



The Road to Scale:

Laying the Groundwork for Minimum Viable Corridors

A QUALITATIVE SYNTHESIS OF
STAKEHOLDER PERSPECTIVES
ON HYDROGEN FOR HEAVY-DUTY
TRUCKING IN CANADA

AUGUST 2026

The Road to Scale:

Laying the Groundwork for Minimum Viable Corridors

A QUALITATIVE SYNTHESIS OF STAKEHOLDER PERSPECTIVES
ON HYDROGEN FOR HEAVY-DUTY TRUCKING IN CANADA

AUGUST 2026

To cite this document:

Horb, E., Cunningham, Z. and Redick, Z. (2026). The Road to Scale: Laying the Groundwork for a Minimum Viable Corridor. Transition Accelerator Reports

Version: 1

Distribution: Transition Accelerator reports are available online at transitionaccelerator.ca

Disclaimer: The opinions expressed in this publication are the authors' alone.

Copyright ©2026 by the Transition Accelerator. All rights reserved. No part of this publication may be reproduced in any manner whatsoever without written permission except in the case of brief passages that may be quoted in critical articles and reviews.

Media Inquiries: For media inquiries, requests or other information, contact communications@transitionaccelerator.ca

Mailing Address: The Transition Accelerator, 2600, 144 – 4th Ave SW, Calgary AB T2P 3N4

Authors

Erin Horb, Calgary Region Hydrogen Hub Corridor Manager, The Transition Accelerator

Zachary Cunningham, Calgary Region Hydrogen Hub Lead, The Transition Accelerator

Zachary Reddick, Low Carbon Fuels Analyst, The Transition Accelerator

Contributors

Canadian Hydrogen Association (CHA)

David Billedeau, President and Chief Executive Officer

Nicolas Hilario, Vice President, Operations and Member Engagement

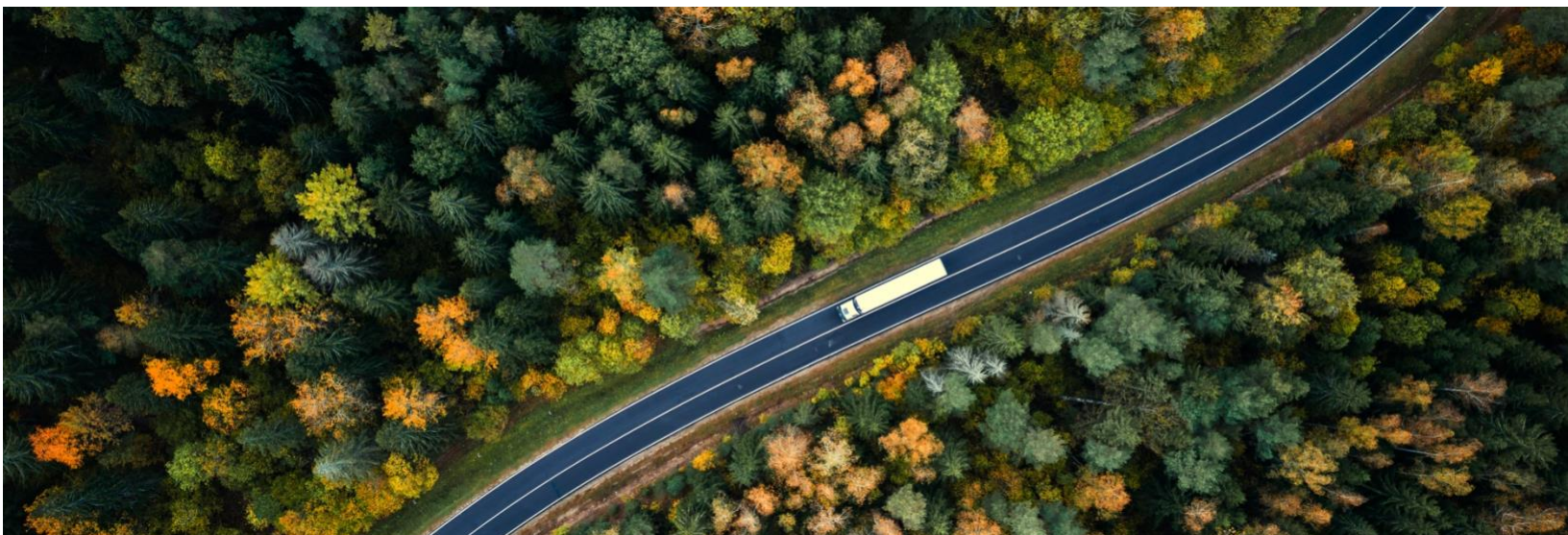
Maike Althaus, Vice President, Government Relations and Public Affairs

Atlantic Hydrogen Alliance (AHA)

Derek Estabrook, Executive Director

Acknowledgements

We would like to thank Mark Lea-Wilson and Dr. David Layzell for their thought leadership and vision in developing the original concept of the *Minimum Viable Corridor* for hydrogen heavy-duty trucking. We are also grateful to David Billedeau, Nicolas Hilario and Maike Althaus of the Canadian Hydrogen Association, and to Derek Estabrook of the Atlantic Hydrogen Alliance, for connecting us with their member networks. Their outreach enabled key interviews that provided the core content for this work. We also thank all those who generously shared their time and insights in these interviews. We spoke to more than 50 key actors across Canada, representing the full hydrogen value chain for heavy-duty transportation.



About Us



The Canadian Hydrogen Association (CHA) is a national, non-profit association comprising of industry, academia, research agencies and end-users focused on advancing the use of clean hydrogen and hydrogen technologies to help create a prosperous net-zero world.



The Atlantic Hydrogen Alliance (AHA) is a non-profit industry association working to advance a thriving low-carbon hydrogen sector in Atlantic Canada.



The Transition Accelerator exists to support Canada's transition to a net-zero future while solving societal challenges. The Transition Accelerator works with innovative groups to create visions of what a socially and economically desirable net zero future will look like and build out transition pathways that will enable Canada to get there. The Accelerator's role is that of an enabler, facilitator, and force multiplier that forms coalitions to take steps down these pathways and get change moving on the ground.





Executive Summary

Hydrogen is a leading option for decarbonizing heavy-duty long-haul trucking, offering the driving range, rapid refuelling, and cold-weather performance that the sector demands. However, hydrogen trucking corridors are more expensive than current, well-developed and essentially risk-free diesel corridors, a competitive challenge also faced by battery electric heavy-duty vehicles, and the elimination of Canada's consumer-facing carbon tax removed a tool for predictably narrowing that cost gap. Understanding the conditions that must be in place before the private sector adopts hydrogen at scale remains a critical and useful exercise.

Working in partnership with the Canadian Hydrogen Association (CHA) and the Atlantic Hydrogen Alliance (AHA), this report presents findings from direct engagement with more than 50 stakeholders across the hydrogen heavy-duty transportation value chain in Canada, conducted between late 2025 and early 2026. Participants spanned hydrogen suppliers, vehicle OEMs, industrial fleet operators, and municipal fleet managers across multiple provinces. Feedback is synthesized through the lens of the Transition Accelerator's Minimum Viable Corridor (MVC) Framework, which identifies the minimum conditions under which each link in the value chain can participate on a commercially sustainable basis, beyond pilots and without ongoing subsidy dependence.

What Stakeholders Told Us

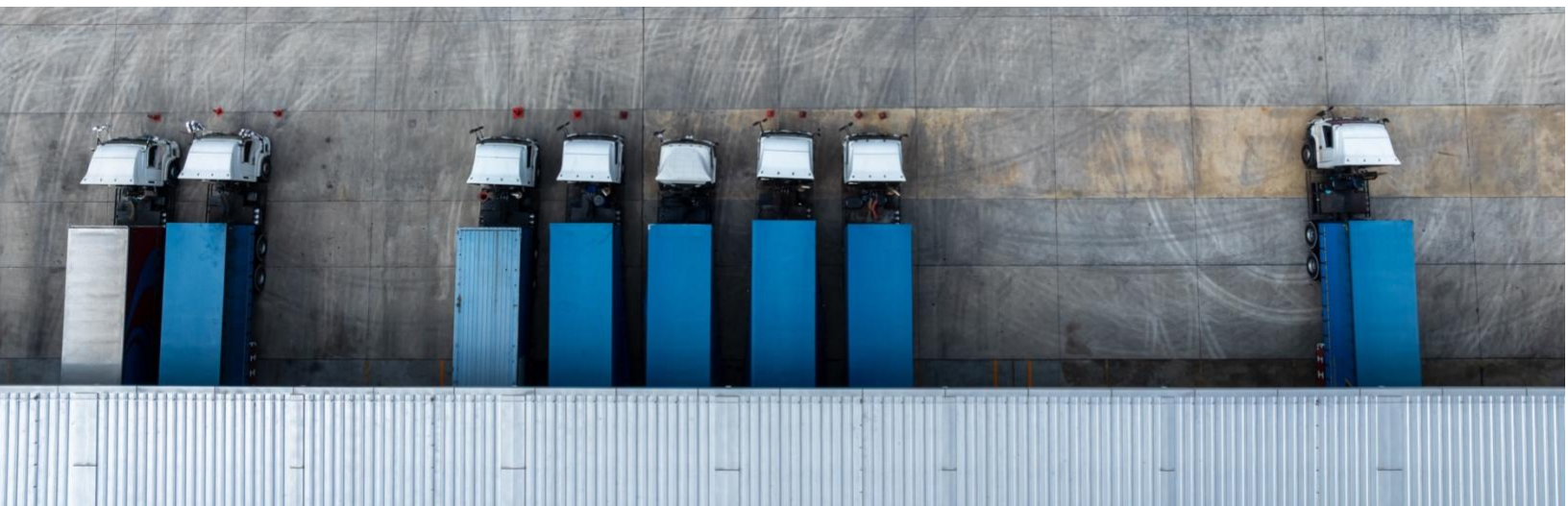
Hydrogen suppliers cannot justify permanent mobility refuelling infrastructure investment without long-term offtake commitments from end-users, with supplier stakeholders indicating that 5 to 20 years of offtake are required to support new fuelling station development. High capital costs, administratively complex federal investment tax credits, and inconsistent provincial permitting also exacerbate commercial deployment. Mobile fuelling units and scalable onsite hydrogen production and dispensing systems were identified as a nearer-term solution where permanent infrastructure cannot yet be economically justified, although smaller scale systems may have a higher per-unit cost of hydrogen. It was also noted that while large industrial scale production may have a low cost of hydrogen at the plant gate, the end cost of delivered hydrogen may be substantially higher based on the distance of the end user from the production location and the transportation method used.

Industrial fleet operators face a cost gap that is currently prohibitive. Hydrogen fuel cell trucks cost three to four times the price of a diesel equivalent, with no established resale market and no replacement for the now-closed federal iMHZEV purchase incentive. The principal operational concern is fuel availability. If hydrogen is not reliably available when and where trucks need to refuel, there is an unacceptable risk of vehicle downtime. This is a fundamental constraint for any fleet considering hydrogen beyond a controlled pilot.

Interest across the value chain is real. Progress is achievable in the near term, and it is worth pursuing now to set the stage for a future corridor.

Municipal fleets expressed greater institutional motivation to explore hydrogen, driven by internal emissions reduction commitments, but face comparable cost barriers and the same critical dependence on fuel availability. Municipalities piloting hydrogen vehicles have had to source their own supply and build their own fuelling infrastructure, a burden well beyond what a pilot program would typically require, and one that many municipalities do not have the internal capacity to handle.

Vehicle OEMs identified insufficient market demand as the central challenge, driven by high fuel and vehicle costs, eroding policy incentives, and a broad freight sector downturn that has extended fleet replacement cycles. The withdrawal of U.S. EPA and CARB regulatory pressure has introduced further uncertainty into Canadian market planning, given the integrated nature of North American vehicle markets.



Synthesis

These findings point to a feedback loop sustained by five interconnected factors: high fuel and vehicle costs; insufficient fuelling infrastructure; policy uncertainty and the loss of key incentive programs; interprovincial regulatory inconsistency; and pervasive information gaps across the value chain that leave stakeholders without the knowledge needed to make confident investment and procurement decisions. The conditions required for a Minimum Viable Corridor have not yet converged in any region in Canada.

No link in the value chain can move forward independently. Suppliers require committed demand before investing in infrastructure; fleets require reliable fuel and viable economics before committing to hydrogen vehicles; and OEMs require sufficient sales volume to bring costs down.

The Path Forward

The near-term opportunity lies in developing viable regional hydrogen hubs where local supply and aggregated demand can be established and become self-sustaining. Municipalities with predictable return-to-base routes and institutional decarbonization mandates are well-positioned to serve as demand anchors, complemented by industrial fleets where route predictability supports reliable demand forecasting. Hubs that achieve self-sustaining viability provide the foundation from which corridor-scale development can grow, but a corridor cannot be relied upon to generate that viability before the hubs themselves are functional.



Several of the most significant barriers identified through this engagement — regulatory inconsistency and information and workforce gaps — are coordination issues, not economic ones. They are solvable within the current environment, independent of the economics.

The following four recommended actions address conditions that can be improved within the current environment. They do not resolve the fundamental cost gap between hydrogen and diesel vehicles, but they target key structural barriers that are challenging for stakeholders in the hydrogen-heavy-duty mobility value chain.



Recommended actions:

1. **Leverage local hydrogen hubs to aggregate demand:** Regional and municipal governments, industry associations, fleet operators, OEMs and suppliers should collaborate through local hydrogen hubs to aggregate regional demand. Greater offtake visibility at the hub level provides the demand certainty that suppliers need to plan and commit to infrastructure investment, whether mobile fuelling units, onsite scalable production and dispensing systems, or permanent large-scale infrastructure. In the near term, this should prioritize the use of hydrogen that is available from a range of production pathways, including those with associated GHG emissions. Early-stage demand and infrastructure development are prerequisites for building a viable hydrogen ecosystem, enabling the sector's future transition toward zero-emission hydrogen production.
2. **Pursue interprovincial harmonization of hydrogen vehicle and infrastructure regulations:** Provincial governments should work together to align on hydrogen vehicle operation and fuelling regulations to reduce inconsistencies along interprovincial routes and markets.
3. **Propose a national framework for standardized hydrogen heavy-duty vehicle training:** OEMs, fleet operators, and safety organizations should collaborate to develop national training standards for hydrogen heavy-duty vehicle mechanics, drivers and first responders.
4. **Require data sharing from publicly funded hydrogen projects:** Provincial and federal governments should consistently require projects to share independently verifiable, non-proprietary data while protecting commercially sensitive information and intellectual property, ensuring that knowledge generated by early deployments benefits the sector as a whole.

