



TRUCK CORRIDOR PROJECT
100% ELECTRIC QUEBEC–TORONTO

Opportunity and feasibility study for 100% electric medium and heavy truck routes along the Quebec– Toronto corridor

PHASE 1

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EXECUTIVE SUMMARY

Freight transport represents an essential lever in the fight against climate change, particularly in Quebec, where the decarbonization of the road sector is a strategic priority.

In response to the commitment of the Quebec government and Hydro-Québec to accelerate carbon neutrality, this project aims to establish the foundations of a charging ecosystem adapted to the needs of heavy commercial vehicles on a key interprovincial trade route.

The modeling focuses on a short- and medium-term public charging infrastructure, while also considering a long-term vision. It takes into account the technological evolution of electric trucks, the growth in freight flows, and the transformation of operational practices. The Quebec City–Toronto corridor, due to its high volumes and diverse user base, represents an ideal testing ground.

This study was structured around several complementary components. First, **the opportunity analysis** provides an overview of the current context of electric trucking, initiatives already underway, and the challenges to overcome to enable a 100% electric long-haul route between Quebec City and Toronto. The **market benchmarking** involved compiling data and trends in the freight transportation sector, assessing the current deployment of charging stations, and estimating future needs. The **technology review** examined advancements, innovations, and emerging practices related to electric trucks and charging infrastructure. Finally, **route analyses** were completed to determine the feasibility and viability of electrifying heavy transport on the Quebec City–Toronto corridor.

MARKET RESEARCH

In Canada, the freight transportation sector accounts for over **32% of total transportation demand** (in 2021). Diesel is the primary fuel used for freight transportation, while electricity represents only a small portion of the energy demand in the transportation sector; however, the share of electricity is growing. In 2021, greenhouse gas (GHG) emissions from the transportation sector amounted to 150 Mt, representing nearly a quarter of Canada's total emissions. Freight transportation alone accounted for one-third of these emissions.

Most freight carriers opt for privatized charging, via charging stations installed on their sites for their own electric vehicles.

Public charging infrastructure remains non-existent and is seen only as a potential supplement. According to Natural Resources Canada's "Charging and Alternative Fueling Station Locator" database, over 71 charging sites – representing more than 250 ports – are located near the corridor, but **none are suitable** for Class 7 and 8 vehicles.

An analysis of heavy truck traffic flows between Quebec City and Toronto was conducted by Attrix. This analysis focused on stops frequently used by long-haul trucks to identify suitable locations for charging stations, with the goal of reaching as many transportation operators as possible. Table SE-1 lists the seven selected locations, along with the average stop duration and the energy required to recharge the vehicles stopping at each location, based on an **average consumption of 1.9 kWh/km**.

Table SE-1: Information for selected sites

Location	Segment	Number of stops Class 8 vehicle	Average duration of stops (minutes)	Energy required for a class 8 vehicle (kWh/ day)
Villeroy	Quebec - Drummondville	5,528	95	13,243
Saint Edward	Drummondville - Montreal	4,133	105	9,688
Bainsville	Montreal - Cornwall	5,337	98	13,573
Cardinal	Cornwall - Brockville	3,467	88	8,638
Pittsburgh	Brockville - Kingston	9,311	50	23,553
Napanee	Kingston - Coburg	19,537	96	50,476
Port Hope	Cobourg - Toronto	5,746	57	12,911

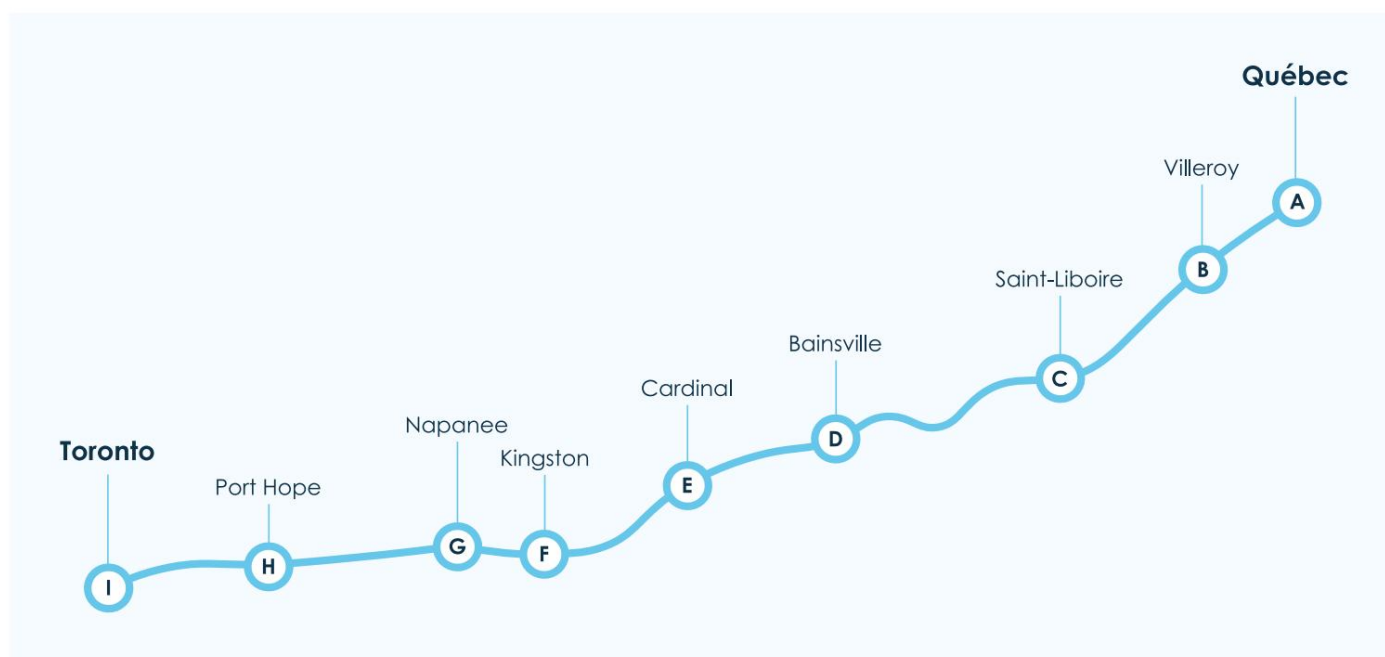
In addition to analyzing transport flows, this study relied on discussions with various industry stakeholders to identify the needs and opportunities for adopting long-distance electric transport. These interviews revealed that the challenges differ depending on company size and mode of transport. Key issues include compliance with standards, the use of management technologies, and cost control. Motivations include cost reduction and customer satisfaction, but the main obstacles remain high initial costs and resistance to change.



FEASIBILITY ANALYSIS

Based on the route determined by Attrix's analysis, different distance intervals were defined to meet current technological requirements and accommodate the charging needs of a typical truck, while respecting the critical threshold for average range. Our analyses, including surveys and a literature review, confirmed that the range of electric trucks in Quebec and/or Ontario is a minimum of 160 km and up to 300 km. Therefore, the route was adapted to provide charging sites spaced in a resilient and accessible manner. In addition to the distance between charging sites, the route's topographic profile was considered in the analysis to present results simulating real-world operating conditions. Figure SE-1 provides an overview of the route and the proposed charging site locations for this corridor project between Quebec City and Toronto. It should be noted that a truck will not necessarily have to stop at each of them to recharge, but redundancy is planned in case of breakdowns or more difficult conditions.

SE-1: Overview of the route and proposed location of charging sites



Once the preliminary route is confirmed, a thorough analysis of its viability is carried out under various operational scenarios. These scenarios present different operating conditions in order to assess the impact of various external factors on the route's feasibility, including temperature, cargo weight, vehicle specifications, speed, and recharging requirements.

Thus, for the proposed route, it was possible to assess the feasibility, the energy required to complete the journey, as well as the necessary operating and recharging times.

According to the results of the feasibility study, all scenarios can accomplish the proposed route.

Figure SE-2 illustrates the state of charge of a Class 8 vehicle in the most critical scenario, that is, the one with the lowest charge level among the modeled scenarios. This scenario differs from the others by a reduced frequency of spot charging, aimed at optimizing travel time. The Saint-Liboire-Bainsville-Cardinal section is identified as the critical segment, where the battery level drops to 45% of its nominal capacity (244 kWh).

Figure SE-2: Battery charge status according to scenario 5



It is also relevant to examine the operating time required to complete the journey under different scenarios. On average, for the 11-tonne scenarios, the journey should take 12 hours to complete. The variation in total time is mainly attributable to charging periods, assuming the vehicle is fully charged at each charging point. The charging time therefore depends on the energy consumed during the transport segment.

Table SE-2: Operating time based on scenarios

Scenario	Departure time	Arrival time	Operating time (Hours)	Charging time (Hour) *
S1	09:00:00	21:02:53	12.2	3.0
S2	09:00:00	20:52:54	11.9	2.8
S3	09:00:00	20:52:54	11.9	2.8
S4	09:00:00	21:31:54	12.6	3.5
S5	09:00:00	20:20:54	11.5	2.3
S6	09:00:00	21:05:54	12.2	3.1
S7	09:00:00	21:16:54	12.4	3.2
S8	09:00:00	21:56:54	13.1	3.9

* To be combined with the driver's regular stops

1. INTRODUCTION

1.1 GENERAL FRAMEWORK

This report stems from the commitment of Propulsion Québec and its partners to accelerate the decarbonization of freight transportation. It represents a first step toward the deployment of public charging stations along the Québec City–Toronto highway corridor [hereafter referred to as *the Corridor* in this study]. Based on short- and medium-term supply modeling, this initiative aims to support the development of long-term perspectives for carbon neutrality in transportation by 2050.

This report explores the feasibility of fully electric journeys using trucks currently available on the market. It also examines various public charging scenarios that could be offered, in the short term, to owners and operators of heavy goods vehicles (HGVs) to facilitate their transition to electromobility.

The analysis conducted by WSP is based primarily on the main objective: the deployment of medium and heavy trucks traveling the corridor over medium and long distances. WSP and Propulsion Québec considered the diverse profiles and dynamics specific to freight carriers with regard to electrification and charging strategies. This work has enriched the analytical criteria and allowed for the development of various models aimed at identifying truly incentivizing charging solutions to promote the transition to electric freight transport.

The report addresses a key question for the energy future of freight transport: *can electric truck journeys be made possible, and what might the public charging infrastructure look like?*

necessary to achieve carbon neutrality by 2050?

Based on empirical data—telematics, statistics, and economics—the report offers analyses, predictions, and recommendations to support the success of the project's initiatives. It presents various scenarios designed to help carriers and policymakers visualize the foundations of a public charging ecosystem, understand how it works, and guide public policy toward a diverse charging offering tailored to the specific needs of this segment of the transportation sector.

1.2 STUDY OBJECTIVES

This study aims to inform Propulsion Québec about the feasibility for freight carriers to make journeys in electric trucks as well as the charging infrastructure needs required for the deployment of electric vehicles in the medium and heavy transport segment.

The first phase of the project (hereinafter the **"Corridor Project"**) **Quebec–Toronto – Phase 1** (or the **"Project – Phase 1"**) pursues the following objectives: To identify the obstacles to achieving a 100% electric truck route medium or heavy traffic between Quebec City and Toronto; Define the needs associated with a charging corridor enabling such journeys; Analyze truck telematics data to determine energy needs, current usage patterns, and potential charging site locations; Propose solutions to facilitate electric truck journeys on this corridor; Develop an implementation plan for the electric corridor (context, objectives,

timeline, applicable technologies, public and private financial model, and preliminary summary budget).

Throughout the report, Phase 1 of the project refers to analyses conducted jointly by WSP and Propulsion Québec, in collaboration with their partners, to confirm the feasibility of operating 100% electric medium and heavy trucks over distances

medium and long lengths along the Quebec–Toronto corridor.

Phase 2 of the project, if initiated by Propulsion Québec and its partners, will consist of the implementation of the electric corridor and the effective circulation of medium and heavy electric trucks on it.

1.3 METHODOLOGY

The first step was to define the target market and analyze the technological and economic resources available to meet charging needs. Subsequently, the study focused on identifying prime locations or opportunities suitable for installing charging stations.

The study is divided into several parts:

Opportunity analysis

This section outlines the current context of electric trucking, existing initiatives, and key opportunities and challenges. It aims to assess the context and objectives related to the deployment of a charging corridor, while identifying the obstacles to overcome to enable 100% electric long-haul trucking between Quebec City and Toronto.

