ.pdf](http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2_TEQ.pdf) p.26
103. [http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2\\_TEQ.pdf](http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2_TEQ.pdf) p.42
104. [http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2\\_TEQ.pdf](http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2_TEQ.pdf), 36
105. The regime may generate more funds than necessary when the regulatory regime targets behavioural change.
106. [http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2\\_TEQ.pdf](http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2_TEQ.pdf), 37
107. Daigle c. Granby, 2014 QCCS 3671
108. See section 3.1.2 of report for legal requirements to use this type of ecofiscal tool
109. [http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2\\_TEQ.pdf](http://espace.enap.ca/id/eprint/213/1/ENAP-Livvable-2_TEQ.pdf), 25

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