Interest across the value chain is real. The cost gap between hydrogen and diesel will not close overnight, but the structural barriers documented in this report are not immovable. Progress on the conditions identified here is achievable in the near term, and it is worth pursuing now to set the stage for a future corridor.

Table of Contents

Executive Summary	iv
List of Figures	x
About The Transition Accelerator	xi
List of Abbreviations	xii
1 Introduction: Laying the Groundwork for Heavy-Duty Hydrogen Fleets	1
1.1 Heavy-Duty Road Fleets in Canada	1
1.2 Hydrogen as a Pathway to Lowering Emissions	2
1.3 Hydrogen Adoption in Heavy-Duty Fleets Today	3
1.4 Report Scope and Structure	6
2 Value Chain Approach and MVC Framework	7
2.1 The Hydrogen Value Chain for Heavy-Duty Trucking	7
2.2 The Minimum Viable Corridor (MVC) Framework	8
3 Approach and Engagement: Listening to the Ecosystem	10
4 Stakeholder Findings: Capturing the Challenges	11
4.1 Hydrogen Suppliers	12
Economic and Investment Challenges	13
Non-Economic Challenges	15
Summary	16
4.2 Hydrogen End-Users: Industrial Fleets	17
Economic and Investment Challenges	19
Non-Economic Challenges	20
Summary	22
4.3 Hydrogen End-Users: Municipal Fleets	23
Economic and Investment Challenges	24
Non-Economic Challenges	26
Summary	28
4.4 Hydrogen Vehicle OEMs	29
Economic and Investment Challenges	31
Non-Economic Challenges	32
Summary	34

5	From Feedback Loop to Viable Corridor	35
	The Central Challenge: A Self-Sustaining Feedback Loop	35
	Factors Driving the Feedback Loop	36
	What This Means for Corridor Development	37
	Near-Term Vehicle Pathways	38
	Looking Ahead.....	38
	Examples from Other Regions	38
6	Recommended Actions: Addressing Structural Needs.....	40
7	Conclusion: Paving the Path to Wider Adoption.....	45
	References.....	47

List of Figures

Figure 1 AMTA’s Alberta Zero-Emissions Truck Electrification Collaboration (AZETEC) 3

Figure 2 The hydrogen value chain for heavy-duty mobility..... 7

Figure 3 How the MVC approach fills the gap between the pilot phase
and commercial adoption 8

Figure 4 The hydrogen heavy-duty mobility ecosystem: Value-chain actors,
enabling conditions, and policy influence..... 36



About The Transition Accelerator

Our Objective

The energy transition is disrupting global power. The Transition Accelerator is here to help Canada win — **economically** and **geopolitically**.

Our Work

The Transition Accelerator drives projects, partnerships, and strategies to ensure Canada is competitive in a carbon-neutral world. We're harnessing the global shift towards clean growth to secure permanent jobs, abundant energy, and strong regional economies across the country.

We work with 300+ partner organizations to build out pathways to a prosperous low-carbon economy and avoid costly dead-ends along the way. By connecting systems-level thinking with real-world analysis, we're enabling a more affordable, competitive, and resilient future for all Canadians.

- 1 **UNDERSTAND** the system that is being transformed, including its strengths and weaknesses, and the technology, business model, and social innovations that are poised to disrupt the existing system by addressing one or more of its shortcomings.
- 2 **CODEVELOP** transformative visions and pathways in concert with key stakeholders and innovators drawn from industry, government, indigenous communities, academia, and other groups. This engagement process is informed by the insights gained in Stage 1.
- 3 **ANALYZE** and model the candidate pathways from Stage 2 to assess costs, benefits, trade-offs, public acceptability, barriers and bottlenecks. With these insights, the process then re-engages key players to revise the vision and pathway(s), so they are more credible, compelling and capable of achieving societal objectives that include major GHG emission reductions.
- 4 **ADVANCE** the most credible, compelling and capable transition pathways by informing innovation strategies, engaging partners and helping to launch consortia to take tangible steps along defined transition pathways.

For more information or interview opportunities please contact:

communications@transitionaccelerator.ca

List of Abbreviations

ABBREVIATION	DEFINITION
AMTA	Alberta Motor Transport Association
BEV	Battery Electric Vehicle
CAPEX	Capital Expenditure
CARB	California Air Resources Board
CIB	Canada Infrastructure Bank
CRN	Canadian Registration Number
CSA	Canadian Standards Association
EPA	Environmental Protection Agency (U.S.)
ESG	Environmental, Social, and Governance
FCEV	Fuel Cell Electric Vehicle
GHG	Greenhouse Gas
GVWR	Gross Vehicle Weight Rating
HDV	Heavy-Duty Vehicle
IEA	International Energy Agency
iMHZEV	Incentives for Medium- and Heavy-Duty Zero-Emission Vehicles
ITC	Investment Tax Credit
MVC	Minimum Viable Corridor
OEM	Original Equipment Manufacturer
OPEX	Operating Expenditure
TCO	Total Cost of Ownership
ZEV	Zero-Emission Vehicle

1 Introduction: Laying the Groundwork for Heavy-Duty Hydrogen Fleets

1.1 Heavy-Duty Road Fleets in Canada

Heavy-duty transportation can be broadly characterized as vehicles with a gross vehicle weight rating (GVRW) of 11,794 kg or greater, encompassing Class 7 (e.g., transit buses, garbage trucks) and Class 8 (e.g., semi-tractors, cement mixers). Heavy-duty fleets include privately owned fleets that support a range of commercial activities, including freight hauling and service delivery, as well as municipal-owned fleets that serve a variety of vocational uses.

Heavy-duty trucking forms the backbone of Canada's national supply chain, with trucks moving approximately 90% of all domestic freight shipments [1] across a vast and geographically demanding country. The sector is highly fragmented and intensely competitive, characterized by thin margins, long-haul routes, high asset utilization, and extreme winter operating conditions. Fleet operators consequently prioritize proven technologies and manage risk carefully, making the introduction of new fuel and vehicle systems particularly complex.



Heavy-duty trucking forms the backbone of Canada's national supply chain.

As of 2022, there were approximately 137,000 trucking businesses in Canada, of which around 84,000 operated without employees. This reflects the predominance of owner-operators and small for-hire carriers across the sector [2]. In the same year, Canada had nearly 595,000 registered Class 7 and Class 8 heavy-duty vehicles [3], with Class 8 trucks accounting for ~87% of this fleet [4]. Although the number of registered vehicles cannot be directly correlated with the number of trucking businesses, together these data illustrate the scale of Canada's heavy-duty trucking fleet and the highly decentralized structure of the industry, which is composed largely of owner-operators and small carriers rather than a small number of large carriers.

Municipal fleets include transit buses, transport trucks, and a range of specialized vocational vehicles (e.g., snowplows, dump trucks, refuse collection trucks) that support public works. These fleet vehicles are publicly owned assets operated by municipalities accountable to taxpayers. They operate on defined urban and regional routes and are subject to procurement processes and budget cycles that differ significantly from private fleet operations. Municipal fleet operators prioritize uninterrupted service delivery and defensible total cost of ownership, balanced with their progress on ESG targets and emission reductions. They must navigate public approval and council oversight when evaluating new vehicle technologies.

Municipal fleets are distributed across hundreds of municipalities nationwide, with fleet sizes ranging from a handful of vehicles in small rural communities to thousands of assets in major urban centres. The capacity to evaluate and adopt new vehicle technologies is generally concentrated among mid- to large-sized municipalities, although some smaller municipalities are also exploring zero-emission vehicles for their fleets. An important distinction between municipal fleet operators and commercial heavy-duty trucking is that the municipal fleet workforce is broadly unionized, and vehicle technology transitions must account for labour relations considerations alongside technical and financial factors.

Heavy-duty road vehicles are a significant and growing source of greenhouse gas emissions in Canada. In 2024, the transportation sector was Canada's second-largest source of GHG emissions, accounting for 22% of the national total [5]. Within the sector, heavy-duty freight trucks have been a primary driver of emissions growth, with emissions from this segment nearly doubling between 1990 and 2024. Based on the most recent data from Transport Canada, on-road freight vehicles account for 25% of total annual transportation emissions [6]. Unlike passenger vehicles, where electrification pathways are well established, heavy-duty applications involve demanding duty cycles, high payload requirements, extreme conditions, and often, refuelling infrastructure constraints. These characteristics make heavy-duty road transport one of the more difficult segments to decarbonize, and one where the choice of zero-emission technology must meet challenging operational demands.

1.2 Hydrogen as a Pathway to Lowering Emissions

Hydrogen can power a heavy-duty truck through more than one technology pathway. Hydrogen fuel cell electric vehicles (FCEVs) generate electricity onboard the truck by combining hydrogen and oxygen in a fuel cell stack to power an electric motor. FCEVs are commercially available today. Dual-fuel retrofit systems, which blend hydrogen with diesel for co-combustion in a single engine to displace a portion of diesel consumption, are also commercially available today. Hydrogen internal combustion engines, which burn hydrogen directly in a modified engine, remain under development and are not yet available for piloting. Heavy-duty vehicle on-road pilots in Canada to date have therefore used only hydrogen fuel cell and dual-fuel vehicle retrofits. This report focuses primarily on hydrogen fuel cell electric vehicles, the pathway that offers a zero-emission solution for heavy-duty applications. Dual fuel technology plays a complementary role, offering fleets an accessible entry point that reduces emissions today while helping build the demand base hydrogen needs to scale.



Photo courtesy: Cespira

Hydrogen is a compelling decarbonization pathway for heavy-duty fleets for several reasons rooted in the sector's operational demands. Unlike battery electric vehicles, which face significant payload penalties from battery weight and lengthy recharging times due to current battery technology, hydrogen fuel cell trucks can refuel in minutes, carry sufficient energy for long-haul routes without excessive weight penalties, and maintain performance in extreme cold weather, where battery efficiency drops significantly [7]. Hydrogen fuel cell electric heavy-duty vehicles are also well-suited to the power and torque demands of heavy freight operations, as they benefit from an electric powertrain. Electric motors deliver

instant torque that can outperform diesel equivalents on steep grades and heavy loads, without the vibration and power lag associated with internal combustion engines [8], [9], [10]. These advantages make hydrogen a credible, compelling, and capable zero-emission option for Canada's heavy-duty commercial transportation sector, where trucks must reliably perform across vast distances, in extreme winter weather, and through challenging terrain.

1.3 Hydrogen Adoption in Heavy-Duty Fleets Today

Among the hydrogen heavy-duty vehicle pilots and early deployments underway in Western Canada and the United States, several notable examples illustrate the range of activity currently taking place. The first such project was the Alberta Zero Emission Truck Electrification Collaboration (AZETEC), a first-of-its-kind, industry-led initiative with 16 collaborating partners spanning industry, academia, and government.

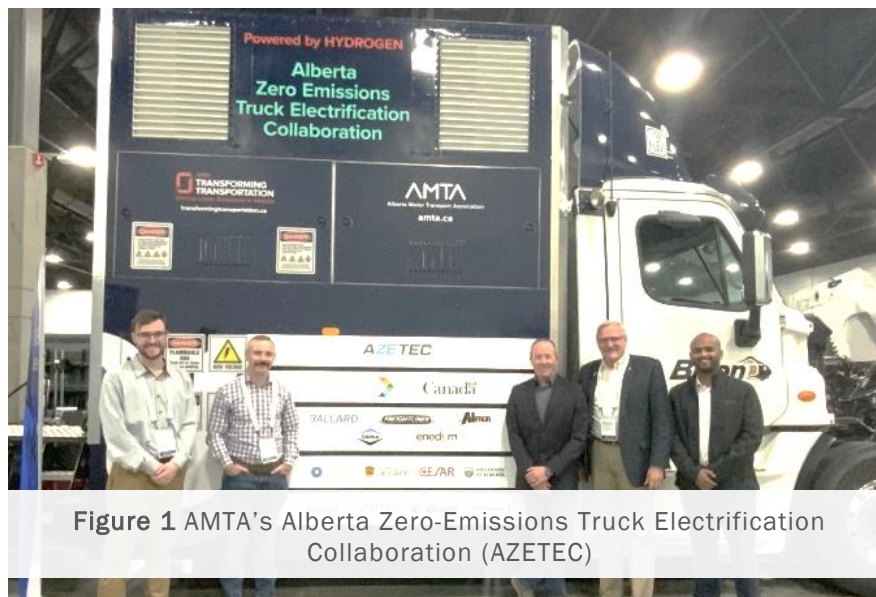


Figure 1 AMTA's Alberta Zero-Emissions Truck Electrification Collaboration (AZETEC)

At the time this project was conceived, no commercially available hydrogen fuel cell Class 8 trucks of the required size existed, so the project partners custom-designed and built two prototypes from the ground up. This multi-million dollar project represented one of the most ambitious early demonstrations of hydrogen fuel cell heavy-duty trucking in Canada [11], [12].

In British Columbia and Alberta, government-funded zero-emission truck testbed projects are underway through AMTA in the Lower Mainland and Edmonton regions, [13] and through Innovate BC in the Prince Rupert region [14]. These testbed trials include having transport companies integrate hydrogen trucks into real-world operating scenarios and existing routes.

Understanding the conditions that must exist before the private sector adopts hydrogen at scale remains a critical and useful exercise, and there is valuable preparatory work to be done today to ‘set the table’ for when conditions change.