Market Markup

This section analyzes and groups available data and concepts relating to the freight transport sector, the deployment and use of existing charging stations, while estimating future needs from sector growth forecasts.

It allows Propulsion Québec to better understand the context in which carriers are evolving in their transition to electric vehicles and to make strategic decisions to support their adoption, as well as to plan a suitable fast charging offer along the Corridor.

By identifying market trends and opportunities, this demand and competitive analysis helps to mobilize stakeholders to properly plan a first large-scale initiative (phase 2 of the project). In addition to assessing current charging needs, this component also considers functional aspects such as reducing risks and operational constraints associated with charging, as well as optimizing resource allocation based on market inputs.

NOTE

The objective of the Project – Phase 1 as well as Phase 2 – **is not to maximize return on investment** by targeting the most profitable segments or sites within the Corridor. Rather, it is to deploy a charging infrastructure offering by promoting **a proactive and incentive-based approach to converting vehicles in this sector to electric.**

Technology Review

Studying the context, trends, and technologies related to electric trucks and charging allows us to take stock of the progress, trends, and innovations in this field. It helps to identify emerging technologies, assess their level of maturity, and understand their advantages and limitations.

Combined with discussions and feedback from the target market, this analysis supports the selection and prioritization of technologies to be deployed in Phase 2 of the project. The ultimate goal remains the deployment of 100% electric medium and heavy-duty trucks over medium and long distances along the corridor, thanks to an accessible, user-friendly, safe, and community-incentivizing charging infrastructure.

Analysis of routes and travel times of electric trucks on the corridor

This component examines the routes taken by electric trucks along the corridor and the associated durations, in order to assess the operational and energy feasibility of electric transport on the Quebec – Toronto corridor.



Recommendations on the opportunities and feasibility of charging initiatives

Based on several deployment scenarios, this section formulates recommendations aimed at optimizing the planning, implementation and efficiency of public charging infrastructure along the corridor.

1.4 LIMITS

The conclusions presented in this study are based on the information and data available at the time of writing. The analysis relies primarily on telematics data relating to transport flows, as well as information gathered from the local market regarding charging needs and supply, technologies, supplier networks, stakeholders, incentives, business models, and pricing available between **November 2024 and May 2025**.

It is estimated that the information provided by Attrix, a study partner, and by the sample of operators and partners consulted offers a representative and reliable picture of truck charging needs and trends. As the study sponsor, Propulsion Québec considers this data to be of sufficient accuracy and quality for the purposes of the project.

Analyses of zero-emission vehicle (ZEV) technologies and charging solutions remain subject to change, given the rapid development of technologies and market conditions. The references, findings, and recommendations presented are based on data available to date, and their relevance may change over time. Therefore, it is recommended that Propulsion

In later phases of the project, Quebec is undertaking a technological and market update to ensure continued consistency of the scenarios and prioritized initiatives with the operational needs of the targeted carriers.

Furthermore, the proposed initiatives should be reviewed in light of public policies on decarbonizing freight transport and the strategies for deploying public charging services put forward by the governments of Quebec and Ontario in the short term (1-3 years), as these may significantly influence the directions of **Project – Phase 1 and Phase 2**.

Uncertainty remains inherent in any modeling exercise. The assumptions and conclusions presented in this report do not necessarily represent a consensus, which justifies the choice of a portfolio of initiatives rather than a single charging option. The various charging scenarios, deployed in different locations along the Corridor and based on distinct economic models, allow for a more effective exploration of the desired incentive effect for converting freight transport to electric.

However, the scenarios presented do not take into account the potential impact of certain factors — economic, logistical, political or regulatory — on the growth of electric vehicle (EV) adoption in this segment. These additional analyses could be incorporated during Phase 2 or later stages of the Corridor Project.

2. MARKET RESEARCH

This section assesses the energy context and that of long-distance freight transport, while also providing an overview of the current supply and demand situation for both freight transport and electric vehicle charging. This analysis is conducted at the Canadian level, with a particular focus on the provinces of Quebec and Ontario, which are directly affected by the project – Phase 1.

2.1 CURRENT CONTEXT

Electric freight transport

In March 2024, Quebec had 5911 registered electric heavy trucks (classes 6, 7 and 8) out of a total fleet of approximately 45,000 vehicles.² This proportion remains modest, but it reflects a gradual adoption of zero-emission technologies in the freight transport sector.

The [Catalogue of specialized rechargeable vehicles](#), published on the website of the Quebec organization [Roulons electric](#), It provides a [useful reference for](#) listing the makes and models currently available on the market. It allows carriers wishing to electrify their fleet to identify vehicles adapted to their operational needs and the operating conditions in Quebec.

OBSERVATIONS & HIGHLIGHTS

¹ In 2021, the freight transport sector represented more than 32% of the total demand for transportation in Quebec. Diesel remains the main fuel used in this segment³.

² Electricity still constitutes only a marginal part of the energy demand of the transport sector, but its share is growing.

In 2021, GHG emissions from the transportation sector amounted to 150 Mt, representing nearly a quarter of Canada's total emissions. Freight transportation alone accounted for approximately 33% of these emissions.

¹ Sources: [AVÉQ](#)

² Sources: [Official Statistics Database – Government of Quebec](#)

³ Canada's Energy Future Report 2023. <https://www.cer-rec.gc.ca/fr/donnees-analyse/avenir-energetique-canada/2023/avenir-energetique-canada-2023.pdf>, page 59.

⁴ Ibid.

Most freight carriers currently favor a privatized charging method, namely charging stations installed at their operating sites or depots, generally reserved for their own fleet of electric vehicles. Public charging options for this segment remain virtually nonexistent, and freight carriers perceive them as an occasional supplement rather than a primary solution. While private charging will remain the priority, developing a public charging infrastructure could be a strategic advantage for freight carriers operating or planning long-distance routes.

Unlike the passenger transport sector, where the electrification of personal vehicles is experiencing strong growth, the technological makeup of freight transport remains more uncertain. Depending on technological and market developments, the sector could diversify towards hydrogen, electricity, or even fuels such as renewable natural gas or bioenergy. Nevertheless, projections indicate that almost all sales of light freight vehicles should be electric by 2040 .

Energy

The energy sector in Quebec and Ontario is distinguished by its complexity and diversity. The methods of electricity production, distribution, and pricing—central elements of any transportation electrification project—directly influence the ability to achieve carbon neutrality targets in transportation. Several challenges and key factors must be considered to effectively plan the future deployment of charging infrastructure:

- 1. Growth in electricity demand.** In the context of ambitious decarbonization, electricity demand will increase considerably, making energy the cornerstone of supplying the land transport sector (the majority share of the energy mix)⁶—particularly for heavy goods vehicles. The availability of this energy and an appropriate tariff structure are essential conditions for the viability of a large-scale public charging network.
- 2. Transition of operators to electric technologies.** By 2050, virtually all owners and operators of heavy-duty vehicles (HVV) – currently dependent on fossil fuels – will need to begin a major operational transformation, replacing their existing assets with electric technologies. This transition will enable a substantial reduction in greenhouse gas (GHG) emissions and contribute to the sector's carbon neutrality targets;
- 3. Evolution of technological costs.** The acquisition costs of battery-electric or fuel cell trucks are expected to decrease continuously, reaching near parity with diesel vehicles between 2035 and 2050⁸ .

In the short term, energy consumption in freight transport will continue to rise as shipping volumes recover to pre-pandemic levels. In the long term, the growth of the electric and hydrogen vehicle fleet will lead to a decrease in energy demand, partially offset by the sustained increase in transport service needs.⁹

⁵ Canada's Energy Future Report 2023 <https://www.cer-rec.gc.ca/fr/donnees-analyse/avenir-energetique-canada/2023/future-energy-canada-2023.pdf>.

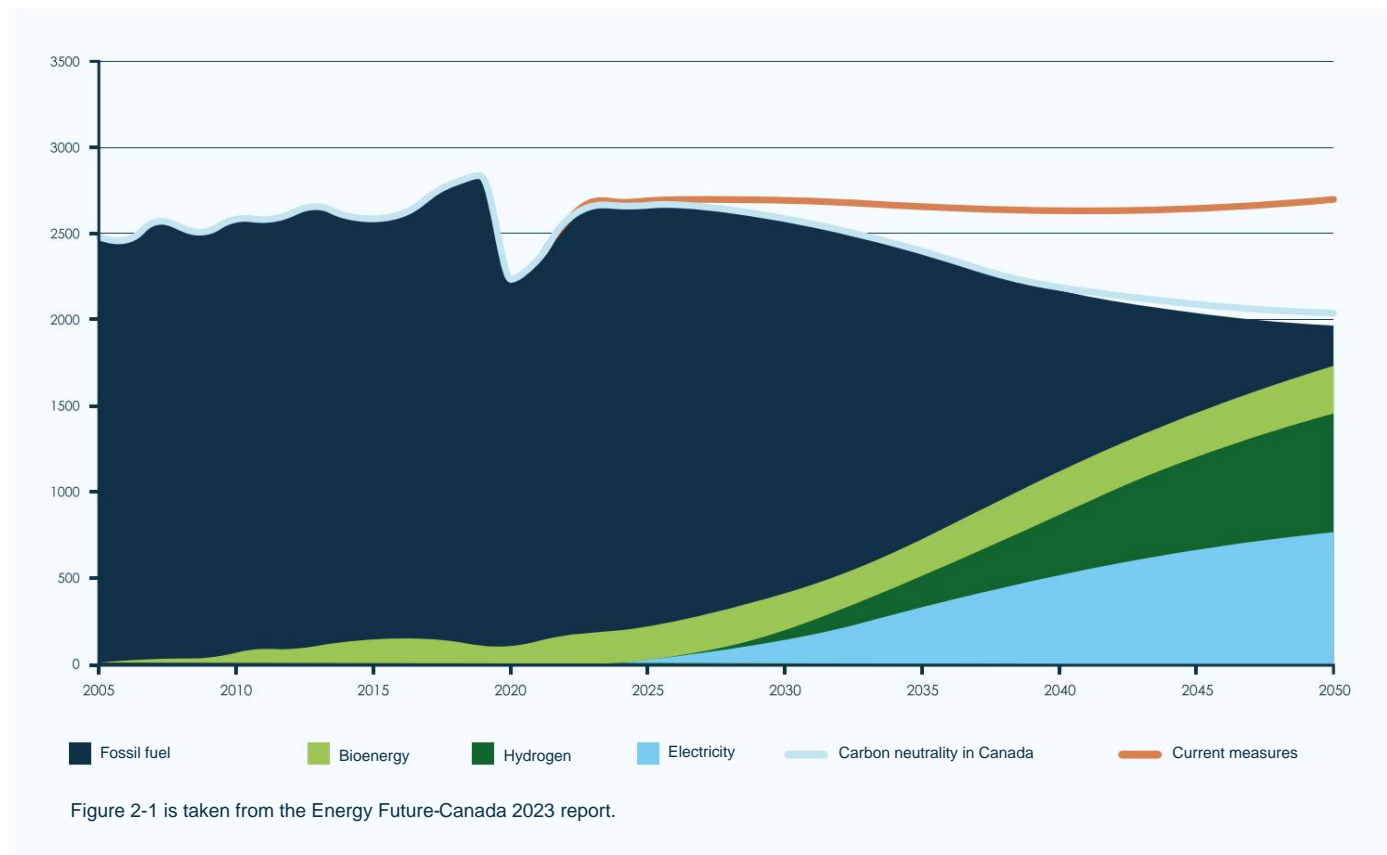
⁶ Canada's Energy Future Report 2023 <https://www.cer-rec.gc.ca/fr/donnees-analyse/avenir-energetique-canada/2023/future-energy-canada-2023.pdf>. Page 12.

⁷ Estimated at 15 MT by 2050 compared to 150 MT in 2021 in Canada, according to the Energy Futures Report-Canada 2023. <https://www.cer-rec.gc.ca/fr/donnees-analyse/avenir-energetique-canada/2023/avenir-energetique-canada-2023.pdf>. Page 47.

⁸ Canada's Energy Future Report 2023. <https://www.cer-rec.gc.ca/fr/donnees-analyse/avenir-energetique-canada/2023/future-energy-canada-2023.pdf>. Page 33.

