PEMBINA institute

Recommendations on the transition to zero-emission heavy-duty vehicles

Pembina Institute comments

Submitted to: Environment and Climate Change Canada | January 21, 2022

Regarding: Discussion paper on the transition to heavy-duty zero-emission vehicles

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Recommendation summary

In response to your discussion paper, and to realize ZE MHDV decarbonization goals, we recommend three key actions in the near term:

- Formalize Canada's objectives for transitioning towards ZE MHDVs by solidifying mandatory 100% ZE MHDV sales target in the ERP to ensure Canada is on track to achieving 30% ZE MHDV sales by 2030 and 100% by 2040.
- Develop and deliver on a concrete implementation plan, by establishing a clear regulatory pathway that is consistent with and meets Canada's emissions reduction goals and ZE MHDV target.
- Commit to a stronger investment strategy to increase both supply and demand, and support innovation and demonstrations to accelerate the market by reducing incremental costs of commercial ZE technologies.

Context

Thank you for the opportunity to respond to questions outlined in the *Discussion paper for heavy-duty vehicles and engines in Canada: transitioning to a zero-emission future.*

The Pembina Institute is a registered charity and non-partisan think tank with offices in British Columbia, Alberta, and Ontario. For 35 years, the Institute has worked with governments, business, and local and Indigenous communities to advance climate and energy policy in Canada.

The Pembina Institute supports the Government of Canada's efforts to engage, coordinate, and collaborate with relevant actors to operationalize its global commitment to enable the full

transition to zero-emission (ZE) medium- and heavy-duty vehicles (MHDVs) by 2040, and to achieve net-zero by 2050.[1] Our comments are informed by over 10 years of research on transportation decarbonization, as well as insights from the Pembina Institute's Urban Delivery Solutions Initiative,[2] a national network of businesses and organizations working to create an efficient and low-carbon urban freight system in Canadian cities.[3]

Discussion and recommendations

Canada needs to swiftly develop and execute a ZE MHDV strategy

While the federal government has begun to implement policies and programs to encourage ZE MHDV adoption and to develop supporting infrastructure, there are considerable gaps that must be filled to support an integrated clean transportation and energy system. In the absence of a national zero-emission vehicle (ZEV) policy and investment strategy for goods movement — from last-mile deliveries to the heavy-duty freight sector — market transformation has been slow, even for those companies that are eager to make the changes necessary for a clean economy. We've heard from businesses and fleet operators of various sizes that a more harmonized and consistent ZEV policy framework across Canada would make their transition planning efforts easier, particularly for those that have inter-provincial or national operations.[4] A national strategy to accelerate ZE MHDVs is especially necessary to address weak policy and market conditions in some regions.

That is why the Pembina Institute has commenced a new study to develop a national zero-emission MHDV strategy to achieve Canada's target of 100% ZE MHDV sales by 2040 and 30% by 2030. To inform the development of this strategy, we will undertake a modelling analysis to examine the impact of various policies on achieving the targets, and to understand the potential GHG emissions reduction and economic impacts. Over the coming months, we plan to work closely with relevant stakeholders such as Electric Mobility Canada and the Pembina Institute's Urban Delivery Solutions Initiative to inform the development of the strategy. We welcome the opportunity to provide more details to Environment and Climate Change Canada, and anticipate making the findings public this year, to inform the Government of Canada's path forward.

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[1] Calstart Drive to Zero, *Memorandum of Understanding on Zero-Emission Medium- and Heavy-Duty Vehicles* (2021). https://globaldrivetozero.org/site/wp-content/uploads/2021/12/Global-MOU-ZE-MHDVs-signed-20-Dec-21.pdf

[2] Carolyn Kim and Cedric Smith, *Building a Zero-Emission Goods Movement System* (Pembina Institute, 2020). https://www.pembina.org/reports/building-a-zero-emission-goods-movement-system-report.pdf

[3] Pembina Institute, "Urban Delivery Solutions Initiative." https://www.pembina.org/UDSI

[4] *Building a Zero-Emission Goods Movement System.*

The economic and public health benefits of a ZE MHDV transition

A clear regulatory pathway for the ZE MHDV transition offers economic benefits to Canadian businesses and their workers as well as public health benefits, especially for Canadians living in urban centres.