In addition, HTEC has developed a commercial vehicle leasing program in the Lower Mainland market, enabling fleets to lease heavy-duty hydrogen fuel cell trucks and purchase hydrogen fuel [15]. In Alberta, the AMTA has been conducting on-road hydrogen truck demonstrations and trials for several years, working closely with local carriers. These trials have allowed a small number of participating carriers to test hydrogen trucks under their specific operating conditions, while also generating driver experience and vehicle performance data [16]. In California, publicly-funded port and freight demonstrations have deployed Class 8 hydrogen fuel cell trucks in drayage and

regional logistics operations [17]. In the transit sector, a fleet of 33 hydrogen buses operated by Foothill Transit in California from June 2023-December 2024 is North America’s largest fuel cell bus deployment to date. The results show that the fleet met key reliability and fuel efficiency targets, though challenges with high upfront capital costs, hydrogen fuel costs and infrastructure expenses were noted as barriers to wider deployment [18].

Together, these projects have collected early data and are beginning to generate operational evidence on the performance and capability of hydrogen fuel cell trucks in demanding heavy-duty applications. The number of fleets that have piloted hydrogen vehicles remains small, however, and participation has been largely confined to large companies with greater resources to trial early-stage new technology.

When considering the transition from pilots to at-scale adoption, the per-unit total cost of ownership (TCO) remains challenging for hydrogen vehicles, driven by high vehicle and fuel costs, uncertain servicing costs, and other factors associated with an immature value chain.

These cost pressures are not unique to hydrogen. Similar TCO challenges are present across all zero-emission heavy-duty vehicle technologies, reflecting the broader early-stage nature of the ZEV market. ZEVs, including hydrogen, also compete with well-developed, commercially mature diesel corridors that are effectively risk-free from an operator's perspective. The cost gap between hydrogen and diesel is now larger than in recent years, as several converging developments have significantly shifted the policy and market landscape.

The Canadian consumer-facing carbon tax was eliminated in early 2025, removing a key financial incentive that previously made the status quo more costly for fleet operators. In the U.S., the federal government moved to repeal California's Advanced Clean Trucks mandate in June 2025, removing one of the most significant regulatory drivers of heavy-duty ZEV adoption in North America [19]. Concurrently, the bankruptcies of hydrogen truck OEMs Hyzon in December 2024 [20] and Nikola in February 2025 [21] have raised major questions about the commercial readiness and supply chain stability of hydrogen vehicle platforms.

Broader macroeconomic pressures, including new trade tariffs and a global shift away from decarbonization toward energy supply security and affordability, have reshaped the trucking industry's operating environment. Together, these developments have changed fleet operators' motivation to transition to zero-emission vehicle (ZEV) platforms: the regulatory pressure that once made inaction costly has eased, diesel supply chains remain robust and low-risk, and the near-term commercial viability of hydrogen and other ZEV platforms is far less certain than it appeared only a few years ago. As a result, many fleet operators are pausing ESG-driven decarbonization initiatives to refocus on core business viability, with hydrogen adoption decisions either on hold or being evaluated primarily through the lens of cost, reliability, and risk.

Large-scale adoption of alternative heavy-duty ZEV platforms (e.g., **battery-electric or hydrogen fuel cell**) is not expected in the near term. Nonetheless, understanding the conditions that must exist before the private sector adopts hydrogen at scale remains a critical and useful exercise, and there is valuable preparatory work to be done today to 'set the table' for when conditions change.

1.4 Report Scope and Structure

This report presents findings from direct stakeholder engagement conducted across the hydrogen value chain in Canada, spanning hydrogen suppliers, vehicle OEMs, and potential industrial and municipal end-users. This engagement has been undertaken through the lens of the Minimum Viable Corridor Framework developed by the Transition Accelerator.

Findings are organized into two categories:

1. ***Economic and Investment Challenges***, which reflect stakeholder perspectives on cost, financial risk and investment viability currently, and in scaling beyond pilots.
2. ***Non-Economic Challenges***, which encompass knowledge gaps, policy and regulatory barriers, and fuel supply, technology and infrastructure constraints currently and in scaling beyond pilots.

Together, these inform a synthesized view of the factors shaping participation in the hydrogen mobility value chain in Canada and where near-term actions may be most impactful.

The report proceeds as follows:

Section 2 provides the value chain context and introduces the Minimum Viable Corridor Framework;

Section 3 outlines the methodology and stakeholder engagement process;

Section 4 presents findings across hydrogen suppliers, OEMs, and end-users;

Section 5 synthesizes key insights;

Section 6 presents recommended near-term actions; and

Section 7 contains concluding remarks.

2 Value Chain Approach and MVC Framework

2.1 The Hydrogen Value Chain for Heavy-Duty Trucking

A value chain describes the sequence of actors and activities required to deliver a product or service to an end-user [20]. This concept is especially important for emerging energy technologies such as hydrogen, where no single actor can create the conditions for market development alone. Each link depends on the others, and the overall value chain is constrained by its weakest link. Understanding the barriers and needs of each stakeholder group is therefore essential to advancing the value chain as a whole. The value chain examined in this analysis is shown in **Figure 2**.

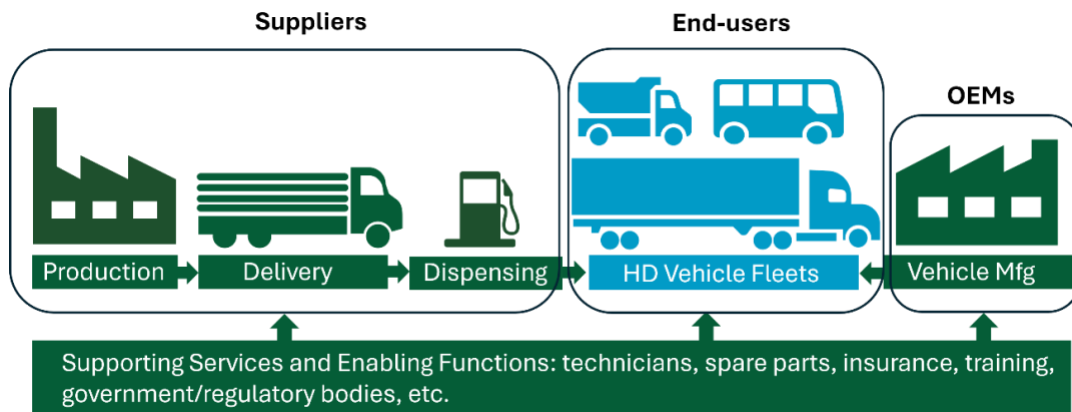


Figure 2 The hydrogen value chain for heavy-duty mobility

- **Suppliers** encompass the upstream and midstream activities required to deliver hydrogen to the point of use, spanning production, delivery, transport, and dispensing.
- **End-users** are the fleet operators who purchase hydrogen vehicles and fuel, and include private industrial transport carriers, vertically integrated retailers, and municipal fleets.
- **Original Equipment Manufacturers (OEMs)** design and produce the hydrogen vehicles that end-users procure and operate.

Supporting services form an enabling layer that overlaps with all the major value chain links. These services, including vehicle servicing by qualified technicians, access to spare parts, hydrogen fuel quality testing, insurance, safety protocols and training programs, are essential to the operational viability across the value chain.

2.2 The Minimum Viable Corridor (MVC) Framework

The MVC Framework developed by the Transition Accelerator was conceived to help identify the minimum conditions needed for hydrogen value-chain actors to commit to sustained commercial activity (beyond pilots).

The MVC Framework focuses on potential hydrogen corridors — defined regions or routes where supply, infrastructure, and demand are concentrated enough to support commercial operations. A Minimum Viable Corridor is the smallest economically self-sustaining version of such a corridor, in which each part of the value chain can operate without ongoing subsidies or pilot-level support. While the corridor concept is most naturally associated with long-haul trucking routes, municipal heavy-duty fleets can also play an important role in corridor development by providing anchor demand at a local hydrogen hub. These fleets do not travel along corridors in the traditional sense; instead, they operate on predictable routes and return to a central depot, making them well-suited to generating consistent fuel demand.

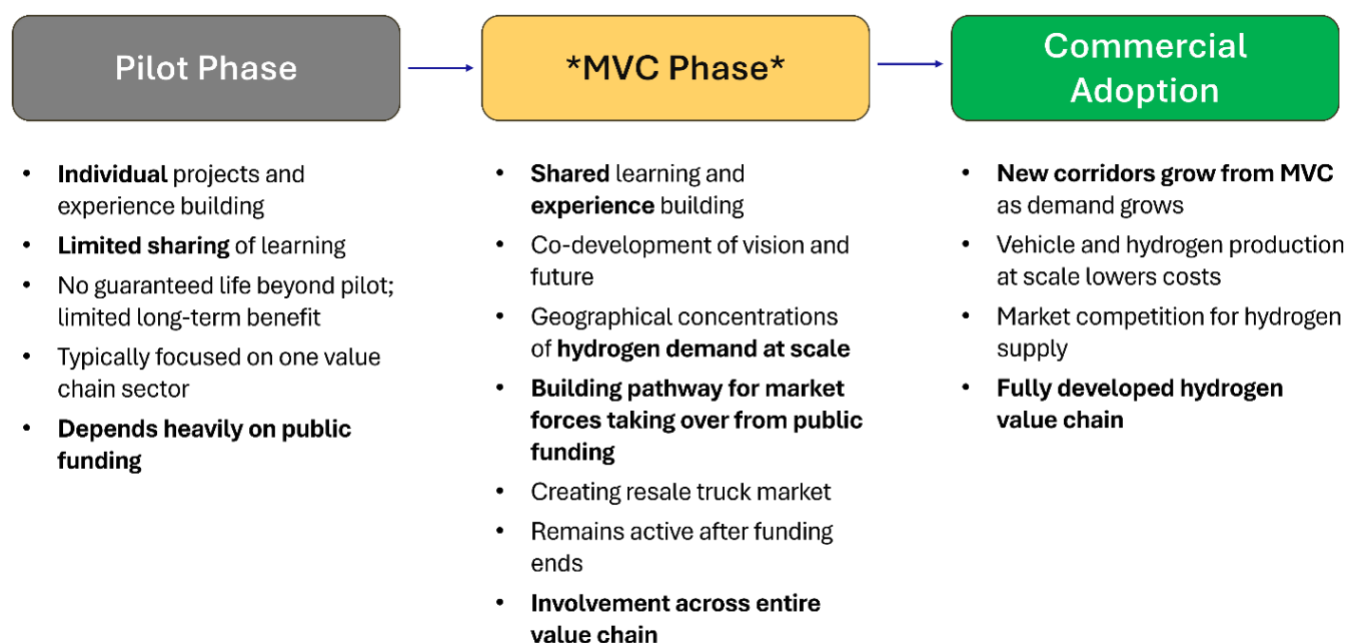


Figure 3 How the MVC approach fills the gap between the pilot phase and commercial adoption

The MVC Framework has two complementary components:

The **qualitative component** identifies the conditions that value-chain stakeholders indicate are needed for them to participate. These conditions include perceived risks, operational constraints, reliability (of vehicles, fuelling stations, maintenance, and servicing), infrastructure needs, policy support, and market signals. Cost and economic concerns are considered here as qualitative risk factors, reflecting stakeholder views on affordability, investment uncertainty, and financial exposure.

The **quantitative component** of this framework, which is outside the scope of this report, models the specific economic thresholds required for each stakeholder type to participate in a given transportation corridor. Although not presented here, the Transition Accelerator has previously conducted modelling work on the hydrogen heavy-duty transportation value chain. For example, this type of modelling would include ranges for station size along a corridor, the number of vehicles required to support viable operations, and the hydrogen cost thresholds that fleet operators can tolerate. Because these thresholds depend on the fleet composition and characteristics specific to each corridor, they vary from one corridor to the next.



Photo courtesy: DTI

3 Approach and Engagement: Listening to the Ecosystem

This report is based on a qualitative, exploratory research approach designed to capture real-world perspectives on challenges and barriers to hydrogen adoption in heavy-duty transportation. The objective was to gather insights from stakeholders that are directly engaged across the hydrogen value chain and to identify common themes, challenges, risks and enabling conditions.

Input was gathered through structured discussions with more than 50 stakeholders across Canada from October 2025 through January 2026, representing a diverse cross-section of the hydrogen ecosystem and multiple geographic regions. This engagement was made possible through partnerships with the **Canadian Hydrogen Association** and **Atlantic Hydrogen Alliance**.

Stakeholders were grouped into three primary categories, aligning with the links of the hydrogen value chain, as well as a fourth, cross-cutting group representing supporting services:

- **Hydrogen suppliers**, including organizations involved in hydrogen production, transport and delivery, and dispensing; a total of 19 organizations were engaged from this category.
- **End-users**, including industrial fleet operators and municipal fleets deploying or considering deploying hydrogen-powered HD vehicles; a total of 23 organizations were engaged from this category.
- **Vehicle manufacturers (OEMs)** involved in the development and commercialization of hydrogen-powered HD vehicles; a total of six organizations were engaged from this category.
- **Supporting services** that enable all links of the value chain to function; a total of seven organizations were engaged in this cross-cutting group.

Data Collection

Insights were collected through guided stakeholder discussions structured around a consistent set of core topics, including key challenges, operational considerations, and adoption barriers. This format allowed for flexibility for participants to highlight issues most relevant to their specific roles and experiences, supporting the identification of both anticipated and emergent themes.

4 Stakeholder Findings: Capturing the Challenges

This section of the report contains the detailed insights that were gathered during the engagement previously described in the methodology section of this report.

The *Economic and Investment Challenges* category captures stakeholder-identified cost and investment-related risks associated with their ability to participate in the hydrogen transportation value chain.

The *Non-Economic Challenges* category is further organized into the following subcategories:

- Policy and regulatory environment
- Fuel supply, technology and infrastructure
- Market capability and knowledge gaps

Together, these categories provide a structured representation of stakeholder perspectives on the key barriers and challenges influencing their ability to participate in the hydrogen value chain for heavy-duty transportation.