Figure 2-1, from the Canada Energy Future report, illustrates final energy demand by fuel type in the transportation sector — including passenger transportation, freight transportation and off-road uses — under the global carbon neutrality scenario.

Figure 2-1: Energy demand for the transport sector by fuel



Existing refueling sites

Natural Resources Canada's database, entitled "Locate of Charging Stations and Alternative Fueling Stations", made it possible to identify sites currently equipped with DC fast charging stations (DCFC) located along the corridor axis.

Only DC fast charging stations with a power output exceeding 150 kW were included in this analysis. Figure 2-2 illustrates, in map form, the location of these existing charging sites along the corridor.

⁹ Canada's Energy Future Report 2023. <https://www.cer-rec.gc.ca/fr/donnees-analyse/avenir-energetique-canada/2023/future-energy-canada-2023.pdf>.

Figure 2-2: BRCC located near the corridor



Although more than 71 charging sites — totaling more than 250 ports — are listed near the Corridor, the Natural Resources Canada (NRCan) database states that none of these sites currently have a configuration suitable for Class 7 and 8 **10** vehicles.

The Electric Circuit is currently conducting fast charging projects specifically for heavy and long-distance transport vehicles¹¹.



The first charging station is located in the industrial area of L'Assomption, near Highway 40. It is equipped with a 180 kW charging station with two SAE Combo connectors.

A second station is installed on Cunard Street in Laval. Its configuration is optimized to accommodate heavy and medium-duty vehicles with trailers, allowing parking on both sides of the two available terminals.

These charging stations share a maximum power of 350 kW and offer SAE Combo and CHAdeMO connectors.

For the moment, the pricing applied in these stations dedicated to heavy and medium-heavy vehicles is identical to that in force throughout the Electric Circuit network for terminals of more than 100 kW.

It should be noted, however, that these two charging stations for heavy and long-distance transport are located outside the scope of the current study.

¹⁰ According to the "Refueling Station and Alternative Fuel Station Locator". A filter on the accessibility of Class 7 and 8 vehicles allowed this conclusion to be reached.

¹¹ <https://lecircuitelectrique.com/fr/vehicules-lourds/>

2.2 CURRENT NEEDS

Based on telematics data and information gathered from potential users, it is possible to draw up a representative picture of the current demand for access to a public charging offer for medium and heavy electrified freight transport.

The following section presents the main findings and recommendations resulting from the analysis of this data.

2.2.1 Empirical Approach

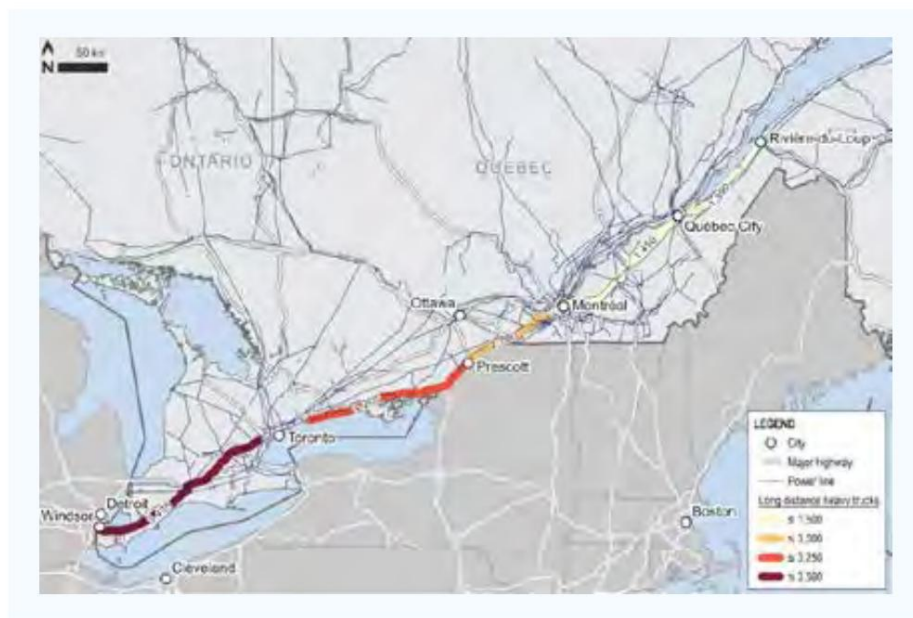
2.2.1.1 Quebec City – Windsor Corridor: Findings from the HEC-CPCS Study

The Chair in Energy Sector Management at HEC Montréal, in collaboration with the consulting firm CPCS, published a report on the decarbonization of long-distance road transport in eastern Canada, focusing more specifically on the Quebec City - Windsor corridor (hereinafter the HEC-CPCS study)¹².

This study highlights the strategic characteristics of this corridor, including: Its connection with major air freight hubs (Toronto Pearson Airport, Montréal-Trudeau and Mirabel International Airports and Hamilton International Airport); Its direct access to a maritime transport platform, namely the Port of Montréal; The presence of multiple intermodal connections, including rail facilities, warehouses and distribution centres.

The volume of long-haul truck traffic on the different segments of the corridor is illustrated in Figure 2-3, taken from a CPCS analysis based on open data from the Ontario Ministry of Transportation (MTO) and the Quebec Ministry of Transport and Sustainable Mobility (MTMDQ).

Figure 2-3: Daily volume of long-distance heavy goods vehicles on the corridor segments (one-way)



¹² Roberts, N., Cyr, M., Whitmore, J., Pineau, P.-O., 2023. Decarbonizing long-distance road transport in Eastern Canada: Part 2 - A techno-economic assessment of carbon-neutral technologies on the A20-H401 corridor between Quebec City and Windsor, prepared by CPCS and the Chair in Energy Sector Management - HEC Montréal for the Government of Quebec.

The MTO and the MTMDQ both publish data on average annual daily traffic and the modal share of trucks travelling on their respective highway networks. This information was used to estimate the annual volume of Class 8 trucks making long-haul trips, as shown in Table 2-1 below.

Table 2-1: Length and annual volume of the different segments of the corridor proposed by the HEC-CPCS study

Highway segment	Segment length (KM)	Annual volume of Class 8 long-haul trucks
Windsor – Toronto	321	1,308,000
Toronto – Prescott	288	1,206,000
Prescott – Montreal	146	1,075,000
Montreal – Quebec	215	544,000
Quebec – Rivière-du-Loup	167	523,000

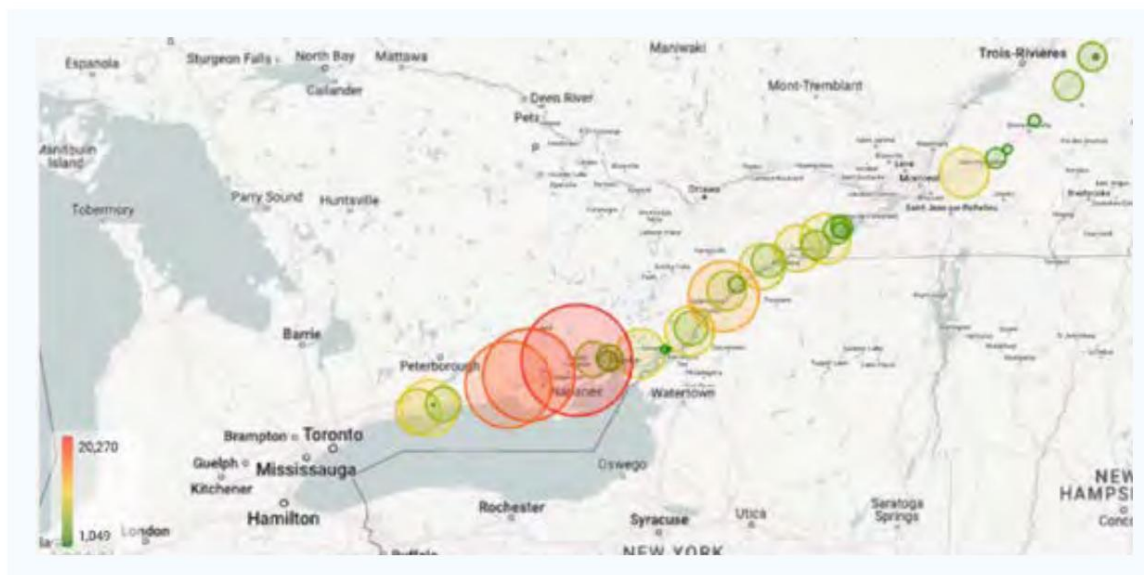
2.2.1.2 ATTRIX

Attrix, a contributing partner in the project and a Canadian company specializing in fleet management, conducted an analysis of heavy truck traffic flows between Quebec City and Toronto.

This analysis aimed to identify the stops most frequently used by class 8 trucks making long-distance journeys, in order to identify sites with favorable potential for the installation of charging stations.

Attrix's analysis identified more than 33 locations with **over 1,000 daily stops**. These locations are shown in Figure 2-4.

Figure 2-4: Results of Attrix analysis



This figure allows visualization and strategic positioning of potential charging sites along the electric corridor in order to reach the largest possible number of transport operators.

Analyzing the collected telematics data makes it possible to identify the points where stops are most frequent, thus optimizing the coverage of the charging network to meet the energy needs of class 8 vehicles.

For this analysis, the Quebec City–Toronto route was divided into seven (7) segments:

1. Quebec ↔ Drummondville
2. Drummondville ↔ Montreal
3. Montreal ↔ Cornwall
4. Cornwall ↔ Brockville
5. Brockville ↔ Kingston
6. Kingston ↔ Coburg
7. Coburg ↔ Toronto

For each segment, the two locations with the greatest potential were selected. Among these, the location offering the longest average dwell time and the best accessibility (east-west direction) was chosen as the priority site.

Table 2-2 presents the seven locations selected for this study, along with the average duration of stops and the estimated energy required to recharge vehicles, calculated on the basis of an **average consumption of 1.9 kWh/km**.

Table 2-2: Information for selected sites

Location	Segment	Number of stops – Class 8 vehicle	Duration average number of stops (minutes)	Energy required – class 8 vehicle (kWh/day)
Villeroy	Quebec ↔ Drummondville	5,528	95	13,243
Saint Edward	Drummondville ↔ Montreal	4,133	105	9,688
Bainsville	Montreal ↔ Cornwall	5,337	98	13,573
Cardinal	Cornwall ↔ Brockville	3,467	88	8,638
Pittsburgh	Brockville ↔ Kingston	9,311	50	23,553
Napanee	Kingston ↔ Coburg	19,537	96	50,476
Port Hope	Coburg ↔ Toronto	5,746	57	12,911

2.2.2 Operational Approach

While the empirical approach relies on quantifiable results, research reports and analysis of travel flows on the targeted route, the operational approach relies on interviews conducted with various industry stakeholders.

This approach aims to identify current gaps and potential opportunities that promote better adoption of long-distance electric transport.

Interviews conducted with various operators provided a better understanding of their operational realities and specific needs. The results indicate that the challenges related to the energy transition vary depending on the size of the company (SME or large company) and the type of activity (road, rail, or maritime in a regional, national, or international area).

The main issues identified concern:

Regulatory compliance in matters of safety and the [environment](#)

The use of fleet management technologies, GPS and telematics

Controlling costs related to fuel, maintenance and tolls.

General challenges in the sector also include road congestion, a shortage of skilled labor, and the transition to low-emission vehicles.

As for motivations, operators cite the reduction of operating costs, the improvement of operational efficiency and customer satisfaction.

However, significant obstacles to adoption remain: high initial costs, technological uncertainties, resistance to change, etc.

2.2.2.1 Carrier Approach

Interviews conducted with carriers provided a better understanding of the progress and initiatives already undertaken to begin the transition of their vehicle fleet.

Kruger Inc. is adding electric vehicles (EVs) to its fleet not only to reduce its carbon footprint, but also to strengthen its commitment to sustainable innovation and meet the growing environmental responsibility expectations of its customers and partners. To facilitate this transition, Kruger Energy Electrification (KEE) is investing in the installation of DC fast charging stations at its industrial sites, minimizing vehicle downtime. KEE is also collaborating with technology providers and companies specializing in electric mobility solutions to accelerate EV adoption. KEE is partnering with carriers but remains responsible for defining the roadmap for conversion plans. Currently, its business model involves converting all or part of its fleet operating on closed circuits (between production sites and warehouses). In a second phase, KEE plans to integrate trucks making longer-distance deliveries. Finally, KEE aims to conduct a comprehensive analysis of its transportation operations to explore electrification opportunities.