At the moment, Canadian businesses are not positioned to reap the benefits of the coming ZE MHDV transition. A study by the International Council on Clean Transportation (ICCT) demonstrates that under current Canadian policy conditions, ZE medium- and heavy-duty vehicle sales are expected to be around 11% and 13%, respectively, by 2040 — well below Canada's target of 100% ZE MHDV sales by 2040.[5] The same study estimates that Canada's ZEV economy represents about $1.1 billion of GDP (2015$) and employs around 10,000 people. With current policies and programs in place, this is expected to grow to $43 billion of GDP and 342,000 workers by 2040. The study concludes that with a stronger policy framework, consisting of a sales requirement and production incentives, this could reach $152 billion and 1.1 million workers in 2040.

Canadians reap significant public health benefits when air pollution and emissions from internal combustion engine vehicles are reduced. A recent study from researchers at the University of Toronto found that diesel commercial vehicles in the GTHA are responsible for 9,810 years of life lost annually (or $3.2 billion in annual social costs).[6] They concluded that removing 240 to 1,000 diesel trucks per day along the Highway 401 corridor and replacing them with alternative technologies like electric trucks or low-emission rail would save 1,310 years of life lost annually (or $428 million in annual social costs). The transition to ZEVs can not only help improve public health, but also reduce the healthcare costs associated with air pollution-induced diseases or conditions. Canadians who live in urban centres near major roadways are especially impacted by high concentrations of harmful air pollutant emissions stemming from polluting vehicles.[7] Trucks, in particular, contribute disproportionately to traffic-related air pollution in Canadian cities.[8]

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[5] *Simulating Zero Emission Vehicle Adoption and Economic Impacts in Canada* (Navius Research Inc. for the International Council on Clean Transportation, 2021), 22. https://theicct.org/publication/simulating-zero-emission-vehicle-adoption-and-economic-impacts-in-canada/

[6] Laura Minet et al., "Quantifying the Air Quality and Health Benefits of Greening Freight Movements," Environmental Research (2020) Vol 183. https://doi.org/10.1016/j.envres.2020.109193

[7] The Southern Ontario Centre for Atmospheric Aerosol Research, *Near-Road Air Pollution Pilot Study* (2019), 3 and 8. https://www.socaar.utoronto.ca/wp-content/uploads/2019/10/SOCAAR-Near-Road-Air-Pollution-Pilot-Study-Summary-Report-Fall-2019-web-Final.pdf

[8] *Near-Road Air Pollution Pilot Study*, 8.

1. Solidify mandatory 100% ZE MHDV sales target in the ERP

The forthcoming Emissions Reduction Plan must solidify Canada's commitment for manufacturers to sell new ZEVs by setting a mandatory target of 30% ZE MHDV sales by 2030 and 100% by 2040. This mandate will achieve the following public policy objectives:

1. **Achieve emissions reductions** that are real, permanent, quantifiable, verifiable, and enforceable, to support Canada's overall commitment to reduce emissions by 40-45% by 2030, and net-zero by 2050.
2. **Accelerate deployment of ZEVs** to achieve significant emissions reductions and support Canada's transition from internal combustion to electric powertrains.
3. **Provide market certainty** for zero-emission technologies and fuelling infrastructure to guide the acceleration of ZE MHDVs. Create a self-sustaining ZE MHDV market that will give consumers access to feasible, high-performance, and safe products.
4. **Protect and preserve public health and well-being** of Canadians by supporting an environment that is free from harmful air pollution and GHG emissions from trucks and buses.
5. **Spur economic activity and innovation** for clean and sustainable technologies. Cultivate a clean transportation economy that increases economic and employment benefits.

2. Establish a clear regulatory pathway

The Government of Canada is unlikely to achieve its ZE MHDV sales targets without regulatory requirements. MHDV manufacturers will lack the regulatory incentive to build ZEVs, which will delay the transition to a sustainable ZE truck market. It is unlikely that ZE MHDV manufacturers would increase production of ZEVs above existing levels in response to market demand alone. Economies of scale in production costs will not be realized unless manufacturers commit to producing larger volumes of these alternative vehicles. It is important that policies are consistent, predictable, and stable over the long term to provide effective market signals that induce investments in ZEV adoption and infrastructure.

Jurisdictions that are leading the effort on MHDV decarbonization and air pollution reduction implement three broad types of regulations:

- mandated sales requirements
- heavy-duty vehicle GHG emission regulations
- clean fuel regulations.