Photo courtesy: Hydra



4.1 Hydrogen Suppliers

What We Heard from Hydrogen Suppliers

Key Need: Secure return on invested capital through revenue certainty before capital commitment

Economic and Investment Challenges

- Absence of stable, long-term offtake commitment
- Low demand for hydrogen — insufficient volume to allow for cost recovery
- High CAPEX and OPEX for production equipment, fuelling infrastructure, and transport
- Canadian Investment Tax Credits (ITCs) for production projects are difficult to access
- Higher costs for businesses to operate in Canada as compared to the United States

Non-Economic Challenges

Policy and Regulatory Environment

- Inconsistent provincial permitting for fuelling infrastructure
- For imported pressurized equipment, difficult process to obtain Canadian Registration Numbers (CRN)
- Policy uncertainty around carbon pricing

Fuel Supply, Technology, and Infrastructure

- Supply chain exposure to tariff and trade disruption

Role in the value chain: Hydrogen suppliers produce, deliver, and dispense the fuel that enables hydrogen heavy-duty trucking. Their infrastructure underpins every other part of the ecosystem.

Key Need: Secure Return on Investment

Hydrogen suppliers identified secure return on invested capital as their fundamental requirement for participation in the hydrogen transportation value chain. Hydrogen production, compression, storage, and dispensing infrastructure all require significant upfront capital expenditures, and have long asset lives and high fixed operating costs. Suppliers require revenue certainty that does not currently exist before capital can be committed in the Canadian mobility hydrogen market.

Supply Effects on the Value Chain

Without a reliable and accessible fuel supply, fleet operators cannot commit to purchasing hydrogen vehicles and OEMs cannot justify expanding their product offerings.

Economic and Investment Challenges

The most significant and consistently cited barrier was the absence of stable, long-term offtake commitments from mobility end-users. Suppliers noted that hydrogen vehicle deployment to date has been limited to pilot projects which have not reached the scale required to generate fuel demand sufficient to recover infrastructure costs. Beyond volume, suppliers indicated that the time horizon of demand matters: pilot projects are inherently finite, and the long-term commitments needed to justify infrastructure investment, typically ranging from 5 to 20 years in line with the depreciation schedules of new fuelling facilities, have not materialized. The result is a feedback loop where infrastructure investment cannot be justified without committed demand, and committed demand is unlikely to materialize without infrastructure in place.

Hydrogen suppliers reported requiring offtake commitments from 5 to 20 years to invest in new fuelling infrastructure.

Mobile fuelling units and scalable onsite hydrogen production and dispensing systems were identified as a nearer-term solution where permanent large-scale infrastructure cannot yet be economically justified, although these smaller-scale systems may have a higher per-unit cost of hydrogen. It was also noted that while large industrial scale production may have a low cost of hydrogen at the plant gate, the end cost of delivered hydrogen to the user may be substantially higher based on the distance of the end user from the production location and the transportation method used.

One hydrogen supplier offered a perspective on the challenge of sequencing investments in the hydrogen transportation value chain: although hydrogen hubs represent a viable and commercially credible model, efforts to establish interprovincial corridors may be moving ahead before the foundational work of making local hubs financially self-sustaining has been completed. In this view, priority should instead be given to building profitable, well-functioning hydrogen hubs at the local level, establishing the demand concentration, operational experience, and business model viability needed to support broader corridor development over time. This sequencing argument has direct implications for how the MVC Framework should be applied: a viable local hub, anchored by committed fleet demand, may be the necessary precursor to a viable corridor, rather than its outcome.

Hydrogen suppliers described significant capital and operational costs that currently make it difficult to operate a profitable business in the mobility sector. Capital costs for production equipment, transport trailers, and fuelling stations were described as high relative to incumbent energy infrastructure, reflecting the specialized, purpose-built nature of the equipment. Several other factors, such as the cost of construction, electricity (in some provinces) and equipment, were noted as high in Canada. Taken together, these factors mean that the current cost of hydrogen for mobility in Canada is far above the goal of nearing diesel parity. Compounding this challenge is the difficulty suppliers face in accessing the Canadian Investment Tax Credits (ITCs), which were described as administratively complex. Suppliers noted, for example, that ITCs require third-party verification of carbon intensity, adding costs and procedural burdens. Furthermore, certain hydrogen production activities critical to mobility applications are explicitly excluded from ITC eligibility – notably liquefaction and compression equipment used to prepare hydrogen for offsite transport. Because these are core components of hydrogen distribution infrastructure for the mobility sector, their exclusion considerably limits the ITC's effectiveness as a derisking tool for hydrogen suppliers serving this market.

Non-Economic Challenges

Alongside the cost challenges outlined above, suppliers identified additional challenges in two areas: the Policy and Regulatory Environment and Fuel Supply, Technology and Infrastructure.

Policy and Regulatory Environment

Policy certainty was identified as a prerequisite for final investment decisions. Carbon pricing mechanisms and associated carbon credits have been material inputs to project financial models. The removal of the federal consumer-facing carbon tax and broader uncertainty around Canada's climate policy direction have introduced investment risk that was not previously present. One-time grants and ITCs provide some support but were seen as insufficient substitutes for durable policy frameworks.

Hydrogen suppliers directly involved in fuelling station development identified the permitting process for hydrogen fuelling stations as a challenge. In some cases, local and provincial authorities with jurisdiction have limited or no prior experience with hydrogen equipment, and the absence of established codes leaves both applicants and approving authorities in uncertain territory. Without an existing regulatory framework to reference, obtaining approvals can be difficult for all parties involved. Permitting requirements were described as inconsistent across provinces, with some provinces having more clearly defined processes than others. This inconsistency was seen as adding complexity for interprovincial operators who must manage different processes across multiple jurisdictions, and was linked to potential delays, additional costs, and a broader sense of regulatory uncertainty around fuelling infrastructure development.

Suppliers noted that certain types of pressure equipment used in hydrogen fuelling infrastructure, such as compressors, storage vessels, piping systems, valves, and fittings, require a Canadian Registration Number (CRN), which confirms that the design has been registered by the applicable provincial or territorial safety authority in accordance with relevant legislation, codes and standards. Suppliers using imported pressure equipment indicated that the process of obtaining the required CRNs can be administratively burdensome, noting that differences in approval processes across provinces create uncertainty about timelines and costs. Some suppliers suggested prioritizing Canadian-manufactured equipment where possible to reduce import-related challenges and support the growth of domestic manufacturing capacity.

Fuel Supply, Technology, and Infrastructure

Stakeholders also noted that equipment supply chains are increasingly exposed to tariffs and trade disruptions, adding to project risk. Electrolyzer costs have not decreased as projected, largely because deployment volumes have remained too low to achieve the economies of scale needed to lower costs. Together, these factors contribute to greater uncertainty and risk in capital cost projections.

Summary

Many hydrogen suppliers would like to participate in the heavy-duty transportation market, and several are already engaged in pilots and early-stage projects. The key barrier is not a lack of willingness but the absence of the economic conditions necessary to justify full-scale investment. Low and uncommitted demand, high capital and operational costs, difficult-to-access incentives, inconsistent permitting, and policy uncertainty combine to make the risk-return profile of mobility hydrogen supply unattractive under current conditions.

Photo courtesy: AMTA



4.2 Hydrogen End-Users: Industrial Fleets

What We Heard from Industrial Fleet End-Users

Key Need: Hydrogen vehicles that meet operational service requirements for payload, reliability and maintenance, at a total cost of ownership (TCO) that is commercially justifiable relative to diesel.

Economic and Investment Challenges

- High capital cost for hydrogen trucks; no current resale market
- High cost for hydrogen fuel
- Combined CAPEX and OPEX result in TCO that is not commercially viable under current conditions
- Federal iMHZEV vehicle rebate program has ended; no announced replacement
- No willingness for fleet operators or their customers to pay a “green premium”

Non-Economic Challenges

Knowledge Gaps

- Long-term vehicle performance data is insufficient to support confident TCO modelling
- Vehicle range under real-world Canadian conditions is not well established

Policy and Regulatory Environment

- Available hydrogen trucks are designed to haul U.S. weights that are significantly lower than Canadian regulated maximums
- Payload penalty from heavier system components reduces available cargo capacity
- Inconsistent provincial zero emission vehicle weight allowances complicate interprovincial route planning
- Recent policy reversals in Canada/U.S. have eroded the urgency for fleets to adopt zero emission vehicles, including hydrogen.

Fuel Supply, Technology, and Infrastructure

- Low hydrogen fuel availability is an unacceptable risk
- Commercially available FCEV truck options are limited
- Small pool of trained mechanics and technicians; no standardized safety training curriculum
- Vehicle and parts supply chains are exposed to tariffs, increasing the already high cost of equipment.

Industrial fleet operators represent a key demand anchor in the hydrogen heavy-duty trucking value chain. Their willingness to commit to hydrogen vehicles and fuel ultimately underwrites the entire value chain. The challenge is that industrial fleets operate in one of the most commercially demanding environments in the transportation sector — characterized by thin margins, high asset utilization, and continuous operations — leaving little room for risk. As a result, fleet operators today approach hydrogen much like any other vehicle purchase: a capital allocation decision evaluated against strict criteria of cost, reliability, and operational fit.

Key Need: Vehicles that Meet Service Requirements Without Compromising Economic Viability

The minimum condition for industrial fleet participation in the value chain at scale was highlighted as the ability to purchase hydrogen trucks that meet standard service needs in terms of payload, reliability, and maintenance requirements at a total cost of ownership that is commercially viable based on existing business models. Fleet stakeholders were clear that adoption decisions cannot be made based on environmental benefit alone.

Industrial Fleets Effect on the Value Chain

Industrial fleets ultimately drive the demand for vehicles and fuel that provides the commercial foundation needed by hydrogen suppliers and OEMs to invest in the value chain.

Importantly, fleet stakeholders stated that not all industrial fleets face the same adoption conditions. Transport companies, whose core business is the movement of goods, operate within the thin-margin, highly competitive environment described above where the cost premium of hydrogen vehicles is difficult to absorb without materially affecting business viability. In contrast, some fleet operators use trucks primarily to support a core business in another sector, such as retail, manufacturing, or resource extraction. In this case, the fleet is a part of their business, but not the core element, and hydrogen adoption may be evaluated

differently depending on their unique business models. These operators may have access to capital and revenue streams that may be able to support the use of alternative fuels such as hydrogen that are not available to pure-play transport companies.

Economic and Investment Challenges

The cost gap between hydrogen and diesel is the most immediate barrier for industrial fleets considering adopting hydrogen vehicles. Hydrogen fuel cell trucks currently cost three to four times the price of a diesel tractor equivalent, with no established resale market to offset costs at vehicle turnover. Hydrogen fuel was seen as prohibitively expensive with a generally opaque pricing market that makes it difficult for fleets to understand the cost of adoption. Together, these factors produce at best an incomplete and speculative TCO based only on upfront vehicle cost and an uncertain cost of fuel that industrial fleet stakeholders described as fundamentally non-viable for the commercial freight sector under current conditions and business models. It's worth noting that this cost challenge is not unique to hydrogen. Battery electric heavy-duty vehicles face comparable cost premiums relative to diesel equivalents, and the larger ZEV market for heavy-duty applications remains at an early and commercially immature stage. The TCO barrier is therefore a sector-wide challenge,

The absence of an established resale market for hydrogen heavy-duty vehicles compounds the TCO challenge. With diesel trucks, an established resale market allows fleet operators to recover residual value at vehicle turnover, partially offsetting the cost of asset replacement. No equivalent market exists for hydrogen trucks, for three main reasons:

- First, most hydrogen trucks currently operating in North America are part of pilot or demonstration projects, meaning total fleet numbers remain too small to generate the secondary-market activity needed for used-vehicle trading.
- Second, the geographic concentration of hydrogen fuelling infrastructure limits where a used hydrogen truck can operate practically, considerably narrowing the pool of potential buyers.
- Third, and perhaps most importantly, concerns about technology durability create substantial residual value uncertainty; prospective buyers face unresolved questions around the remaining life of the fuel cells and batteries, which carry high replacement costs today. Also, there are requirements around inspections and a finite service life for hydrogen storage tanks. Limited maintenance accessibility adds further risk because trained technicians are scarce, and parts availability is uncertain.

Together, these factors make it difficult to assign a credible resale value to hydrogen trucks at turnover.

Also mentioned was the discontinuation of the federal iMHZEV point-of-purchase rebate program, which offered up to \$200,000 per Class 8 hydrogen fuel cell electric truck. This rebate was seen as one of the few mechanisms that could have partially bridged the CAPEX gap, given that no replacement program had been announced. This incentive was stackable with provincial support, which was seen as a key additional funding source, and varied by province.

Industrial fleet stakeholders indicated that their customers currently have no appetite to pay a green premium for transporting their goods. Even customers who had shown early interest have retreated, citing the need to prioritize business survival within a difficult economic environment. The overall message was that industrial fleets are not in a position to absorb the high costs of transitioning to hydrogen (or any other zero-emission vehicle platform) under current market conditions.

Regarding insurance, fleet operators indicated that insuring one or two pilot hydrogen vehicles is not, or would not be, a significant barrier, particularly for larger, self-insured operators. However, scaling up the proportion of hydrogen vehicles in the fleet would increase risk exposure, primarily because of their elevated asset replacement value.

Non-Economic Challenges

Knowledge Gaps

Industrial fleets make vehicle procurement decisions based on well-understood performance and maintenance profiles built up over years of operational experience with diesel. Hydrogen trucks do not yet have that track record. Pilot projects provide some insight into reliability and maintenance requirements, but they operate vehicles under conditions unlikely to reflect the demands of a realistic full commercial service.

Long-term reliability, maintenance costs, and component service life remain insufficiently documented to support confident TCO projections, a gap that is material given that maintenance costs are a significant component of fleet operating economics. Vehicle ranges under Canadian real-world conditions, such as extreme winter weather, steep grades, and heavy payloads, remain insufficiently documented for confident route planning and operational feasibility assessments.