Location Brossard has undertaken the electrification of its fleet of heavy trucks in collaboration with Cléo, a subsidiary of Hydro-Québec, and GLOBOCAM, a heavy truck dealership. To begin this transition, ten

Electric trucks have been ordered. Six of their clients will benefit from this transition to greener vehicles. To optimize charging management and minimize energy costs, Location Brossard uses Cléo's smart platform, as well as charging infrastructure leased from Cléo, including a site with three dual 180 kW DC fast charging stations. The next step is to deploy six new DC fast charging stations (24 kW ABB wallboxes) to preheat and precondition the batteries at the end of the charging cycle, thus ensuring vehicle range. Location Brossard's objective is to create customized solutions for its clients' conversion to alternative energy sources. The company recommends that the selected charging sites allow for expansion and offer commercial services, similar to gas station hubs. The primary motivation for this conversion is to meet customer demand. The turnkey project aims to internalize the charging infrastructure to introduce customers to EVs and mitigate risks.

Location Brossard was one of Cléo's first customers in 2022 for the EaaS service (six-year contract), and 30% of its customers' charging takes place at the Brossard operating site.

DHL is committed to electrifying its fleet and reducing its carbon footprint. DHL Express Canada has invested \$15 million to add 110 electric vehicles to its fleet, with Class 6 trucks deployed in Montreal in 2022, and plans to electrify 66% of its global fleet by 2030. DHL covers a large part of Canada and France, with electric vehicles traveling an average of 100 km per day in urban areas, and plans to extend this range to 400 km with the next generation of vehicles.

The company distinguishes itself through its commitment to green and innovative transport solutions, using sustainable fuels and investing in eco-friendly buildings. Nearly 80% of the company's target fleet consists of vans and pickup trucks, with only 10% targeted by the Corridor project.

The company is currently focused on electrifying its Class 3 vehicles. Key routes include Mirabel-Lachine-Ottawa, Hamilton-Ottawa, and connections between Hamilton Airport and warehouses in other major cities such as Brampton and Ottawa, using heavy-duty trucks. The vehicles refuel at ESSO gas stations, their partner, and there are no plans for electrification or charging station deployment in Quebec. Existing charging stations are used for last-mile deliveries. The company is ready to invest in charging stations for its operating sites and warehouses and would be interested in charging network offerings such as CE. Short trips are already covered by private charging stations at warehouses, while medium and long trips are not yet addressed.

Nationex has an ambitious strategy to convert its delivery vehicle fleet to electric, addressing the challenges of the parcel delivery sector in Quebec. Nationex delivers approximately 10 million parcels annually from 25 depots across Quebec and Ontario. Nationex aims to electrify all its electrifiable vehicles by 2025, a goal accelerated by the September 2023 acquisition of Courant Plus, a company specializing in electric vehicle (EV) delivery. Nationex also plans to expand the concept of green zones, initially developed by Courant Plus in Montreal, to other cities in Quebec and Ontario. Nationex's active fleet includes electric heavy trucks, vans, and electric bicycles, reflecting its commitment to vehicle diversification.

According to Nationex, the main challenges facing the parcel delivery sector in Quebec include urban congestion, which complicates fast and efficient deliveries, and tight deadlines imposed by consumer expectations for rapid, sometimes same-day, deliveries. Environmental concerns are driving companies to adopt more sustainable delivery solutions. For long-distance routes offered by Nationex, such as Montreal-Toronto, a stop in Kingston allows for a quick vehicle and driver change, guaranteeing delivery within 24 hours. Routes are divided into blocks of approximately 300 km to optimize operations. Electrifying the Montreal-Toronto corridor is a significant challenge, and Nationex is seeking to collaborate with other operators to deploy dedicated charging sites, considering the creation of outsourced public charging hubs.

Simard Transport has launched an initiative to electrify its truck fleet in collaboration with GLOBOCAM and CLÉO. The company has integrated four Freightliner eCascadia trucks, equipped with 438 kWh batteries.

To ensure the charging of these trucks, Simard Transport installed two 120 kW charging stations and two 24 kW ABB DC Wallbox charging stations, managed by CLÉO (POLARA) via a smart platform that optimizes charging and reduces electricity costs. GLOBOCAM supported Simard Transport throughout their implementation process.

by providing technical and operational analyses, training, and assistance in obtaining grants.

Currently, the electric trucks operate on local routes in Montreal, using highways A13, A15, A20, and A40, with an average daily trip of 150-200 kilometers. Charging is only available at the Lachine terminal, but Simard is open to using various public charging stations in the future if it helps them increase their range while maintaining efficient operations.

2.2.2.2 Operator approach to top-ups

Meetings were held with **Circuit Électrique (CÉ)** to better understand the approach adopted by charging operators in the context of projects intended for heavy transport.

The fast-charging pilot project currently includes the deployment of four sites dedicated to electric trucking. – Several fast-charging pilot projects for trucks have been deployed (four sites). The key performance indicators (KPIs) focus primarily on user satisfaction, favoring an experiential evaluation rather than measures strictly based on usage rates, given the relatively low volume of light vehicles on the roads at present.

The sites selected for this pilot project are intra-urban or peri-urban multimodal hubs, rather than motorway rest stops. The deployment of motorway sites by the Electric Circuit began in June 2025, and these fast-charging stations will be reserved for heavy-duty electric vehicles, with a pricing structure that varies according to the power offered.

Furthermore, the "CE – Business Solutions" initiative, in its final version, includes the integration of a time-based charging reservation function. The on-site logistics analysis also aims to refine design standards, particularly regarding site location and configuration.

Testimonies gathered by CE indicate that their truck charging stations are, for the moment, considered fallback solutions, and that ideally, users would depend as much as possible on their infrastructure deployed at their operating sites.

According to CÉ, the direction and destination remain the same, but the speed and pace of initiatives to convert heavy vehicles to EVs are slowing. Sites with easements without compensation are becoming scarce, except for rest stops built by the MTMD (Ministry of Transport of Dangerous Goods and Services), which benefit from preferential conditions. CÉ must therefore now add rental costs to its operating expenses.

Future Plan and Investment – Over the next five years, ten more sites are planned, with an initial investment of \$35 million, focusing on quality rather than quantity. The only guidelines imposed by the government prioritize the highway environment. In 2025, two charging sites will be deployed by the CE, with four more expected to follow in 2026. The CE's preferred sites will include rest areas located on Highways 20 and 40.

Two main trends are emerging for long-haul aircraft: relying on third-party refueling or privatizing this refueling by internalizing this capability at their depot. The choice between these options will largely depend on the financial model and the balance between cost savings and increased operating expenses.

2.2.2.3 Charging-as-a-service (CaaS) approach

The CAAS model is a turnkey charging solution, in which a company owns, installs and operates charging infrastructure made available to another company or customer.

7Gen is a leading provider of electric vehicle solutions and charging infrastructure, specializing in medium and heavy-duty vehicle fleets in North America. Their mission is to make EV adoption seamless and cost-effective by offering electric vehicle leasing as a service, comprehensive electrification support, financing, and software. By simplifying the transition to zero-emission fleets, 7Gen helps fleet managers overcome knowledge and capital barriers, making EVs a clear alternative to traditional internal combustion engines. With 7Gen, customers enjoy all the benefits of a fully integrated EV fleet on a single, affordable monthly bill.



3. TECHNOLOGY REVIEW – CHARGING SECTION

3.1 REFILL OFFER - LITERATURE REVIEW

3.1.1 Marking of technologies and practices in truck charging

This section provides an overview of the charging technologies and equipment currently available on the market, in order to better understand the options applicable to medium and heavy electric vehicles (MEVs)¹³.

This analysis aims to compare the different technological solutions and to establish a prioritization of **charging options on which Propulsion Québec and its partners should focus their efforts in Phase 1 of the project.**

Stationary charging

Stationary charging via direct connection involves supplying electricity to the vehicle using a connecting cable. The vehicle must be plugged in to receive the energy required for charging.

The location of the charging stations must be planned according to the energy needs of the vehicles, whether at the depot where they are parked or at strategic points along their route.

Direct connection is possible from three levels of chargers (levels 1, 2, and 3). Level 1, using a standard 120-volt wall outlet, is not considered a viable option for heavy vehicles due to the high capacity of their batteries and the charging time required.

1 AC Chargers – Level 2

Level 2 charging stations provide power ranging from 7.4 to 22 kW. Depending on the station model and the rated current of the circuit breaker supplying it, charging time can vary considerably.

Since electric vehicle batteries can only store energy in direct current (DC), the on-board charger (internal converter in the vehicle) ensures the conversion of alternating current (AC) into direct current.

¹³ Practical guide, “Understanding charging options for heavy-duty electric vehicles”. Lion Electric, March 2024.

These charging stations offer several advantages: lower acquisition cost than fast charging stations, simpler and less expensive installation, and compatibility with the majority of light and medium electric vehicles. However, these offer a slower charging speed and are only compatible with vehicles equipped with an on-board charger, which can affect the cost of the vehicle.

2

DC fast charging stations (DCFC) – Level 3

DC fast chargers (DCFCs) represent the fastest charging stations currently available on the market.

Unlike level 2 charging stations, the conversion of alternating current to direct current is carried out inside the charging station, eliminating the need for an on-board charger in the vehicle.

A DC charging station comprises: an electrical cabinet containing a rectifier, as well as one or more control boxes (distributors). The cabinet can be installed remotely from the distributors, which reduces the footprint and offers greater flexibility in site layout (e.g., service stations, rest areas).

The power outputs offered range from 25 kW to 350 kW, enabling much faster battery charging. However, this high power requires more in-depth electrical planning to ensure grid capacity and power supply stability.

DC fast chargers offer several advantages: reduced charging time and lower vehicle costs, as they do not require an onboard charger. However, they also have some drawbacks, as the acquisition cost is higher and the energy demand is greater, which can influence the cost of electricity (connection power).

Table 3-1 below presents some examples of BRCCs currently offered on the market.

Table 3-1: Example of BRCC currently available on the market

Settings	ABB		Kempower	ChargePoint	Siemens
Model	HVC-150	HVC-360	Express Plus	C801P120	SiCharge UC 150
DC Power (kW)	150	200-360	200	150	150
Input voltage (Vca)	480/600	480	480	480	480/600
Dimension of the electrical cabinet (mm)	H: 2030	H: 2180	H: 2191	H: 2195	H: 2210
	L: 1170	L: 1170	L: 1039	L: 650	L: 1092
	P: 770	P: 770	P: 998	P: 841	P: 991

* Note that, in a cable charging context, the determining factor will be the maximum power capacity that the vehicle can accept during charging.

ERS technology (“Electric Road Systems”)

1

Mobile or stationary charging via induction

Inductive charging allows energy to be transferred to a vehicle's battery without direct connection or physical contact. The driver simply positions the vehicle near the power source for charging to begin automatically.

This technology makes it possible to transform a parking space or garage into a charging station without a physical connection¹⁴.

In a vehicle fleet context, the absence of manual intervention (such as connecting the cable) represents a significant operational gain, reducing the risks associated with forgetting to recharge, which can have major consequences on operations.

One of the major advantages of this technology lies in dynamic inductive charging, which allows the vehicle to be recharged while in motion. In this case, induction coils embedded in the road surface generate an electromagnetic field that is captured by receivers installed under the vehicle, thus transferring energy to the battery.¹⁵ This approach could reduce, or even eliminate, the need for stops dedicated to static charging.

However, several technical and institutional challenges still limit the deployment of this technology:

High installation costs;

¹ Dependence on the will of the owners or operators of road infrastructure, generally governmental in Canada and particularly in Quebec (i.e. Ministry of Transport and Sustainable Mobility);

¹ Low transfer power observed in current pilot projects, hindering its adoption for heavy vehicles;

¹ Reputational risks for the politician, associated with performances deemed insufficient.

Furthermore, a working group on electric road systems, conducted in collaboration with the French Ministry of Transport, raised several points of concern regarding mobile or stationary inductive charging. These observations mainly relate to the still insufficient technological maturity, the limited energy efficiency in the context of e-bike transport, the durability risks associated with integrating coils into asphalt pavements, the high copper consumption, and the large surface area required for the receiving coils, which are difficult to reconcile with the geometry of road tractors, whose tolerance margin with regard to the lateral positioning of vehicles remains very small.¹⁶

¹⁴ Practical guide, “Understanding charging options for heavy-duty electric vehicles”. Lion Electric, March 2024.