Mandated sales requirements

We recommend that the federal government establish a ZEV standard that requires manufacturers to sell an escalating annual percentage of new MHDVs on a trajectory that achieves the 30% and 100% new vehicle sales targets. Mandating escalating sales requirements for new vehicles has been proven as an effective tool to scale up ZEV adoption and vehicle supply,[9] and should be implemented at a national scale for MHDVs. For example, British Columbia and Quebec's light-duty ZEV sales mandate increased the available supply of ZEV models. In the three years after the adoption of Quebec's ZEV Act in 2016, the percentage of ZEV models available in Quebec increased from 66% to 92%.[10,11]

A national ZEV standard is needed to support consistency across regions and alignment with regulations impacting the North American market. Within Canada, two provinces with mandated ZEV sales requirements — Quebec and B.C. — are leaders in EV market penetration at 6.8% and 8.4% market share respectively.[12] Meanwhile provinces without mandated sales requirements, like Ontario whose EV market penetration was 1.75% in 2020, have weaker EV market shares.[13] Leading provinces are beginning to set goals for their MHDV fleets. At COP26, Quebec committed to transition its government MHDV fleet by 2040. Without a national ZEV standard, there may be uneven uptake and distribution of vehicle supply across regions.

Create a national ZEV standard that aligns with leading U.S. States

The Government of Canada should look to California's Advance Clean Truck (ACT) rule for guidance on how to create a strong ZEV standard for MHDVs. The ACT Rule is the "first-of-its-kind requirement for electric trucks" and supports the Government of California's target of 100% ZE MHDV sales by 2045.[14] It applies a phased approach by requiring MHDV manufacturers to sell an increasing percentage of ZEVs over time. Annual sales targets start with model year (MY) 2024 vehicles and lead up to MY 2035, at which point 55% of class 2b-3

[9] John Axsen, Suzanne Goldberg and Michael Wolinetz, Accelerating the Transition to Electric Mobility in Canada: The case for a zero-emission vehicle mandate (Equiterre, 2017),10, 53-54. https://www.equiterre.org/sites/fichiers/repac_en.pdf

[10] Environnement et Lutte contre les changements climatiques, Zero Emission Vehicle (ZEV) Standard: Report on the Results of the First Compliance Period (2020), 7. www.environnement.gouv.qc.ca/changementsclimatiques/vze/bilan-norme-vze-periode-1-en.pdf

[11] Expressed as a percentage of ZEV models in California that were also available in Quebec.

[12] Statistics Canada, "Table 20-10-0021-01: New motor vehicle registrations." https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2010002101

[13] "Table 20-10-0021-01: New motor vehicle registrations."

[14] California Air Resources Board, "California Takes Bold Step to Reduce Truck Pollution," June 25, 2020. https://ww2.arb.ca.gov/news/california-takes-bold-step-reduce-truck-pollution

vehicles, 75% of class 4-8 straight trucks and 40% of class 7-8 tractor trucks sales will be required to be ZEVs.[15]

To date, five states have adopted the ACT Rule: Oregon, Washington, New York, New Jersey and Massachusetts. Together, these states adopting the ACT Rule account for 20% of the U.S. trucking fleet.[16] Maine, Colorado, Illinois, Connecticut, and Vermont are considering adopting the rule.

If Canada modeled an MHD ZEV standard in line with the ACT Rule, Table 1 demonstrates the estimated life cycle GHG emissions reductions resulting from new ZEV sales each year based on data from GHGenius, a life cycle assessment tool.

Table 1. GHG emissions reductions of BEVs relative to a diesel baseline stemming from new ZEV sales in Canada under the ACT rule

Vehicle Classes	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
2b to 3	4%	6%	8%	12%	17%	21%	25%	29%	34%	38%	43%	47%
4 to 8	8%	10%	12%	18%	27%	35%	45%	49%	54%	58%	63%	68%
8b	4%	6%	9%	13%	18%	22%	27%	31%	36%	36%	36%	36%

California's forthcoming Advanced Clean Fleets is another measure being developed to further accelerate ZE truck and bus adoption. The regulation would require fleets that are especially well-suited for electrification to transition to ZEVs even sooner than some of the targets outlined in the ACT rule. This includes public fleets and drayage fleets, as well as federal and high-priority fleets that earn gross revenue greater than $50 million or that control a fleet of 50 or more vehicles.[17] Under this regulation, subcontractors would be considered part of a company's fleet, meaning that fleets headquartered in other regions may also be required to comply with the regulation.[18]