Policy and Regulatory Environment

Industrial fleet stakeholders identified hydrogen vehicle haul weights as an important limitation. Regulated maximum vehicle weights are determined by infrastructure protection requirements, vehicle configuration (including axle number and spacing), OEM weight ratings, tire specifications, and vehicle safety and engineering limits. Class 8 hydrogen fuel cell trucks commercially available today are engineered to U.S. federal standards, with a maximum gross vehicle weight of

37,195 kg (82,000 lb) [22]. Canadian weight limits permit significantly higher gross vehicle weights on many corridors, up to 63,500 kg (140,000 lb) in some configuration [23].

To illustrate the magnitude of this difference, a carrier switching from a truck engineered to Canadian limits to one engineered to U.S. standards would see available cargo capacity reduced by more than 40%, regardless of the regulated maximum weight permitted on a given route. For Canadian carriers that routinely transport heavy loads that approach the Canadian maximum weight, this payload reduction is not commercially feasible.

Where a truck built to U.S. weight standards is otherwise feasible for a carrier, a further constraint arises from the weight of zero-emission vehicle systems, including powertrain components and onboard energy storage. This additional system weight is not unique to hydrogen. Battery-electric heavy-duty vehicles incur significantly larger weight penalties due to the mass of their battery packs, making this an even more acute constraint for BEV platforms. Fuel cell powertrains, including onboard hydrogen storage, are heavier than equivalent diesel systems, thereby directly reducing available payload capacity within the gross vehicle weight limit that applies on a given route. Some provinces have introduced weight allowances for zero-emission vehicles specifically to offset this payload penalty. British Columbia, for example, provides an additional 1,000 kg weight allowance for hydrogen-powered commercial vehicles, with a corresponding increase in the maximum gross combination vehicle weight [24]. Alberta provides an additional 1,000 kg axle-weight allowance for alternative-fuel vehicles, including hydrogen, without raising the gross vehicle weight ceiling [25]. These different design choices produce meaningfully different outcomes for operators: a higher GVW ceiling expands what a vehicle can legally carry, while an axle weight allowance alone does not, since axle limits constrain how that weight can be distributed regardless of what the GVW ceiling permits. For fleets operating interprovincially, the absence of a consistent national framework means the weight accommodation for zero-emission trucks varies by jurisdiction, complicating cross-boundary route planning.

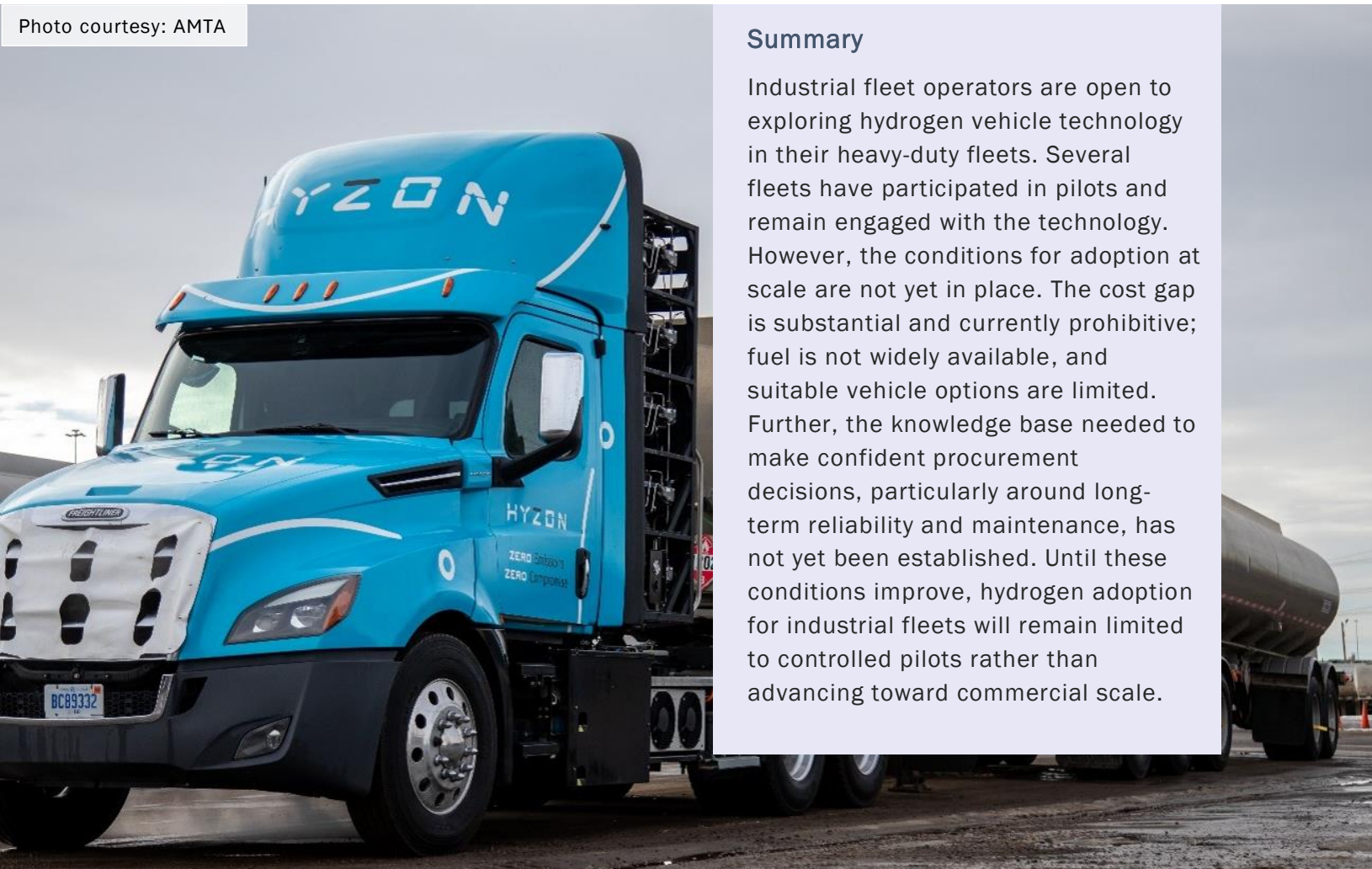
Industrial fleets have indicated that the broader policy environment has introduced additional uncertainty. Fleets look to policy signals, such as mandatory ZEV sales mandates and emissions standards, to gauge the direction and pace of regulatory change. Recent reversals of these signals in Canada and the U.S., combined with hydrogen OEM bankruptcies (of Hyzon and Nikola) and delayed new vehicle model release dates, have reduced confidence in the near-term trajectory of hydrogen vehicle development. Today, there is a narrow range of vehicle options available to Canadian fleets.

Fuel Supply, Technology, and Infrastructure

Low fuel availability was identified as the single most critical operational barrier for industrial fleets. Fleet managers indicated that fuel unavailability is an unacceptable operational risk — one that represents a fundamental constraint for any fleet considering hydrogen adoption at scale beyond a controlled pilot. Given the current sparse and geographically limited hydrogen fuelling network in Canada, hydrogen remains operationally unviable for most long-haul routes.

Industrial fleet stakeholders noted that vehicle availability compounds the fuel problem. Commercially available hydrogen fuel-cell Class 8 trucks remain very limited and as noted above, are not suitable for all carriers due to haul weight constraints. Hydrogen-diesel dual-fuel engine retrofits were identified as a more accessible near-term pathway, as they can be applied to a broader range of existing vehicle types, though they do not constitute a zero-emission solution. Workforce readiness was also raised as a concern: the pool of mechanics and technicians trained to service hydrogen vehicles is small, standardized safety training curricula do not yet exist, and the specialized knowledge required adds operational risk for fleets that rely on consistent, rapid vehicle turnaround.

Photo courtesy: AMTA



Summary

Industrial fleet operators are open to exploring hydrogen vehicle technology in their heavy-duty fleets. Several fleets have participated in pilots and remain engaged with the technology. However, the conditions for adoption at scale are not yet in place. The cost gap is substantial and currently prohibitive; fuel is not widely available, and suitable vehicle options are limited. Further, the knowledge base needed to make confident procurement decisions, particularly around long-term reliability and maintenance, has not yet been established. Until these conditions improve, hydrogen adoption for industrial fleets will remain limited to controlled pilots rather than advancing toward commercial scale.

4.3 Hydrogen End-Users: Municipal Fleets

What We Heard from Municipal Fleet End Users

Key Need: Reliable fuel and available vehicles that can deliver essential services at a TCO comparable to incumbent fuels, while also advancing emission reduction goals.

Economic and Investment Challenges

- High capital cost for hydrogen fuel cell buses, trucks and vocational vehicles
- High cost of hydrogen fuel compared to diesel, compounding high vehicle capital costs
- Cost structure acceptable for pilots may not be acceptable for fleet-wide adoption
- Dedicated funding currently available for municipal ZEV fleet transition, but longer-term funding outlook is uncertain

Non-Economic Challenges

Knowledge Gaps

- Limited long-term reliability and maintenance cost data
- Knowledge of available hydrogen vehicle models suitable for municipal services is limited
- Vehicle range under real-world operating conditions is not yet well-established
- No consistent ecosystem-wide approach to hydrogen vehicle safety training exists for drivers, mechanics, or first responders; unionized workforce requirements add a further layer of complexity

Policy and Regulatory Environment

- Implications of CSA standards that govern indoor hydrogen vehicle maintenance and parking facilities present a complexity and financial risk, particularly with retrofitting existing fleet facilities

Fuel Supply, Technology, and Infrastructure

- Limited fuel availability is a critical operational barrier; municipalities piloting hydrogen have had to source their own supply and fuelling infrastructure
- Limited pool of trained mechanics and technicians available to service vehicles
- Uncertainty on which credible companies exist that can provide fuelling capability
- Vehicle and parts supply chains exposed to tariff and trade disruption

Municipalities differ from industrial hydrogen end-users in ways that are relevant to technology adoption. Unlike commercial carriers, they are not primarily profit driven. Instead, they are accountable to taxpayers and guided by public service mandates. Operational continuity is their overriding constraint since municipalities cannot accept failures that would compromise essential service delivery.

Yet municipalities are not without appetite for change. Many have established internal ESG and emission reduction targets that create an institutional mandate to explore low-emission vehicle technologies, including hydrogen. Because of these commitments, municipal stakeholders indicated a greater willingness to absorb a modest cost premium, particularly during a pilot phase in which the technology's feasibility is being evaluated. However, municipal stakeholders were clear that costs substantially above diesel parity would be difficult to sustain and justify to taxpayers on an ongoing basis.

Key Need: Reliable Fuel and Available Vehicles at a Comparable TCO to Current Fuels

Municipal stakeholders indicated that the minimum condition for their participation in the hydrogen value chain at scale is reliable fuel and available vehicles that can deliver essential services at a total cost of ownership comparable to diesel.

Economic and Investment Challenges

The cost gap between hydrogen and incumbent fuels is a significant barrier for municipalities. Stakeholders indicated that hydrogen fuel cell buses today cost approximately twice as much as a conventional diesel bus, and hydrogen trucks carry a similar premium. Proposed fuel costs for pilot projects have been as high as four times those of diesel on an equivalent energy basis, not accounting for vehicle efficiency improvements from fuel cell vehicles, which are not yet widely understood.

For pilot projects, higher vehicle and fuel costs have been manageable and often supported by dedicated funding programs. However, stakeholders were clear that the cost structure acceptable for a pilot would not likely be acceptable for broader fleet-wide adoption. Scaling hydrogen vehicles across a municipal fleet would require either a substantial reduction in vehicle and fuel costs or sustained funding support.

Dedicated funding for municipal zero-emission fleet and transit vehicles is currently available and has been an important enabler of pilot activity, but the longer-term funding outlook is uncertain. Municipalities are aware that broader adoption will ultimately need to rest on a viable business case that does not depend on ongoing grant funding. Insurance was not identified as a significant barrier for most municipalities. Larger cities are typically self-insured, and smaller municipalities can access coverage through regional municipal associations. However, municipalities noted that higher asset values associated with hydrogen vehicles will translate into higher replacement and insurance costs at scale.

Photo courtesy: HTEC



Non-Economic Challenges

Knowledge Gaps

Municipalities identified several areas where the lack of accessible, reliable information is a barrier to decision-making. Long-term reliability and maintenance costs for hydrogen vehicles are not yet well established, with most available evidence reflecting short-term pilot experience rather than the sustained full-time service demands of municipal operations.

Battery electric buses are generally expected to have lower maintenance costs than diesel equivalents over their lifecycle, given the reduced mechanical complexity (and fewer moving parts) of electric powertrains. However, some municipal interviewees noted that their early experience with battery electric buses has not always aligned with these projections. In at least one case reported by municipal stakeholders, maintenance costs have proven higher than anticipated, even exceeding those of diesel equivalents.

These municipalities expressed that maintenance cost projections for hydrogen vehicles should similarly be interpreted with caution until supported by more robust operational evidence. Vehicle range under real-world Canadian operating conditions, including extreme winter weather and varied terrain, is also insufficiently documented, which is a particular concern for transit buses and vocational vehicles operating on fixed routes where service reliability is non-negotiable.

Municipalities expressed a strong willingness to share operational data and lessons learned on maintenance and reliability with other municipalities if given the opportunity. This disposition represents a meaningful opportunity for knowledge-building across the sector if a coordinated mechanism can be established.

Policy and Regulatory Environment

Municipalities engaged in this study indicated that piloting hydrogen vehicles requires navigating a range of regulations, codes, and standards applicable to vehicles, fuelling infrastructure, and maintenance facilities. This regulatory landscape spans multiple authorities, and municipal stakeholders noted that it is still evolving as hydrogen technology matures. The capacity to interpret and manage this regulatory landscape varies, as smaller municipalities typically rely on one or two staff for zero-emission fleet planning, while larger municipalities have dedicated internal resources.