¹⁵ HH Wu, A. Gilchrist, K. Sealy, P. Israelsen and J. Muhs, “A review on inductive charging for electric vehicles,” 2011 *IEEE International Electric Machines & Drives Conference* (IEMDC), Niagara Falls, ON, Canada, 2011, pp. 143-147, doi: 10.1109/IEMDC.2011.5994820.

¹⁶ Electric Road System (ERS), “Technical Solutions, Potential and Obstacles”, Working Group #2, Ministry responsible for Transport, July 2021.

2

Mobile charging via overhead line

Mobile charging via overhead lines is based on an "electric road" concept, in which the vehicle is directly connected to overhead lines linked to a traction power station. The vehicle is equipped with a pantograph (or other type of connector) that allows it to connect to the overhead lines to recharge its battery while simultaneously powering the propulsion system. The operation of trams clearly illustrates this principle of dynamic charging via overhead lines. This technology, characterized by high power transfer, presents significant potential for the electrification of long-distance heavy trucks. Its technological maturity, already demonstrated in urban transport systems since the late 19th century, makes it a theoretically applicable option today.

To be compatible with this system, a light rail vehicle (LRV) must be equipped not only with a pantograph to connect to the power line, but also with an electric motor and a battery to operate when the overhead power lines are unavailable. This grid dependence, however, limits the LRV's freedom of movement, as journeys remain contingent on the availability of charging infrastructure. Nevertheless, depending on the capacity of the onboard batteries, it is not necessary for the overhead lines to cover the entire route, which could facilitate the gradual deployment of the technology and reduce obstacles to its adoption.

Studies suggest that a network of catenaries installed at intervals of approximately 100 kilometers would allow for efficient operation¹⁷.

In Europe, several pilot projects and feasibility studies are underway to assess the efficiency and economic viability of this type of charging for trucks transporting goods.

However, the volume of vehicles on road segments must be sufficiently high to justify the installation and investment in an overhead contact line (OCL) network.¹⁸ According to a British study cited in Lion Electric's * *Understanding Charging Options for Heavy-Duty Electric Vehicles**, the cost of installing an OCL network is estimated at approximately US\$1.5 million per kilometer (or over US\$2 million per mile). Although this technology does not involve any direct intrusion into the road surface and can be deployed without altering it, its implementation remains dependent on the public authorities responsible for road infrastructure, which, in Canada and particularly in Quebec, are primarily governmental (i.e., the Ministry of Transport and Sustainable Mobility).

Finally, the installation of catenaries could hinder air access for emergency services, requiring prior coordination with the relevant authorities to assess operational feasibility and ensure the safety of interventions.

3

Mobile charging by conduction

Mobile charging by conduction allows vehicles to be powered while driving, thanks to conductive rails or strips embedded in the road surface. This system enables vehicles to drive continuously while charging their batteries, eliminating the need for dedicated charging stops. This technology is similar to overhead line charging, except that the energy transfer occurs along the ground rather than via overhead power lines.



Credit: Edison International

Figure 3-1: Vehicles and overhead line charging for a pilot project in California

¹⁷ "Climate Friendly Road Freight FactSheet", Siemens, nd

¹⁸ Practical guide, "Understanding charging options for heavy-duty electric vehicles". Lion Electric, March 2024.

Implementing such a system would require installing a power supply track in the road surface. A parallel can be drawn with the Montreal metro, whose operation relies on a traction rail positioned close to the running rails, ensuring a continuous connection to the electrical grid.

It is estimated that this technology could offer a higher charging power than the two other electric road systems (ERS) mentioned above, namely induction and catenary. However, its implementation and use raise safety issues, including the risks of electrocution, problems of adhesion or stability for light vehicles, as well as reliability constraints in winter conditions, particularly in a Canadian climatic context.¹⁹



3.1.2 Comparative approach and prioritizations

Table 3-2 below, adapted from the guide *Understanding Charging Options for Heavy-Duty Electric Vehicles*

Published by Lion Electric, it presents a comparative analysis of the main charging technologies. It illustrates the different options considered, their charging speed and relative cost, as well as their ease of implementation, which depends on the number of stakeholders to be involved, the nature of the work required and the ownership status of the sites.

Table 3-2: Charging options for heavy vehicles

	Charging speed	Costs	Management of stakeholders
AC Charger – Level 2	Slow	\$	Simple
BRCC – Level 3	Slow to Fast	\$\$	Simple
Induction	Slow	\$\$\$	Complex
Catenary	Fast	\$\$\$\$\$	Complex
Conduction	Fast	\$\$\$\$	Complex

¹⁹ Electric Road System (ERS), “Technical Solutions, Potentials and Barriers”, Working Group #2, Ministry of Transport, July 2021.

Conclusion on the state of "ERS" charging in Canada

In Canada, initiatives integrating charging technologies by induction, catenary or rail remain limited and are mostly in the research or demonstration phase.

1. Induction

The development of inductive charging for electric vehicles is still in the research and development stage. For example, the National Research Council of Canada (NRC) is currently exploring various wireless charging technologies²⁰, including induction, to assess their feasibility and effectiveness.

By comparison, in the United States, the City of Detroit became the first to offer a public road with inductive charging: a section of about 400 meters is already equipped with coils integrated into the pavement²¹.

2. Catenary

To date, there are no major public charging projects using overhead lines for electric trucks in Canada. However, this technology is used in some public transit systems, notably streetcars and trolleybuses.

In Europe, it is widely established in major cities that have maintained or reintroduced the tramway, and it remains inseparable from railway networks.

In Canada, unless installed on private sites, such as warehouses housing a full fleet of heavy vehicles for passenger or freight transport, this technology is rarely deployed in public spaces. It remains primarily suited to vehicles operating on fixed routes or closed circuits.

A relevant example in the country is that of [Vancouver's trolleybuses](#), which already use overhead catenaries for their electricity supply on the municipal network.

3. Rail/Conduction: Rail

charging technologies are primarily used in conventional rail systems. To date, [no significant projects have been identified for electric trucks in Canada](#).

These ERS charging technologies therefore remain in an early stage of development and require substantial infrastructure investments before large-scale deployment can be considered. For the time being, **charging stations represent the most viable and suitable solution for the Canadian context.**

Given the constant technological advances and the increasing number of pilot projects internationally, it would be relevant to assess the future applicability of these alternative technologies in subsequent phases of the project or new research and experimentation mandates.

²⁰ Report "Looking Ahead: Multiple Perspectives on Canada's Technological Future - 2030-35"

²¹ Michigan Department of Transportation. (nd). Wireless charging roadway. Michigan.gov. <https://www.michigan.gov/mdot/travel/mobility/initiatives/wireless-charging-roadway>



3.1.3 Summary review of energy supply

The Canadian electricity grid stands out for having one of the lowest emission levels in the world, with over 81% of production from low-emission or zero-emission sources²². Hydroelectric resources, which accounted for more than 61% of the electricity produced in Canada in 2021, constitute the main basis for the country's low-carbon energy production.

Energy production varies from province to province depending on available local resources. For example, Quebec produces 94% of its electricity from hydroelectric sources²³, while Ontario relies on a more diversified energy mix, including nuclear power, which accounts for approximately 55% of its production²⁴.

According to the report *Canada's Energy Future 2023 – Energy Supply and Demand to 2030*, electricity consumption is expected to increase significantly by 2030, possibly doubling, while emissions from generation continue to decline. By 2035, the Canadian grid could even become carbon-negative, particularly through the deployment of BECCS (bioenergy with carbon capture and storage) technologies.

²² Canada Energy Regulator, 2023. Canada's Energy Future in 2023 - Energy Supply and Demand to 2050.

²³ Canada Energy Regulator. (nd). Provincial and territorial energy profiles - Quebec. CER. <https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-quebec.html>

²⁴ Canada Energy Regulator. (nd). Provincial and territorial energy profiles - Ontario. CER. <https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-ontario.html>

3.2 RECOMMENDATIONS ON TECHNOLOGICAL CHOICE

Phase 1 of the Corridor project prioritizes the deployment of charging stations as the main solution, due to several practical, economic, and operational factors:

Cost and infrastructure: Charging stations are generally less expensive to install and maintain than induction, rail or catenary charging technologies, which require complex and costly infrastructure.

Flexibility and accessibility: Charging stations can be installed in a wide variety of strategic locations—such as industrial parks or rest areas—offering flexibility for truck operators. In contrast, induction or rail charging technologies require specific infrastructure and are less adaptable to diverse environments. The logistical and operational constraints mentioned by the carriers consulted demonstrate a strong preference for traditional charging stations.

Proven technology: Charging stations are a mature and standardized technology, supported by international standards such as SAE Combo and CHAdeMO. While alternative technologies (induction, overhead lines, rail) are undergoing promising testing, they remain in the development phase in Canada and their adoption depends heavily on government support, particularly from the Ministries of Transportation and Highway Infrastructure, at both the federal and provincial levels.

Charging time: DC fast chargers allow for significant charging in a short time, a crucial advantage for trucks operating on tight schedules. Other technologies, unless deployed over long distances or at high frequency, do not provide the same range-to-charging-time ratio, reducing their operational efficiency.

Government support: Charging station deployment projects often benefit from strong institutional support through subsidies and public investment programs. For example, the Quebec government has invested over \$1.9 million in the deployment of public charging infrastructure.

In summary, fast charging stations installed on motorway sites represent the most practical, economical and immediately available solution to support an exploratory phase of the deployment of charging for electric heavy trucks.

3.3 OUTLINE OF CURRENT INITIATIVES

Currently, the most widespread standard for public charging of electric trucks is the DC fast charging system, which typically offers a power output between 50 kW and 400 kW.

Table 3-3: Types of charging for electric trucks

CCS (Combined Charging System)	MCS (Megawatt Charging System)
<p>Fast charging allows for high-power charging ranging from 24 to 400 kW. A 50 kW CCS charger can recharge a 300 kWh truck battery in approximately six hours, which makes it suitable for overnight charging.</p> <p>A 350 kW CCS charger can charge the same truck in 60 to 90 minutes.</p>	<p>This technology is currently under development and is slated for commercial launch in Europe by 2025. Designed to deliver a maximum power output of 3.75 MW, this system will be used in road, maritime, and air transport. To recharge trucks, MCS charging stations are expected to provide 750 to 1000 kW of power, enabling a full charge in approximately 45 minutes for most long-haul electric trucks and providing them with up to 400 km of additional range.</p>

INITIATIVE #1

Greenlane I-15

UNITED STATES

[Greenlane](#), An initiative from a consortium formed by Daimler Truck North America, BlackRock, and NEXtera Energy has inaugurated its first charging center for heavy-duty electric vehicles (HGVs) in Colton, California. Located along the I-15 highway corridor, this center aims to meet the energy needs of HGVs and is open to both the public and commercial fleet operators.

Colton Centre has a diverse charging infrastructure, with over 41 chargers.

It includes 12 parking lanes equipped with 400 kW dual-port chargers and 29 lanes with 180 kW chargers, primarily intended for tractors operating without a semi-trailer. The site has been designed to facilitate future expansion: prefabricated cable trenches allow for the addition of new chargers at a low marginal cost, depending on demand growth.

Beyond its energy-related function, the Colton Centre emphasizes driver comfort and safety. It offers access to a lounge, dining options, restrooms, free Wi-Fi, and customer support. Enhanced security measures are also in place, including on-site security personnel, a camera system, and secure access control.



Credit: The EV Report

²⁵ See the MCS initiative led by the European consortium [MILENCE](#).

This installation represents the first step in a large-scale vision to create a comprehensive EV charging network along the I-15 corridor. New sites are already planned in Long Beach, Barstow and Baker, California, at intervals of approximately 60 to 90 miles (100 km to 150 km) to support long-distance electric transportation.

The Greenlane project received a US\$15 million grant from the South Coast Air Quality Management District's Carl Moyer Zero-Emission Infrastructure Program, illustrating the critical role of public funding in the deployment of large-scale charging infrastructure.

Finally, Greenlane relies on in-depth traffic flow analysis and proprietary telematics data from multiple sources to define an electrified corridor strategy. This approach makes it possible to identify optimal locations based on the frequency of heavy vehicle travel and the routes most suitable for electrification.

INITIATIVE #2

Rhine-Alpine Corridor — Germany

BP Pulse. BP, a subsidiary of the energy group and an operator in the field of charging for electric vehicles, has announced the deployment of its very first public charging corridor for electric trucks.

The project comprises eight dedicated charging stations, equipped with high-speed charging points, strategically located along the Rhine- Alpine corridor, one of Europe's busiest road freight routes . The first six sites, already operational, feature 300 kW DC fast chargers specifically designed for electric trucks. Two new sites will be added to this network within the next six months, further strengthening the corridor's connectivity.



The Rhine-Alpine corridor links the main North Sea ports (in Belgium and the Netherlands) to the Mediterranean port of Genoa, Italy, via a road network of approximately 1,300 km. This route represents a major asset for the European continent as it connects port, industrial and intermodal areas that are essential to the continental supply chain.

Beyond deploying charging stations, BP also aims to develop an integrated network of mobility hubs along major European logistics corridors. These hubs will offer a range of complementary energy options, including traditional fuels, to support operators in a gradual transition to zero-emission solutions.

The corridor's charging sites are designed to offer optimal comfort to carriers: they have secure and well-lit rest areas , toilets, showers and catering areas, allowing drivers to enjoy their break while charging their vehicle²⁷.

²⁶ <https://www.drivegreenlane.com/locations/>

²⁷ BP. (January 2023). BP pulse builds Europe's first public charging corridor for electric trucks along major logistics route. BP Global. <https://www.bp.com/en/global/corporate/news-and-insights/press-releases/bp-pulse-build-europes-first-public-charging-corridor-for-electric-trucks-along-major-logistics-route.html>

INITIATIVE #3**Coalition I-10****UNITED STATES**

Smart Freight Centre, a global non-profit organization dedicated to climate action in the freight industry, has launched the I-10 Coalition, a partnership bringing together various shippers and transportation companies to accelerate the deployment of heavy-duty electric vehicles. This initiative unites several major international players, including DHL, DB Schenker, Maersk, Microsoft, and PepsiCo, who will test long-haul electric transport operations along the I-10 corridor connecting Los Angeles, California, and El Paso, Texas, in the United States.



Credit: Terawatt Infrastructure

The coalition seeks to demonstrate the potential for emissions reduction in commercial vehicle fleets, while accelerating the deployment of long-haul electric vehicles (EVs) and promoting cost parity with conventional vehicles. By identifying key lessons learned and structuring an operational ecosystem around electric trucking, this pilot project aims to attract new carriers and shippers to begin their transition to electric, while also incentivizing technology providers to accelerate the development of charging solutions for electric transportation.

The coalition members rely on six of Terawatt Infrastructure's charging hubs located along the I-10 corridor. Each of these sites is equipped with Megawatt Charging System (MCS) and features advanced security measures to protect vehicles, cargo, and equipment.²⁸

The charging stations are spaced approximately 240 km (150 miles) apart, a distance appropriate for the average range of electric trucks currently available on the market. They are also located within one mile of highway exits to optimize accessibility, and their size varies from 4 to 100 acres, depending on the location and anticipated traffic.²⁹

A key example of this initiative is the Rancho Dominguez facility, located near the port of Long Beach, California. This site will include a total of 20 DC fast-charging stations, offering a total capacity of 7 MW, enough to charge up to 125 trucks per day. Terawatt's reservation system and site management approach ensure reliable and continuous charging, thanks to a charging management system, a dedicated technical team, 24/7 customer support, and on-site parts and maintenance management, thus improving grid reliability.³⁰

An interesting feature of this project is the number of stakeholders involved. The simultaneous participation of multiple shipping and freight companies ensures effective use of the corridor, while also allowing for the collection of concrete usage data and feedback. The coalition also benefits from substantial government support: in partnership with the New Mexico Department of Transportation (NMDOT), Coalition 1-10 was selected to receive US\$63.8 million through the U.S. Department of Transportation's Charge and Fuel Infrastructure (CFI) grant program.³¹

²⁸ <https://www.terawattinfrastructure.com/blog/i-10-ev-charging-coalition-adds-ch-robinson-dhl-electrolux-and-ikea>

²⁹ <https://www.aztechcouncil.org/i-10-to-become-first-electric-corridor-network-of-electric-heavy-duty-charging-centers/>

³⁰ <https://www.terawattinfrastructure.com/blog/terawatt-opens-its-first-medium--and-heavy-duty-ev-charging-site-in-california>

³¹ <https://www.terawattinfrastructure.com/blog/terawatt-infrastructure-awarded-63-8-million-federal-ev-charging-grant>

4. FEASIBILITY ANALYSIS (VEHICLES COMPONENT)

Given the ecological and economic benefits associated with the decarbonization of this transport segment, it appears essential to examine now the conditions favorable to the conversion of the heavy truck segment towards electrification, as well as the appropriate pendular charging methods to meet the autonomy constraints over medium and long distances.

Adopting electric heavy trucks is proving to be more complex than adopting individual electric cars.

It raises several technical and operational challenges, particularly in terms of battery autonomy, capacity and weight, charging logistics, as well as considerable initial investments, which must be rigorously planned to ensure long-term profitability.

The integration of an electric truck fleet must therefore be carried out gradually. As presented in section 3, the electric heavy vehicle market already offers a diversity of models suited to various applications, making it possible to adapt the technology to different operating profiles.

The [Rechargeable Fleet project, led by the Innovative Vehicle Institute \(IVI\)](#) and published in 2024, made it **possible** to identify the **most profitable and easiest road and heavy vehicle profiles** to electrify, as well as the **winning conditions** to ensure their operational performance.

The project analyses were carried out using real geomatics data collected from 60 trucks belonging to 20 Quebec transport companies, totaling more than 800,000 kilometres of journeys and covering various activities.

This IVI report makes 6 overarching recommendations aimed at facilitating the transition to electric trucks:

Target routes of 200 km per day.*

Return to the terminal every evening.*

Operate on a single shift.

Target vehicles with dry gearboxes and no accessories.

Prefer journeys at moderate speeds.

To transport light loads, i.e. 20,000 lb or less for a class 8 tractor.

***Note :** these two recommendations are difficult to integrate into the context of the present project, due to its purpose as a long-distance road corridor.

Table 4-1, shown on the following page, lists the different models of heavy-duty electric vehicles currently available in Canada.

Table 4-1: Example of vehicle models available on the market

Manufacturer	BYD	Peterbilt	Volvo	Nikola	Freightliner
Model	8TT	579EV	VNR Electric	Tre BEV	eCascadia
Weight (kg)	37,194	37,195	37,195	22,453	37,195
Range (km)	241 – 322	320	282 – 343	531	249 – 370
Nominal battery capacity (kWh)	422 – 563	564	375 – 565	733	194 – 291
Charging time (80% battery life)	N / A	60 to 90 min at 260 kW	60 to 90 min at 250 kW	1 hour at 350 kW	N / A
Price ³²	\$463,000 - \$550,000	\$540,000	\$604,163 - \$677,327	N / A	N / A

4.1 PROPOSED ROUTE

As part of the Quebec City-Toronto road corridor project, a route linking Quebec City to Toronto was established. This route, developed in collaboration with Attrix, corresponds to a typical route used by fleet operators for freight transport. The empirical approach described in section 2.2 was used to assess its logistical and energy potential.

From this route, several strategic sites were selected to assess the feasibility of installing charging stations. These sites were chosen according to four criteria: their geographical location along the main road, the distance between sites (set between 60 and 150 kilometers), the configuration of the area, and the availability of space on the sites to accommodate charging stations and heavy vehicles.

This distance range was chosen to meet current technological conditions and satisfy the charging needs of a typical truck, without exceeding the critical threshold of average range.

The range of an electric truck varies depending on several factors, including battery capacity, load weight, truck model, and driving conditions. Generally, electric truck manufacturers advertise ranges of between 200 and 450 kilometers per full charge.³³ Analyses conducted as part of this project, along with the literature review and surveys carried out in Quebec and Ontario, confirm that **the actual observed range of electric trucks is between 160 and 300 km**, depending on operating conditions.

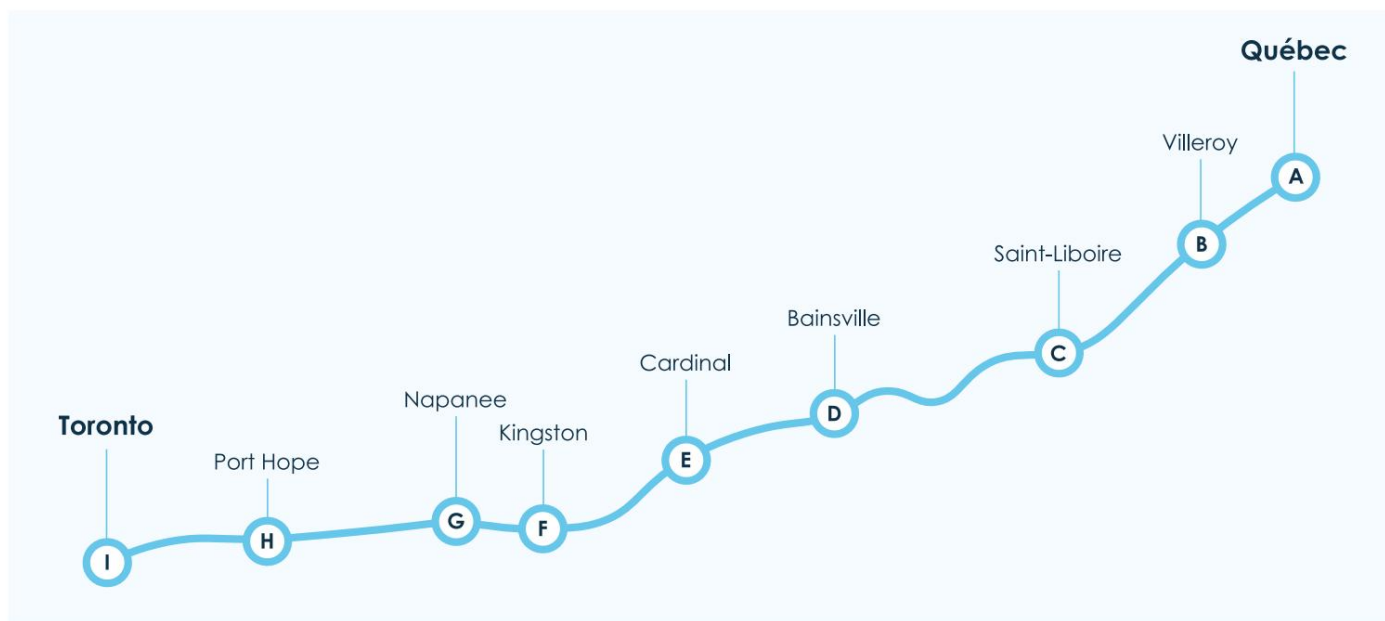
Furthermore, it is essential to incorporate an operational safety margin, taking into account, in particular, increased energy consumption in winter or extreme conditions. Therefore, the final route has been designed with resilience in mind, featuring strategically spaced and accessible charging points.

³² Prices are indicative only and based mostly on information available in the "Zero-Emission Medium- and Heavy-Duty Vehicle" guide. Compiled by Clean Energy Canada and CALSART, May 2024.

³³ Electric truck demonstration project in Quebec, Rechargeable Heavy Truck Fleet, IVI. November 2024. Available: <https://flotterechargeable.ca/wp-content/uploads/2024/11/rapport-ivi-flotterechargeable-web1.pdf>

Figure 4-1 provides an overview of the route and proposed charging site locations for this Quebec City-Toronto corridor project. It should be noted that a truck will not necessarily have to stop at every site to recharge, but redundancy is planned in case of breakdowns or more challenging conditions.

Figure 4-1: Overview of the route and proposed location of charging sites



In addition, Table 4-2 presents the distances separating the different charging sites identified along the route.