A recently developed CSA standard, B401.3-25, governing maintenance and indoor parking facilities for hydrogen vehicles, was identified by some municipalities as a source of financial uncertainty. The standard applies directly to municipal facilities, and stakeholders indicated that compliance, particularly where existing infrastructure requires retrofitting, could entail material capital costs. The extent of these costs varied by facility, but the standard was flagged as a potentially significant barrier. Municipal stakeholders suggested that shared maintenance

facilities among end-users could help distribute this cost, particularly given the small number of vehicles currently in operation. Municipalities noted that their internal climate and decarbonization policies have remained relatively stable despite the shifting external policy environment, providing some degree of institutional continuity. However, delays in hydrogen vehicle model development and release timelines, driven in part by shifting external policy signals, directly affect what municipalities can procure.

Fuel Supply, Technology, and Infrastructure

Hydrogen fuel availability was identified as a primary operational barrier for municipal fleets, consistent with what industrial fleet stakeholders reported. The lack of existing fuelling infrastructure has required municipalities currently piloting hydrogen vehicles to source their own hydrogen and develop their own fuelling infrastructure. This is an undertaking that goes well beyond what municipalities typically manage for a pilot program and requires specific internal capacity and resources that municipalities indicated they may not have.

Fuel cell electric buses are commercially available, but models procured have been reported to have a long lead time (1-2 years) from order to delivery. These buses are currently being tested in municipal pilots. Commercially available FCEV options for specialized vocational trucks, such as dump trucks and winter response vehicles like snowplows, are still limited, making near-term procurement planning for these vehicle types difficult. Municipalities expressed interest in dual-fuel retrofit technology as a near-term pathway, particularly for vocational vehicles not yet served by commercially available FCEV platforms, given the lower cost and reduced operational risk relative to dedicated hydrogen platforms.

On the maintenance side, the pool of trained hydrogen vehicle mechanics and technicians is considered small, and access to qualified servicing is a critical operational concern for municipalities operating hydrogen vehicles. Additionally, the absence of a consistent ecosystem-wide approach to safety training for drivers and first responders was identified as a gap.

Unionized workforce requirements may add a further layer of complexity to workforce development and training implementation for many municipalities, particularly where specialized external vehicle maintenance is required. In these cases, outsourcing maintenance may create labour-relations challenges if it is perceived as a loss of bargaining-unit work and a missed opportunity to develop internal expertise in emerging vehicle technologies

Summary

Municipal fleets present a meaningful near-term opportunity for hydrogen adoption in Canada, where electrification cannot meet today's service requirements. The municipalities engaged in this study indicated a motivation to explore hydrogen use to achieve municipal emissions-reduction goals, and dedicated funding has enabled pilot activities. Municipalities expressed openness to collaboration, including willingness to share permitting experience, operational data, and lessons learned. Scaling up beyond pilots will require a reliable fuel supply, broader vehicle availability, and a cost structure that can support adoption beyond the pilot stage.



Photo courtesy: AMTA

4.4 Hydrogen Vehicle OEMs

What We Heard from Vehicle OEMs

Key Need: Sufficient, durable market demand built through accessible and affordable hydrogen fuel, supportive government policy, and purchase incentives.

Economic and Investment Challenges

- Low demand for hydrogen FCEVs due to high vehicle and fuel costs
- North American truck production volumes have declined
- Longer fleet asset replacement cycles are reducing new vehicle purchase opportunities
- Observed trend of reduced corporate emphasis on ESG priorities has weakened expected demand signals
- Federal iMHZEV rebate program ended with no replacement announced
- Federal dual-fuel retrofit rebate program closed
- Provincial purchase incentives available but inconsistent across jurisdictions

Non-Economic Challenges

Policy and Regulatory Environment

- No fleet mandate currently exists for hydrogen vehicle adoption
- Carbon pricing uncertainty reduces cost competitiveness of zero-emission vehicles
- Uncertainty around future direction of U.S. EPA and CARB regulations is disrupting Canadian market planning
- Policy advocacy focused more on supply-side development than end-use adoption; gap in support available to OEMs and fleet operators
- Interprovincial inconsistency in vehicle regulations complicates market development across Canada

Fuel Supply, Technology, and Infrastructure

- **Low hydrogen fuel availability is an unacceptable risk**
- Commercially available FCEV truck options are limited
- Small pool of trained mechanics and technicians; no standardized safety training curriculum
- Vehicle and parts supply chains are exposed to tariffs, increasing the already high cost of equipment.

OEMs develop and manufacture the hydrogen vehicles that end-users procure and operate, connecting fuel supply to fleet adoption. The OEMs engaged in this study represented a range of roles within this segment, including heavy-duty truck manufacturers, bus manufacturers, engine technology developers, and dual-fuel retrofit technology providers.

Key Need: Sufficient, Durable Market Demand

The minimum condition for sustained OEM participation in the hydrogen heavy-duty transportation value chain is sufficient, durable market demand. This is what drives their continued investment in vehicle development and production. OEM stakeholders indicated that building that demand requires enabling conditions that make purchase decisions viable for end-users: accessible, affordable hydrogen fuel; supportive government policy; and purchase incentives that help offset the significant cost premium of hydrogen vehicles relative to diesel.

OEM Effects on the Value Chain

Without commercially available and affordable hydrogen vehicles, fleet operators cannot transition to hydrogen, and fuel suppliers lack the end-use demand needed for infrastructure investment.

Economic and Investment Challenges

The most fundamental economic challenge facing OEMs is low demand for hydrogen vehicles. High vehicle and fuel costs are the primary driver of that low demand: cost premiums deter fleet adoption, which limits sales volumes, which in turn prevents the economies of scale needed to bring costs down. Fuel cell electric buses currently cost approximately twice as much as diesel equivalents; heavy-duty fuel cell trucks carry a similar or greater premium. OEMs noted that they believe lower fuel costs would meaningfully improve their sales prospects.

OEMs noted that changing fleet business practices and refocused priorities have increased the challenge for hydrogen vehicle roll-out. North American freight markets have experienced a prolonged downturn since early 2022. This has been driven by excess trucking capacity, suppressed rates and weakened demand following the post-pandemic surge in goods movement. Faced with prolonged financial pressure from this freight recession, fleets have responded by deferring capital expenditure and extending asset replacement cycles. Fleet replacement cycles that previously lasted four years may now extend to six or more, reducing the frequency of new-vehicle purchases. This lower demand has led major OEMs to scale back heavy-duty vehicle production amid declining orders. In the broader freight sector, fewer new-vehicle purchases reduce the opportunity for hydrogen trucks to enter fleets.

The freight recession has also shifted fleet priorities, with near-term financial survival increasingly displacing longer-term decarbonization commitments. Powertrain and energy diversification has emerged as a fleet resilience strategy and has largely replaced the pursuit of pure ESG targets. A broader retreat from ESG priorities among fleet operators and institutional investors has further dampened the demand signals that OEMs had previously anticipated. So even when replacement cycles create purchase opportunities, the willingness to pay a premium for zero-emission vehicles has diminished.

Stakeholders in this study highlighted that the barrier to fleet adoption has increased following the removal of key federal incentive programs. The federal *iMHZEV* rebate program, which provided up to \$200,000 toward the upfront purchase cost of zero-emission vehicles, including hydrogen FCEV Class 8 trucks, is no longer available [26]. Similarly, Canada's *Green Freight Program – Stream 2*, which provided non-repayable contributions of up to 50% of eligible costs for engine repowers and fuel switching technologies to reduce GHG emissions, including hydrogen-diesel dual fuel retrofits, has also closed [27].

We also heard that access to private financing has tightened. Venture capital availability for hydrogen technology development was perceived by OEMs to have decreased recently. Financing through the Canada Infrastructure Bank (CIB) remains a potential avenue, as the CIB has indicated that hydrogen projects may fall within its mandate; however, OEMs noted uncertainty about the CIB's current investment priorities and appetite for early-stage hydrogen applications.

The combined pressures of reduced federal programming, inconsistent provincial support, and constrained private capital have contributed to weaker-than-expected FCEV demand and slowed OEM technology development. Some OEMs indicated that internal budgets for hydrogen research and development have been reduced and that timelines have been extended as a result.

Non-Economic Challenges

Policy and Regulatory Environment

OEMs identified stable, long-term government policy as a critical enabler of hydrogen vehicle market development and its absence as a significant barrier to progress. Effective policy frameworks could take several forms, including fleet transition mandates, emission reduction requirements, vehicle purchase rebates, and carbon pricing, each of which would strengthen the business case for hydrogen adoption. Without such frameworks, adoption remains entirely voluntary in a market where hydrogen is not yet cost-competitive with incumbent fuels. Carbon pricing is particularly relevant in this regard, as it would directly improve the relative economics of zero-emission vehicles, but current policy uncertainty means it cannot be accurately factored into fleet procurement decisions.

It was highlighted that emissions regulations from the U.S. Environmental Protection Agency and the California Air Resources Board served as significant drivers of hydrogen technology development, compelling OEMs to invest in compliant powertrains. With the federal U.S. U-turn on energy policy, a key external pressure on technology development has weakened, disrupting Canadian market planning given the integrated nature of North American vehicle markets.

OEMs noted that policy advocacy in the hydrogen space has tended to focus on production and supply-side development rather than end-use adoption, leaving a gap in support for vehicle manufacturers and fleet operators. This pattern is reflected in assessments of the current state of the global hydrogen market. The IEA's *Global Hydrogen Review 2025* [28] found that hydrogen demand for new applications, including road mobility, remains less than 1% of total global demand, and that demand growth continues to be driven by industrial feedstock use rather than the successful implementation of energy and climate policies.

The Hydrogen Council's *Global Hydrogen Compass 2025* [29] further underscores the consequences of this imbalance, finding that 88% of global industry leaders identified demand-side policy as the single most impactful lever for advancing hydrogen offtake. Yet it remains the least developed area of the policy landscape. The fact that advocacy has not shifted in this direction suggests that the market conditions needed to support the commercialization of hydrogen vehicles will not materialize unless policy efforts are deliberately reoriented toward end-use adoption.

Interprovincial inconsistency in vehicle regulations, including zero-emission vehicle weight allowances and tire requirements, adds further complexity to market planning. OEMs noted that codes and standards governing vehicle build are generally workable; those governing fuelling infrastructure and training are less clearly defined.

Fuel Supply, Technology, and Infrastructure

OEM stakeholders identified insufficient hydrogen fuelling infrastructure as a critical barrier to vehicle deployment. OEMs indicated they are unable to sustain vehicle sales in markets where hydrogen fuel is unavailable and noted that a stable, accessible fuel supply must be established before market entry can be considered.

Notably, the OEMs engaged for this project did not express interest in assuming direct responsibility for hydrogen supply. The current approach described was a partnership arrangement with established hydrogen retailers or working alongside fleet customers to support fuel procurement. This posture likely reflects, in part, the difficulties associated with vertical integration in nascent hydrogen markets. Nikola Corporation's attempt to combine truck manufacturing with mobile refuelling operations, before its bankruptcy in 2024, illustrated the financial and operational risks of OEMs extending into the fuel supply chain without the scale or infrastructure to support it.

However, though not stated directly by stakeholders in this study, recent industry activity suggests that OEMs may be reconsidering this boundary. In May 2026, Toyota Motor North America announced a commercial agreement with Hyroad Energy to deploy 40 (Hyroad) hydrogen FCEV trucks in California, where Toyota committed to supplying hydrogen fuel through refuelling infrastructure it is developing directly [30]. This business model, in which an OEM assumes responsibility for fuel supply, represents a departure from the model described by stakeholders engaged in this study, and may indicate evolving approaches to market entry as the sector matures.

Vehicle availability varies by segment. Fuel cell electric buses are commercially available, with a lead time of approximately one to two years from order to delivery. Heavy-duty fuel cell trucks are commercially available, but they are limited by the issues discussed in Section 4.2. Hydrogen internal combustion engine vehicles are in development with no confirmed commercial release timeline. While hydrogen technology development continues to advance in Europe and Asia, North American programs have slowed or, in some cases, been paused.

Commercially available dual-fuel retrofit technology represents a nearer-term pathway to hydrogen adoption, despite not being endorsed by conventional vehicle OEMs, who void existing warranties when retrofit kits are installed. However, one dual-fuel OEM stakeholder noted that the target vehicles for this type of retrofit are typically older units already outside of warranty coverage. Retrofit kits modify

existing diesel engines to combust diesel and hydrogen together, reducing emissions relative to diesel-only operation, and may be thought of as a transitional technology.

Dual-fuel stakeholders noted several advantages relative to FCEV platforms: lower upfront capital costs, applicability across a wider range of vehicle types, including those for which FCEV models are not yet commercially available, and lower operational downtime risk, as dual-fuel vehicles can revert to diesel-only operation when hydrogen is unavailable. Installation timelines are approximately three months for existing vehicle designs and six to 12 months for new designs. Stakeholders engaged through a separate Alberta initiative noted, however, that real-world dual-fuel deployments have shown mixed reliability and that controlling combustion rates in practice presents ongoing technical challenges. The technology is considered to have potential as a transitional platform, but broader conclusions await more operational data.

An emerging parallel pathway is OEM-installed hydrogen-diesel combustion systems, which manufacturers indicated could achieve high hydrogen utilization rates and significant emissions reductions relative to diesel-only operation, at a cost comparable to aftermarket retrofit solutions. These systems are still in the testing phase and are not yet commercially available.

Parts availability for FCEV servicing presents an additional operational challenge. OEMs acknowledged supply chain exposure to tariffs and trade disruptions, with wait times exceeding 120 days reported for some components. No industry-wide consensus on training standards exists for hydrogen vehicle mechanics, drivers, or first responders. OEMs provide vehicle-specific training to their customers, but noted that this approach does not scale at the sector level.

Summary

The OEMs engaged in this study continue to develop technology and support customers in active pilots. However, the conditions needed to sustain and scale that investment are not currently in place. Low demand, a challenging incentive environment, infrastructure gaps, and policy uncertainty are collectively constraining OEM commitment to the Canadian hydrogen heavy-duty transportation market. The technology exists and, in some segments, is commercially ready, but without stronger and more durable enabling conditions, the pathway from pilot to commercial scale remains unclear.