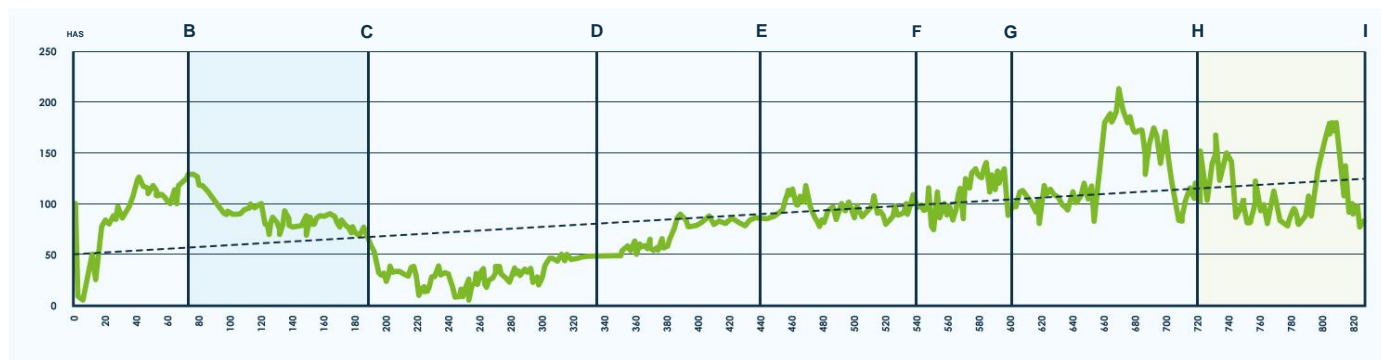
Table 4-2: Additional information on proposed charging sites

Site of recharge	Description	Distance from the previous charging station	Distance cumulative (km)
<small>HAS</small>	Quebec City	-	0
B	Villeroy	73.8	73.8
C	Saint-Liboire	115.5	189.3
D	Bainsville	146.1	335.4
E	Cardinal	104.4	439.8
F	Kingston	99.8	539.6
G	Napanee	61.5	601.1
H	Port Hope	118.8	719.9
I	Toronto	107.0	826.9

In addition to the distance between charging points, it is essential to consider the topographic profile of the route. This aspect is particularly important when assessing the feasibility of a fully electric journey, since the vehicle's energy consumption varies significantly depending on the road's gradient.

Figure 4 2 below illustrates the elevation profile of the road along the corridor, which reaches a high point of 214.7 meters in the Napanee – Port Hope section.

Figure 4-2: Elevations and slopes of the route



From Quebec City to Toronto, the route has an average gradient of 0.008%. The Port Hope - Toronto segment is distinguished by a more demanding topography, characterized by pronounced elevation changes, while the Villeroy – Saint-Liboire segment represents the least demanding portion of the route.

These variations in slope and terrain directly influence the energy consumption of heavy electric vehicles, and therefore their charging needs. The final route and the selection of charging sites were thus established taking into account both the distance to be covered and the elevation profile.

NOTE

The journey to the east proves to be more energy-intensive than the one to the west, due to topographical conditions and driving dynamics; it was therefore chosen as the reference scenario for the models.

4.2 RESULTS

Once the preliminary route was confirmed, a feasibility analysis of the route was carried out based on different operational assumptions, called modeling scenarios.

This section details the methodology used, the assumptions made, and the empirical results obtained to confirm the feasibility of the Quebec-Toronto corridor under several operating conditions representative of the market.

4.2.1 METHODOLOGY

The feasibility analysis is based on a multi-criteria modeling of the proposed route, integrating both internal factors (vehicle characteristics, range, payload, etc.) and external factors (topography, temperature, road conditions, etc.).

The objective of this approach is to assess the actual capacity of a heavy vehicle to complete the defined route, based on specific technological and environmental parameters.

The following methodological steps were carried out to complete this analysis:

1. Route Modeling

The route was segmented into more than 7,500 points, spaced approximately 100 meters apart. These points allow the gradient and elevation of the route to be characterized based on the difference in altitude between each point and the next.

2. Consolidation of modeling assumptions

A market study was conducted to identify and validate the assumptions to be integrated into the modeling, including vehicle parameters, the characteristics of the proposed chargers and the average charging time.

3. Development of operational scenarios

Several scenarios were developed to simulate different operating conditions and assess their impact on the energy feasibility of the route. These scenarios, detailed in Table 4.3, take into account variables such as temperature, cargo weight, vehicle technical specifications, charging speed, and the frequency of charging stops.

4. Energy analysis

The modeling scenarios were then applied to the simulated route, in order to assess the energy consumption of each and to validate the feasibility of these scenarios.

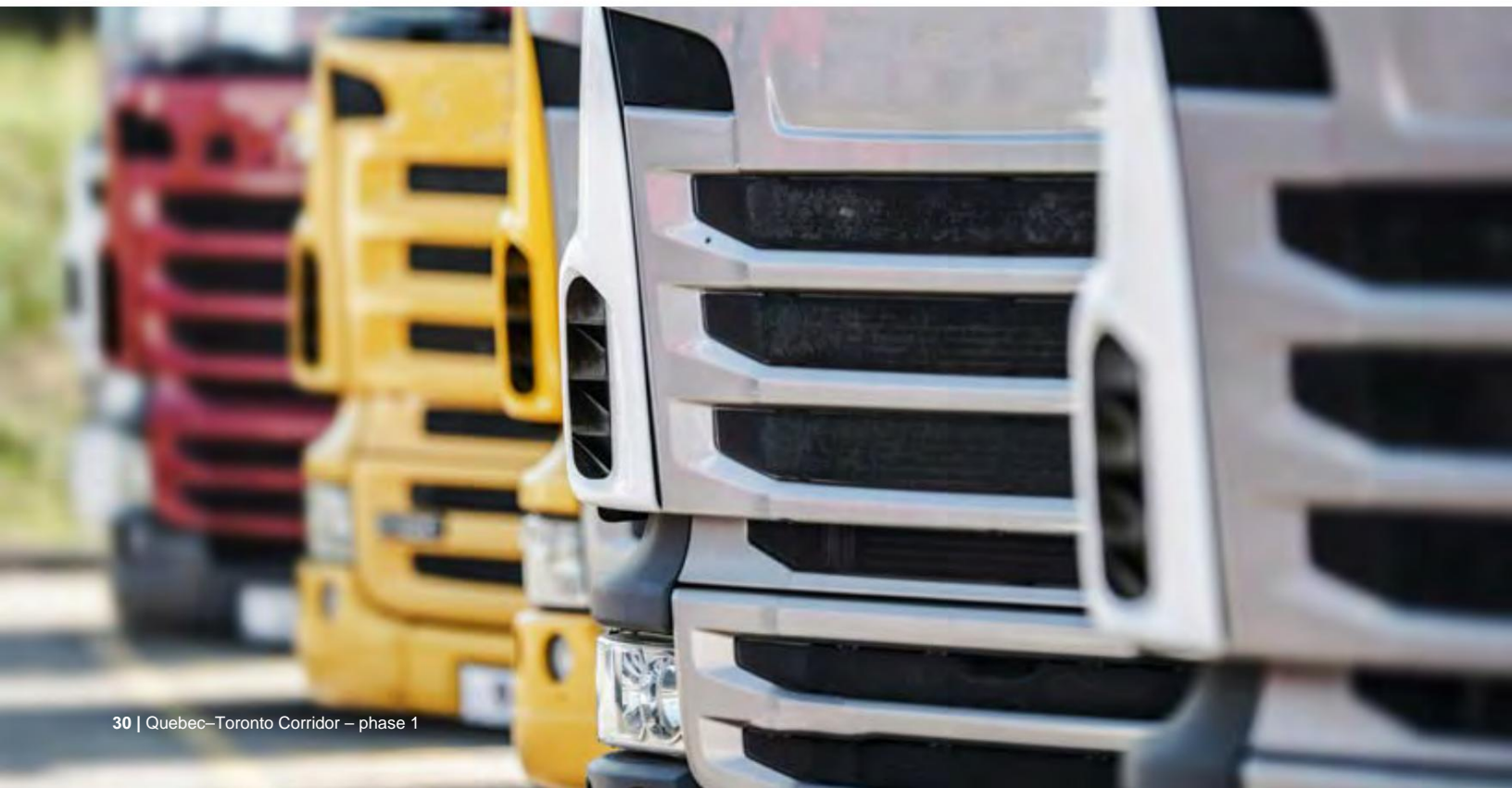


Table 4-3: Modeling Scenario and Conditions

Item	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8
Outside temperature	30°C	20°C	15°C	15°C	15°C	0°C	-10°C	-10°C
Tonnage	11 t.	11 t.	11 t.	22 t.	11 t.	11 t.	11 t.	22 t.
Nominal battery capacity	630 kWh	630 kWh	630 kWh	630 kWh	630 kWh	630 kWh	630 kWh	630 kWh
Usable capacity	504 kWh	504 kWh	504 kWh	504 kWh	504 kWh	504 kWh	504 kWh	504 kWh
Recommended technology	Battery-powered electric	Battery-powered electric	Battery-powered electric	Battery-powered electric	Battery-powered electric	Battery-powered electric	Battery-powered electric	Battery-powered electric
Driving speed	90 km/h	90 km/h	90 km/h	90 km/h	90 km/h	90 km/h	90 km/h	90 km/h
Power of the chargers	360 kW	360 kW	360 kW	360 kW*	360 kW	360 kW	360 kW	360 kW
Minimum recharge level	20%	20%	20%	20%	20%	20%	20%	20%
Specifics of the scenario	High temperature	.	.	Heavier load (tonnage)	*Limited recharge along the route	.	Cold temperature	Cold temperature and heavier load (tonnage)

 The color of the cell denotes the variables affected by the scenario.

Note : When the temperature drops below -10°C, the vehicle's energy consumption tends to stabilize, as the cabin heating system is already operating at full capacity. For this reason, no scenarios below -10°C have been modeled.

4.2.2 MODELING ASSUMPTIONS

In addition to the scenarios presented in Table 4.3, several assumptions were defined to frame the analysis. These concern the characteristics of the vehicle, the parameters of the charging infrastructure, and the operational conditions associated with their use.

Table 4-4: Modeling Assumptions

Item	Value
VEHICLES	
Vehicle weight when empty	11,000 kg
Maximum cargo capacity	26,000 kg
Nominal battery capacity	630 kWh
Buffer charge state	20%
CHARGERS	
Charging power	360 kW
Charging efficiency	90% (*)
Charger/Vehicle Ratio	1
OPERATIONS	
Driving speed	90 km/h
Recharge	The operator fully recharges the vehicle's battery each time it stops.

(*) Charging was modeled as follows: when the state of charge (SOC) is below 40%, the charging power is approximately 185 kW. Between 40% and 70%, the power reaches 290 kW, a limit generally imposed by the vehicle's system. Above 70%, the charging power gradually decreases to stabilize at 145 kW.

4.2.3 EMPIRICAL RESULTS

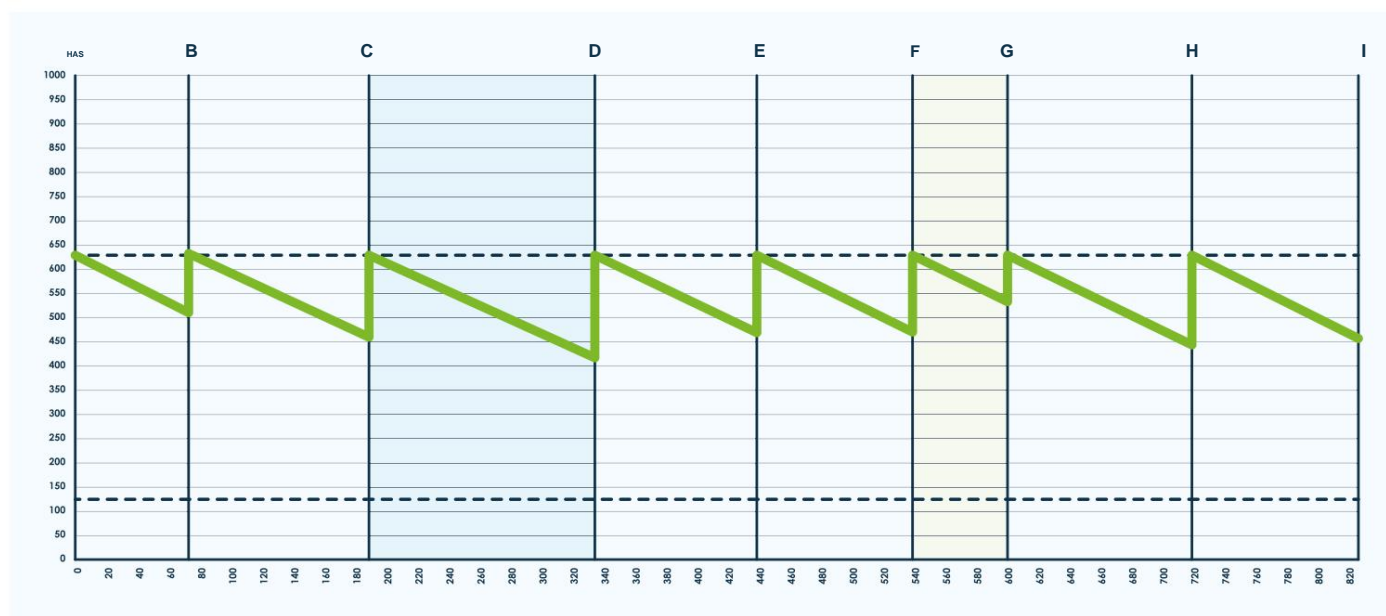
Applying the different modeling scenarios to the proposed route yielded concrete results regarding the feasibility of the journey, the energy required to complete the journey, and the required operating and recharging times.