5 From Feedback Loop to Viable Corridor

The MVC Framework is built on the premise that a hydrogen corridor becomes viable only when each link in the value chain can participate on terms that are economically and operationally sustainable. This engagement has indicated that the conditions for a large-scale rollout of heavy-duty hydrogen transportation in Canada are not yet in place. The more immediate opportunity lies in developing local supply and demand through regional hydrogen hubs, supported by the policy and regulatory architecture needed to make value chain participation viable. Corridors can naturally emerge from that foundation as the ecosystem matures.

The Central Challenge: A Self-Sustaining Feedback Loop

The most consistent finding across all stakeholder groups is not any single barrier in isolation, but the way barriers interact and reinforce each other across the value chain. No link can move forward independently because each depends on conditions that the others must first create. Suppliers require committed demand before investing in infrastructure. Fleets and municipalities require reliable fuel supply and costs approaching diesel parity before committing to hydrogen vehicles. And OEMs require sufficient sales volume to achieve the scale needed to bring vehicle costs down and to make hydrogen vehicle models available for the Canadian market. The result is a feedback loop in which the success of each link is contingent on the others. The figure below illustrates the structure of this feedback loop, mapping the causal relationships between value chain stakeholders and the enabling conditions that link them. The policy and regulatory environment is shown as a cross-cutting influence in the economics and risk profile of all three primary value chain links.

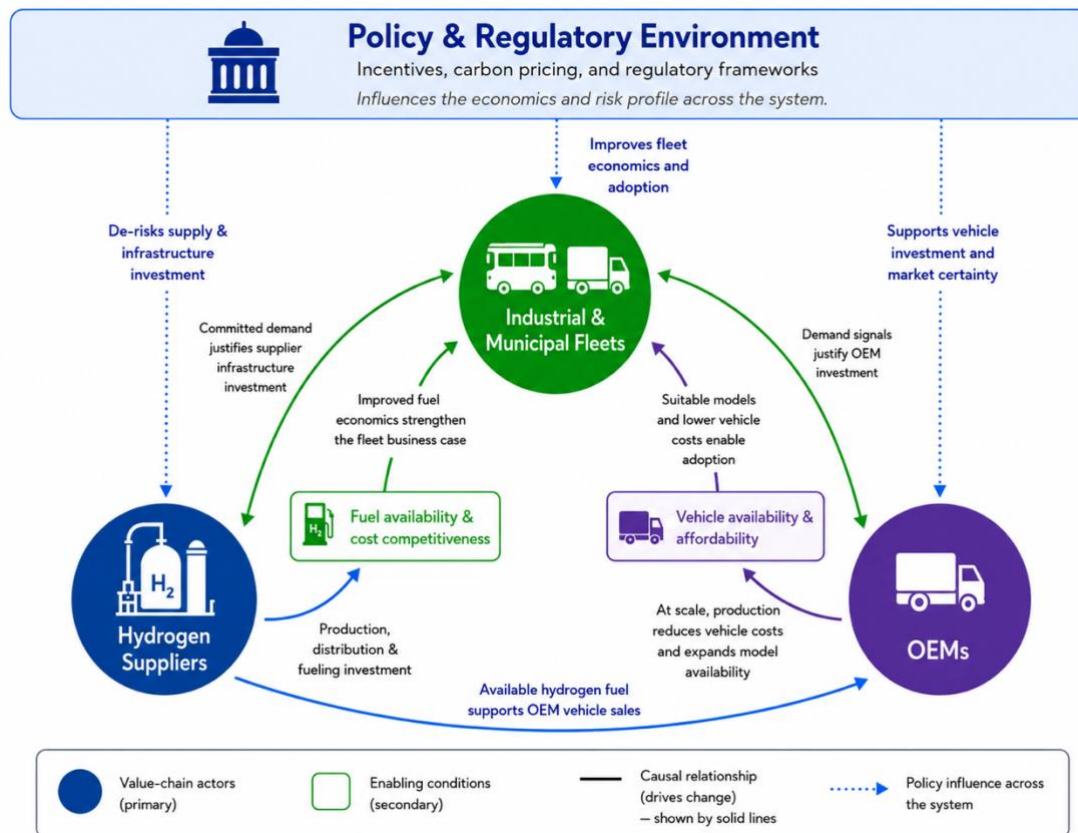


Figure 4 The hydrogen heavy-duty mobility ecosystem: Value-chain actors, enabling conditions, and policy influence

Factors Driving the Feedback Loop

High hydrogen fuel and vehicle costs are a fundamental barrier to adoption. Current hydrogen fuel prices and vehicle purchase costs make the economics of transitioning from diesel unworkable for most fleet operators. Without viable economics for end-users, the demand signals that suppliers and OEMs need to justify investment simply do not materialize. Closing this gap will require scale, technology maturation, and sustained policy support. Under current conditions, cost alone is sufficient to prevent most fleets from moving beyond pilots.

Lack of fuelling infrastructure and fuel availability are critical geographical constraints, creating a barrier that limits the feasibility of adoption outside a small number of locations. Commercial fleets and municipalities cannot commit to hydrogen vehicles without reliable, affordable access to fuel along their operating routes. OEMs cannot sell hydrogen vehicles into markets where fuel is unavailable. And suppliers cannot justify the capital required to build out infrastructure to provide fuel when there is insufficient demand to guarantee an acceptable ROI. This creates a stalemate that is limiting the progress of the hydrogen mobility ecosystem beyond pilots.

Policy uncertainty and the loss of incentives have weakened the external signals that were previously encouraging ZEV adoption. The elimination of federal vehicle purchase incentives, the removal of the consumer-facing carbon tax, and the absence of fleet transition mandates have withdrawn the mechanisms that were partially bridging the cost gap between hydrogen and diesel. Recent U.S. policy reversals, including the repeal of California's Advanced Clean Trucks rule, have further unsettled the North American market signals that OEMs and suppliers rely on when making long-term investment decisions.

Interprovincial regulatory inconsistency adds complexity throughout the value chain. Suppliers navigate inconsistent permitting processes across jurisdictions. Fleets encounter a patchwork of vehicle operation regulations, including zero-emission vehicle weight allowances, that vary by province. OEMs must account for differing provincial requirements around vehicle operation, permitting and compliance, which is challenging when deploying new technologies across multiple markets. Municipalities, while not typically involved in inter-provincial operations, encounter approval processes that vary by province and local authority, limiting the extent to which lessons learned in one jurisdiction can be directly applied in another.

Information gaps impact decision-making across the value chain. This is a coordination issue, distinct from the economic and regulatory challenges described above. Fleets and municipalities lack reliable, forward-looking information on where and when fuel and vehicles will be available. Performance and maintenance data from existing pilots is not being systematically collected or shared across the sector, meaning each new participant is largely starting from scratch. Permitting experience accumulated by early movers is not yet widely accessible to others. Training and safety resources are fragmented across jurisdictions as there is currently no consistent national approach in place.

What This Means for Corridor Development

These five conditions represent the most significant and broadly shared barriers identified through stakeholder engagement. They do not capture every challenge encountered across the value chain, including stakeholder-specific barriers and emerging disruptions such as tariff and trade uncertainty, but they are the conditions most directly sustaining the feedback loop. They also help explain why Canadian hydrogen heavy-duty transportation has remained at the pilot stage: pilots do not generate the scale, infrastructure, or policy momentum needed to reach corridor viability.

Breaking this pattern requires coordinated action at the system level. Conditions must improve simultaneously across multiple links of the value chain to make progress. Notably, several challenges, particularly those related to information gaps and regulatory inconsistency, represent coordination issues rather than economic

ones and are therefore more immediately actionable within the current environment. Work on these issues can proceed independently of the larger economic challenges.

Near-Term Vehicle Pathways

While the structural conditions described above must ultimately be addressed for hydrogen heavy-duty transportation to reach commercial scale, end-user stakeholders identified near-term vehicle technology options that could help build momentum in the interim. Dual-fuel retrofit systems commercially available today were seen as more immediately accessible than full FCEV adoption. While not a zero-emission solution, dual-fuel retrofits offer a lower-cost entry point into hydrogen utilization across a broader range of vehicle types and use cases than FCEV platforms currently support. By generating near-term hydrogen demand and broadening fleet participation ahead of full FCEV commercial viability, dual-fuel deployment may help support the aggregated local demand hub model.

Looking Ahead

The findings presented in this section reflect the qualitative component of the MVC Framework and identify the conditions stakeholders consider necessary for their sustained participation in the hydrogen-heavy-duty transportation value chain. This first round of engagement shows that these conditions have not yet converged in any region across Canada, and that interdependencies across value chain participants mean progress in one part of the value chain depends on progress in others. No single segment can advance independently.

The economic challenges identified across the value chain, particularly the cost gap between hydrogen and diesel, and the capital requirements for infrastructure investment, underscore that breaking the feedback loop will require more than coordination alone.

The path forward, therefore, does not begin at the corridor scale, but with the deliberate development of viable local supply and aggregated demand through a regional hub approach. If supported by policy and advanced in the near term through transitional technology options such as dual-fuel systems, these conditions could help disrupt the current feedback loop and lay the foundations for future corridor viability.

Examples from Other Regions

While Canada's hydrogen heavy-duty transportation sector remains at the pilot stage, other jurisdictions have advanced further along the path toward commercialization, and the business models that are gaining traction offer directly relevant lessons.

Across California and Europe, the projects making progress share common characteristics: they are not standalone vehicle deployments, but integrated regional ecosystems built around concentrated demand, dedicated infrastructure, and shared commercial risk across value chain participants. This aligns with a key finding from the stakeholder engagement in this project: that the priority should first be on developing functional local hubs that balance supply and aggregated demand.

In California, Toyota's recently announced collaboration with Hyroad Energy, in which Hyroad provides trucks, maintenance and fleet management software while Toyota supplies hydrogen fuelling infrastructure, represents an ecosystem-based approach in which vehicle deployment, fuel supply, and fleet operations are coordinated under a single commercial framework [30]. This approach de-risks the participation of fleets by reducing the need for a large upfront investment in vehicles and fuelling infrastructure. The model also demonstrates how mobile and scalable fuelling solutions can support early deployments while permanent infrastructure is developed.

A second California example illustrates a complementary approach centered on concentrated demand at a fixed location. Beginning in January 2026, what is expected to be California's largest hydrogen truck fleet deployment launched at the Port of Long Beach [31]. The project combines a large fleet commitment to use hydrogen trucks, dedicated nearby fuelling infrastructure, and high-utilization drayage routes operating within a defined geographic area. This demonstrates how aggregating demand at a regional hub can provide a viable commercial foundation for all partners, strengthening the business case for infrastructure investment ahead of broader corridor development.

At the international level, the Hydrogen Mobility Europe (H2ME) program, which ran from 2015 to 2023 across nine European countries, offers instructive lessons on what demonstration-scale investment can and cannot achieve. The €170 million program, co-funded as a public-private partnership, was the most ambitious coordinated hydrogen deployment project attempted in Europe to date [32]. The program generated significant technical knowledge, demonstrated the reliability of hydrogen vehicles in real-world operations, and yielded valuable insights into permitting, infrastructure design, and safety. However, at the conclusion of the project, demand levels remained insufficient to support the business case for refuelling infrastructure, and a self-sustaining commercial hydrogen mobility market had not emerged. The H2ME experience reinforces a central lesson: technical demonstration, however well-funded, is not, on its own, sufficient to generate the commercial viability to underpin a self-sustaining corridor that can operate independently of ongoing government subsidies.

6 Recommended Actions: Addressing Structural Needs

The recommendations presented here do not attempt to resolve the economic fundamentals of hydrogen competitiveness, which require sustained policy support, technology cost reductions, and market development over time. Instead, they focus on the conditions that can be meaningfully improved within the current environment: reducing regulatory misalignments along interprovincial corridors, anchoring demand at the regional level to give suppliers and OEMs the market visibility they need, and closing the information gaps that are slowing decision-making across the value chain. These recommendations are intended to reduce the barriers to corridor viability that are within reach today, while laying the groundwork for the broader market development that hydrogen heavy-duty transportation in Canada will require over time.



Recommendation 1: Leverage Local Hydrogen Hubs to Aggregate Demand

Category: Region-Level Action

Primary Issue Addressed: Demand-supply feedback loop

Regional and municipal governments, industry associations, fleet operators, OEMs, and suppliers should collaborate through local hydrogen hubs to aggregate regional demand. Greater offtake visibility at the hub level provides the demand certainty that suppliers need to plan and commit to infrastructure investment, whether mobile fuelling units, onsite scalable production and dispensing systems, or permanent large-scale equipment. Municipalities, with their fixed routes, predictable fuel consumption, and institutional decarbonization mandates, are well-positioned to serve as demand anchors in local hubs (and eventually corridor endpoints), with industrial fleets providing complementary anchors, where route predictability supports reliable demand forecasting. This approach requires facilitation and partnership development among value chain participants rather than major public funding and is actionable within the current policy environment. Demand could also be supplemented through shared infrastructure with large consumers, such as hydrogen freight rail, lowering the bar for entry.

Photo courtesy: Hydra



Recommendation 2: Pursue Interprovincial Harmonization of Hydrogen Vehicle and Infrastructure Regulations

Category: Interprovincial Action

Primary Issue Addressed: Interprovincial regulatory inconsistency

Provincial governments should work together to harmonize hydrogen vehicle operation and fuelling regulations, reducing the inconsistencies in permitting processes, vehicle weight allowances, and equipment registration requirements that currently add friction and cost at every link in the value chain and are a particular barrier to corridor development along interprovincial routes. Addressing this does not require new legislation; it requires improved coordination among existing provincial regulatory bodies, with a focus on priority areas where inconsistencies have the greatest impact on corridor viability, including fuelling-station permitting and hydrogen-vehicle weight allowances. Building on permitting experience already documented by early mover jurisdictions and existing provincial approaches to hydrogen vehicle weight allowances would provide a practical foundation for harmonization efforts. As part of this work, jurisdictions that are further advanced in hydrogen vehicle regulation should be identified and assessed as potential benchmarks with a view to adopting best practices that have already been tested in comparable operating environments.

Photo courtesy: AMTA



Recommendation 3:

Propose a National Framework for Standardized Hydrogen Heavy-Duty Vehicle Training

Category: Knowledge Gap Actions

Primary Issue Addressed: Workforce and training gaps

The absence of standardized training frameworks for hydrogen vehicle mechanics, drivers, and first responders was identified as a shared barrier by industrial fleets, municipalities, and OEMs, limiting the scalability of workforce readiness as hydrogen vehicle deployment grows. Addressing this gap is primarily a coordination and standard-setting challenge rather than a funding problem, as the expertise required to develop training standards already exists within OEMs, fleet operators, and safety organizations currently engaged with hydrogen vehicles. OEMs, fleet operators, and safety organizations should collaborate to develop national training standards for hydrogen heavy-duty vehicle mechanics, drivers, and first responders. Convening these parties around a shared framework for technician certification, driver safety training, and first responder preparedness would build the workforce capacity that corridor-scale hydrogen deployment will require.



Recommendation 4: Require Data Sharing from Publicly Funded Hydrogen Projects

Category: Knowledge Gap Actions

Primary Issues Addressed: Information gaps; inequitable access to publicly funded knowledge

Publicly funded hydrogen pilot projects are generating the real-world vehicle performance, maintenance and infrastructure data needed to support informed investment and procurement decisions from future end users. However, these pilot findings are not consistently accessible beyond the organizations directly involved. Provincial and federal governments should therefore establish clear and consistent data-sharing requirements for publicly funded projects that distinguish independently verifiable, non-proprietary project data from corporate claims, while protecting commercially sensitive information and intellectual property. This would allow public investment to contribute to a shared body of knowledge that others can build upon, supporting the development of Canada's hydrogen mobility ecosystem and value chain.

Photo courtesy: AMTA



7 Conclusion: Paving the Path to Wider Adoption

Heavy-duty transportation is one of the most difficult sectors to decarbonize, and hydrogen is one of the few pathways to meet its demands. Hydrogen offers the range, payload capacity, refuelling speed, and cold-weather performance that battery-electric alternatives cannot yet provide across all use cases.

A commercially viable hydrogen heavy-duty transportation sector in Canada would reduce emissions from one of the country's largest and hardest-to-abate sources, support the development of a new industrial value chain, and position Canada as a leader in a technology that is gaining traction globally.

The stakeholder engagement documented in this report confirms that hydrogen remains a technically credible pathway for decarbonizing heavy-duty trucking in Canada, and that genuine interest exists across the value chain.

The barriers are not primarily technical. They are structural: a self-sustaining demand-supply feedback loop, fed by high fuel costs, insufficient infrastructure, policy uncertainty, interprovincial regulatory inconsistency, and fragmented information. Until these conditions improve in a coordinated way, no single actor in the value chain can move forward with confidence. The opportunity, however, remains real, and the work of building the conditions for a viable hydrogen value chain is worth pursuing.

The MVC Framework provides a useful lens for understanding why this matters. A Minimum Viable Corridor requires not just that individual links in the value chain be viable in isolation, but that they reach viability simultaneously. The qualitative analysis presented here identifies where that threshold remains out of reach and why. A one-size-fits-all corridor strategy is unlikely to succeed given the regional variation in regulatory environments, fleet compositions, infrastructure conditions, and demand profiles documented across this study. The more promising near-term path is organic and stakeholder-led: regional demand aggregation through local hubs anchored by municipalities and industrial fleets with predictable routes and institutional motivation, supported by targeted regulatory coordination and improved information-sharing across the value chain.

Large-scale, government-led corridor investment is unlikely in the near term under current policy and market conditions, though the longer-term trajectory remains open. Even in a scenario where significant public investment is available, a fundamental challenge persists; there is no clear pathway to an economically self-sustaining corridor once that investment ends. Subsidies and grants can catalyze early activity, but a corridor that remains dependent on ongoing public funding does not meet the threshold the MVC Framework is designed to identify. The goal

is not a heavily subsidized corridor that continually relies on significant public spending, but a viable business model, and that distinction has important implications for how near-term efforts are allocated to support the development of hydrogen hubs and corridors.

In the interim, progress on the qualitative conditions identified in this report represents the most actionable path available: reducing regulatory friction, aggregating demand, closing information gaps, and building workforce capacity. These are coordination and knowledge problems, and they are solvable within the current environment. Addressing them now will smooth the path to a viable corridor when broader economic and policy conditions are ready to support it.



Photo courtesy: HTEC

References

- [1] Statistics Canada, 'Origin and destination of transported commodities, Canadian Freight Analysis Framework'. Government of Canada, May 14, 2020. doi: 10.25318/2310014201-ENG.
- [2] Transport Canada, 'Key traffic and volume statistics', Transport Canada. Accessed: Jun. 24, 2026. [Online]. Available: <https://tc.canada.ca/en/corporate-services/transparency/corporate-management-reporting/transportation-canada-annual-reports/transportation-canada-2022/key-traffic-volume-statistics-2>
- [3] Statistics Canada, 'Vehicle registrations, by type of vehicle and fuel type'. Government of Canada, 2022. doi: 10.25318/2310030801-ENG.
- [4] Statistics Canada and Government of Canada, 'The Daily — Vehicle registrations, 2024'. Accessed: Jul. 24, 2026. [Online]. Available: <https://www150.statcan.gc.ca/n1/daily-quotidien/251017/dq251017c-eng.htm>
- [5] Environment and Climate Change Canada, 'Greenhouse Gas Emissions: Environmental Indicators'. Accessed: Jun. 24, 2026. [Online]. Available: <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html>
- [6] Transport Canada, 'Transportation in Canada 2023: Greenhouse Gas Emissions', Transport Canada. Accessed: Jun. 24, 2026. [Online]. Available: <https://tc.canada.ca/en/corporate-services/transparency/corporate-management-reporting/transportation-canada-annual-reports/transportation-canada-2023/greenhouse-gas-emissions>
- [7] Z. Redick, D. Layzell, and A. De Barros, 'Net-zero transition model of Alberta's heavy-duty trucking sector', *Transp. Res. Part Transp. Environ.*, vol. 140, p. 104612, Mar. 2025, doi: 10.1016/j.trd.2025.104612.
- [8] J. Lof, C. MacKinnon, G. Martin, and D. B. Layzell, 'Survey of Heavy-Duty Hydrogen Fuel Cell Electric Vehicles and Their Fit for Service in Canada', The Transition Accelerator, Sep. 2020. [Online]. Available: <https://transitionaccelerator.ca/survey-of-heavy-duty-hydrogen-fuel-cell-electric-vehicles-and-their-fit-for-service-in-canada/>
- [9] Volvo Trucks and Jan Strandhede, 'Volvo's heavy-duty electric truck is put to the test: excels in both range and energy efficiency'. Accessed: Jun. 15, 2026. [Online]. Available: <https://www.volvotrucks.com/en-en/news-stories/press-releases/2022/jan/volvos-heavy-duty-electric-truck-is-put-to-the-test-excels-in-both-range-and-energy-efficiency.html>
- [10] M. Gobbi, A. Sattar, R. Palazzetti, and G. Mastinu, 'Traction motors for electric vehicles: Maximization of mechanical efficiency – A review', *Appl. Energy*, vol. 357, p. 122496, Mar. 2024, doi: 10.1016/j.apenergy.2023.122496.
- [11] Alberta Motor Transport Association, 'Alberta Zero Emission Truck Electrification Collaboration | AMTA Innovation'. Accessed: Jun. 24, 2026. [Online]. Available: <https://amta.ca/azetec>
- [12] 'AZETEC project enters next phase of testing in Canada'. Accessed: Jun. 15, 2026. [Online]. Available: <https://blog.ballard.com/truck/azetec-project-next-phase-testing-canada>
- [13] Alberta Motor Transport Association, 'Zero Emission Truck Testbed (ZETT)'. Accessed: Jun. 15, 2026. [Online]. Available: <https://amta.ca/zero-emission-truck-testbed-zett/>
- [14] Innovate BC, 'For the Long Haul: Revolutionizing Sustainable Trucking'. Accessed: Jun. 15, 2026. [Online]. Available: <https://www.initforthelonghaul.ca/>
- [15] HTEC, 'Hydrogen Electric Truck Leasing in Canada'. Accessed: Jun. 15, 2026. [Online]. Available: <https://www.htec.ca/truck-leasing/>

- [16] Erin Horb, 'Decarbonizing Heavy-Duty Transportation in Alberta: AMTA's Hydrogen Story', Alberta Motor Transport Association. Accessed: Jun. 15, 2026. [Online]. Available: <https://amta.ca/decarbonizing-heavy-duty-transportation-in-alberta-amtas-hydrogen-story/>
- [17] Hyundai Motor Company, 'Hyundai Motor Spearheads U.S. Zero-Emission Freight Transportation with NorCAL ZERO Project Launch'. Accessed: Jun. 15, 2026. [Online]. Available: <https://www.hyundai.com/worldwide/en/newsroom/detail/hyundai-motor-spearheads-u.s.-zero-emission-freight-transportation-with-norcal-zero-project-launch-0000000760>
- [18] M. Jeffers, Y. He, and M. Lammert, 'Fuel Cell Electric Bus Status Report 2025', *Tech. Rep.*, no. NLR/TP-5400-97796, Mar. 2026, Accessed: Jun. 24, 2026. [Online]. Available: <https://docs.nlr.gov/docs/fy26osti/97796.pdf>
- [19] Alejandra Carranza, 'Trump signs resolutions killing California's zero-emissions rules | Trucking Dive', Trucking Dive. Accessed: Jun. 24, 2026. [Online]. Available: <https://www.truckingdive.com/news/trump-revokes-california-emissions-policies-bill-trucking-reacts/750613/>
- [20] David Taube, 'Hyzon lays off workers, plans to liquidate business | Trucking Dive', Trucking Dive. Accessed: Jun. 24, 2026. [Online]. Available: <https://www.truckingdive.com/news/hyzon-lays-off-workers-plans-to-liquidate-business/736150/>
- [21] David Taube, 'Nikola files for bankruptcy, seeks to wind down operations | Trucking Dive', Trucking Dive. Accessed: Jun. 24, 2026. [Online]. Available: <https://www.truckingdive.com/news/nikola-files-for-bankruptcy-seeks-to-wind-down-operations/740317/>
- [22] Hyundai Motor Company and Jin Cha, 'Hyundai's XCIENT Fuel Cell Hitting the Road in California - Releases - Official Media Site NEWSROOM'. Accessed: Jun. 15, 2026. [Online]. Available: <https://www.hyundainews.com/releases/3362>
- [23] Task Force on Vehicle Weights and Dimensions Policy, 'Heavy Truck Weight and Dimension Limits for Interprovincial Operations in Canada'. Accessed: May 29, 2026. [Online]. Available: https://cantruck.ca/wp-content/uploads/2019/02/MOU_public.pdf
- [24] Government of British Columbia, 'Weight allowance greenlit for low-carbon commercial vehicles', BC Gov News - Transportation and Transit. Accessed: Jun. 15, 2026. [Online]. Available: <https://news.gov.bc.ca/releases/2021TRAN0035-000920>
- [25] Alberta Transportation and Economic Corridors, 'Commercial vehicle – Oversize and overweight permits | Alberta.ca'. Accessed: Jun. 15, 2026. [Online]. Available: <https://www.alberta.ca/commercial-vehicle-oversize-and-overweight-permits>
- [26] Transport Canada and Government of Canada, 'Closed: Incentives for Medium- and Heavy-Duty Zero-Emission Vehicles (iMHZEV)'. Accessed: Jun. 15, 2026. [Online]. Available: <https://tc.canada.ca/en/road-transportation/innovative-technologies/electric-vehicles/closed-incentives-medium-heavy-duty-zero-emission-vehicles>
- [27] Natural Resources Canada, 'Green Freight Program'. Accessed: Jun. 15, 2026. [Online]. Available: <https://natural-resources.canada.ca/energy-efficiency/transportation-energy-efficiency/greening-freight/green-freight-program>
- [28] International Energy Agency, 'Global Hydrogen Review 2025 – Analysis', Sep. 2025. Accessed: Jun. 15, 2026. [Online]. Available: <https://www.iea.org/reports/global-hydrogen-review-2025>
- [29] Hydrogen Council and McKinsey & Company, 'Hydrogen Council Global Hydrogen Compass 2025', Hydrogen Council. Accessed: Jun. 15, 2026. [Online]. Available: <https://compass.hydrogencouncil.com/wp-content/uploads/2025/09/Hydrogen-Council-Global-Hydrogen-Compass-2025.pdf>

- [30] Jacob Brown and Suzanne Block, 'Toyota Announces Strategic Collaboration with Hyroad to Deploy Hydrogen Fuel Cell Trucks', Toyota USA Newsroom. Accessed: Jun. 24, 2026. [Online]. Available: <https://pressroom.toyota.com/toyota-announces-strategic-collaboration-with-hyroad-to-deploy-hydrogen-fuel-cell-trucks/>
- [31] Pacific Clean Fuels, 'Hyroad Project'. Accessed: Jun. 24, 2026. [Online]. Available: <https://pacificcleanfuels.com/hyroadproject/>
- [32] Hydrogen Mobility Europe, 'Hydrogen Mobility Europe (2) Project Successfully Concludes | Hydrogen Mobility Europe'. Accessed: Jun. 24, 2026. [Online]. Available: <https://h2me.eu/2024/04/24/hydrogen-mobility-europe-2-project-successfully-concludes-2/>



Canadian
Hydrogen
Association

Association
Canadienne de
L'hydrogène

The Transition
Accelerator



L'Accélérateur
de transition