According to the results of the feasibility study, **all the simulated scenarios make it possible to complete the Quebec - Toronto route in its entirety.**

Figure 4-3 illustrates the evolution of the state of charge (SOC) of a heavy vehicle traveling along the route, according to the conditions and parameters of scenario 1. It shows that a combination of the gradient and the length of the segments directly influences the variation in the battery's energy level. The Saint-Liboire-Bainsville section, 146 km long (the longest of the route), is therefore the so-called "critical" section, requiring the most significant recharging thereafter.

This segment reduces the load level to 67% of the vehicle's nominal capacity, representing the minimum point observed for an operator traveling the route under the conditions defined by scenario 1.

Figure 4-3: Battery charge state according to scenario 1



Similarly, Figure 4-4 illustrates the evolution of the state of charge (SOC) of a class 8 vehicle according to the conditions and parameters of scenario 5. This scenario is distinguished from the others by a reduced charging frequency, favouring fewer charging sites where a stop is made in order to optimize the total travel time.

The Saint-Liboire-Bainsville-Cardinal section is identified as the critical segment of this route. Due to its length and topography, it causes the battery level to drop to up to 45% of the nominal capacity, leaving approximately 244 kWh remaining.

Comparing figures 4-3 and 4-4, it appears that scenario 5 offers no energy redundancy.

By stopping at each charging point, the vehicle has enough charge to skip a charging station if necessary. Conversely, scenario 5 does not allow for this possibility: vehicles following this model would not be able to reach the next charging points if needed or in an unforeseen event.

Figure 4-4: Battery charge status according to scenario 5



Table 4-5 presents the minimum load state recorded for each simulated scenario. In all cases, except for scenario 5, this critical point is reached at Bainsville. Scenario 5 stands out by reaching its minimum threshold at Cardinal.

Table 4-5: Minimum load state for the scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8
Minimum charge state	67%	69%	69%	62%	45%	66%	64%	57%

The results relating to energy requirements vary depending on the specific conditions of each scenario. Figure 4.5 illustrates the average energy consumption (in kWh/km) observed on the different segments of the route, depending on the modeling scenarios.

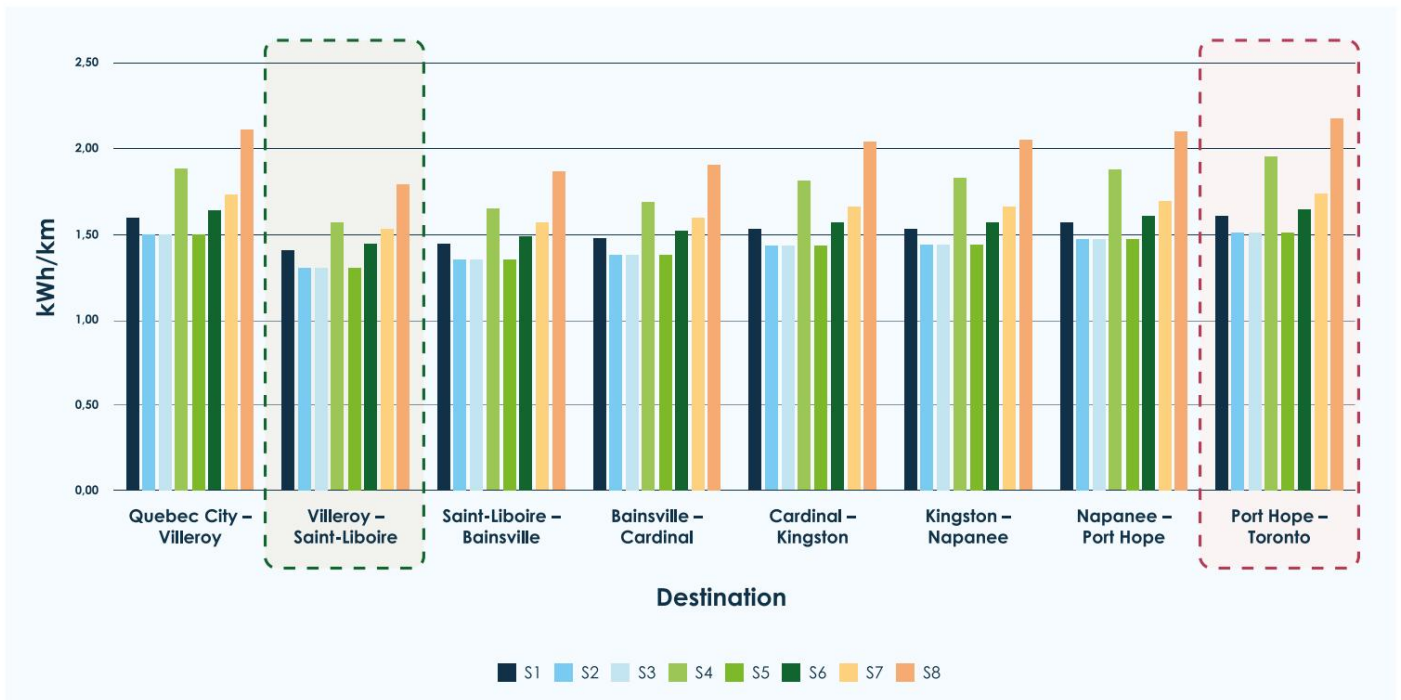
The Villeroy-Saint-Liboire segment stands out for its superior energy efficiency, directly correlated with the topographic profile shown in Figure 4.2, confirming that slope is a key external factor influencing energy consumption. Conversely, the Port Hope-Toronto segment exhibits the highest average energy consumption, also attributable to its steeper average slope.

A comparative analysis highlights a significant increase in energy consumption between these two sections:

- For scenarios 4 and 8, where the influential parameter is vehicle tonnage, consumption increases by 22% to 25% between Villeroy-Saint-Liboire and Port Hope-Toronto.
- For scenarios 1, 2, 3, 5, 6 and 7, where temperature is the main influencing variable, the average increase is around 15%.

This difference highlights the significant impact of cargo weight on energy demand, particularly in steeply inclined segments or those with significant elevation changes.

Figure 4-5: Average energy consumption according to section



Finally, it is relevant to analyze the total operating time required to complete the proposed route, according to the different simulated scenarios. On average, for scenarios with an 11-ton load, the total travel time should take 12 hours.

For comparison, a diesel truck covers the same 827 km route in approximately 9 hours and 30 minutes, including mandatory and operational stops (breaks, safety checks, etc.) totaling nearly an hour. If this hour is used for charging, the electric truck would require between 11% and 27% more time to complete the journey. This time variation is primarily attributable to charging time, which is directly dependent on the amount of energy consumed on each segment of the route.

The analysis assumes that the vehicle is fully recharged at each charging station stop. The longest charging times are observed in scenario 8 (cold temperature conditions and increased charging) and scenario 4 (additional charging). Conversely, the shortest charging times are observed in scenario 5, which includes a longer final segment with no charging planned at the end of the journey.



Table 4-6: Operating time based on scenarios

Scenario	Departure time	Arrival time	Operating time (Hours)	Charging time (Hour) *
S1	09:00:00	21:02:53	12.2	3.0
S2	09:00:00	20:52:54	11.9	2.8
S3	09:00:00	20:52:54	11.9	2.8
S4	09:00:00	21:31:54	12.6	3.5
S5	09:00:00	20:20:54	11.5	2.3
S6	09:00:00	21:05:54	12.2	3.1
S7	09:00:00	21:16:54	12.4	3.2
S8	09:00:00	21:56:54	13.1	3.9

* To be combined with the driver's regular stops



4.3 SITE CHARACTERISTICS

Once the feasibility analysis of the route has been completed, it is necessary to examine the potential charging sites and the characteristics they should have.

Opportunity and feasibility analyses have helped to refine the key success factors for deploying a charging offer at certain strategic sites in the Corridor.

The selection of these sites is based on an analysis of attributes likely to promote a positive experience for road operators and encourage them to regularly use motorway rest areas – referred to here as intrinsic qualities.

The assessment also takes into account the reasons for stopping and the incentive factors that could encourage charging point operators (CPOs) to deploy charging infrastructure there, i.e. the extrinsic qualities.

Table 4-7: Analysis criteria for selecting charging sites during deployment

INTRINSIC QUALITIES	
Accessibility and visibility	The sites should be easily accessible and well signposted from the motorway. Site accessibility should not pose a barrier to use.
Number and diversity of services	A well-equipped area with several amenities for resting and/or refueling during stops. (See section 3.3, which brings together some current initiatives)
Accessibility and availability of supplies	Charging infrastructure compatible with different types of vehicles for this segment, arranged in such a way as to limit the change in habits of road operators.
Safety and comfort	A secure, well-lit, and possibly monitored environment (cameras).
Enhanced appeal and experience	Comfortable facilities for drivers (rest areas, toilets, relaxation areas, etc.).
EXTRINSIC QUALITIES	
Energy capacity	Availability/adaptation of electrical infrastructure possible to meet the energy needs of chargers.
Connectivity	Internet connection available for optimal use of the charging infrastructure and efficient demand management.

In Quebec, as in the rest of Canada, truck parking in public places, service stations, rest areas or roadside stops is governed by legal provisions and logistical and spatial constraints, including those provided for in the Highway Traffic Act and the Highway Safety Code.

During project implementation, charging stations must be positioned safely, respecting minimum distances between vehicles to allow easy access and prevent collisions, while maintaining clear access for maneuvering and emergency vehicles. Sites must also include separate parking areas for electric trucks to avoid congesting charging stations for passenger cars and ensure efficient use of the facilities.

5. CONCLUSION

This analysis has highlighted the main levers to prioritize in order to optimize the deployment of a charging infrastructure adapted to electric trucks in the Quebec and Canadian context.

Based on the results of the feasibility analysis, it is possible to state that an electric heavy rail transit system between Quebec City and Toronto is technically feasible. Using currently available technologies, such a route can be accomplished by scheduling strategic stops at dedicated charging sites along the corridor. These stops will, however, introduce an additional time constraint, which will need to be optimized to remain competitive with conventional transportation. Integrating charging periods into operators' mandatory rest periods represents an effective solution for reducing downtime and operating costs.

Analysis of the current context and existing infrastructure highlights the lack of accessible charging stations for freight trucks. Despite the implementation of pilot projects, it remains essential to develop a public or private-shared charging infrastructure to overcome barriers to adoption and stimulate the transition to electrification. Charging sites must be designed to be safe and functional, taking into account truck maneuverability, emergency vehicle access, and smooth operational flow.

The additional facilities (rest areas, restrooms, catering) will help transform these refueling areas into true service hubs tailored to the needs of haulers. The accessibility of these sites will require careful consideration of equipment compatibility, infrastructure layout, and adherence to the established practices of road transport operators, in order to ensure a smooth, safe transition adapted to the realities of heavy transport.

In short, the project's success will depend on effective coordination of technological, human, and regulatory aspects. Adopting high standards for safety, connectivity, and comfort, combined with rigorous space planning and adherence to legal frameworks, will enable the sector to meet its current and future needs.

Quebec and Canada will thus be able not only to accelerate the energy transition of freight transport, but also to position themselves as leaders in the development of heavy-duty charging corridors that are safe, accessible and attractive to all road transport stakeholders.

Finally, the financial evaluation of the transition to electric freight transport, as well as the associated business models, will need to be studied by

Propulsion Québec and WSP in subsequent phases of the project



propulsion
Québec