There are ZE MHDVs in pre-production or production, or which are available for retrofit across all vehicle weight classes and segments in the U.S. and Canada according to data in the ICCT's

[15] California Air Resources Board, *Advanced Clean Trucks* (2021), 1. https://ww2.arb.ca.gov/sites/default/files/2021-08/200625factsheet_ADA.pdf

[16] Laura Bliss, "Six States Adopt Clean Truck Rule," *Transport Topics*, January 6, 2022. https://www.ttnews.com/articles/six-states-adopt-clean-truck-rule

[17] California Air Resources Board, *Advanced Clean Fleets* (2021), 1. https://ww2.arb.ca.gov/sites/default/files/2021-08/210817acffactsheet.pdf

[18] Sean Cocca, "Navigating Regulations in the Clean Fleet Landscape," *Advanced Clean Trucks News*, January 14, 2022. https://www.act-news.com/news/navigating-regulations-in-the-clean-fleet-landscape/

Race to Zero report and Calstart's Zero-Emissions Technology Inventory (ZETI) tool.[19,20] Table 2 provides a summary of 2020 data on the number and vehicle range of announced or available battery electric vehicle (BEV) and fuel-cell electric vehicle (FCEV) models in the U.S. and Canada as of 2020.

Table 2. ZE MHDV model availability and approximate range by class.

Vehicle Class	Available/ Announced BEVs	BEV Range	Available/ Announced FCEVs	FCEV Range
Class 2b-3	8	180 to 320 km	1	950 km
Class 4	11	140 to 250 km	-	-
Class 5-6	22	150 to 400 km	1	280 km
Class 7-8 rigid trucks	14	150 to 500 km	-	-
Class 7-8 tractor trucks	7	230 to 810 km	5	310 to 1210 km

Source: ICCT[21]

Model years affected

While the ACT Rule applies to MHDVs as early as model year (MY) 2024, we recommend a mandatory sales requirement be phased in starting from MY 2025/2026. Given that only eight years remain in the lead-up to the Government of Canada's 30% by 2030 ZE MHDV sales target, it will be critical to get started as soon as possible. Moreover, contributing to emissions reductions in the near term can have a more positive impact on Canada's carbon budget.[22] Should a more conservative sales percentage be determined for MY 2025/2026, this will likely require a sharper rate of increase in the percentage sales requirements leading up to 2030.

[19] Ben Sharpe, Claire Buysse, Jason Mathers and Victor Poudelet, *Race to Zero: How manufacturers are positioned for zero emission commercial trucks and buses in North America* (International Council on Clean Transportation, Environmental Defense Fund and Propulsion Quebec, 2020). https://theicct.org/publication/race-to-zero-how-manufacturers-are-positioned-for-zero-emission-commercial-trucks-and-buses-in-north-america/

[20] Global Commercial Vehicle Drive to Zero, "Zero-Emission Technology Inventory." https://globaldrivetozero.org/tools/zero-emission-technology-inventory/

[21] *Race to Zero: How manufacturers are positioned for zero emission commercial trucks and buses in North America*, 9.

[22] Isabelle Turcotte and Nichole Dusyk, *How to Get Net-Zero Right* (2021), 3. https://www.pembina.org/reports/how-to-get-net-zero-right.pdf

Setting interim targets that account for Canada's ZE MHDV market and suitability

The future expansion of the ZE MHDV market is dependent on the compatibility and suitability of zero-emission technologies in the MHDV market with fleet operational needs and requirements. Phasing in a mandated sales requirement for vehicle segments in Canada should be driven by a ZEV suitability analysis of Canadian MHDV market segments.

California's escalating sales percentages for each vehicle group under the ACT rule is a response of California Air Resources Board's (CARB's) truck market segment and suitability analysis and concerns regarding payload, range, towing capabilities, and charging/refuelling infrastructure availability. CARB evaluated the sales percentage that would be a good fit for electrification for each vehicle segment according to four vehicle operating characteristics: weight; route/range; charging/fuelling infrastructure access; and battery/vehicle space constraints.[23]

The assessment determined that vehicles that operate out of a centralized base, have predictable routes, have low daily range requirements (less than 100 miles per day), and are not weight/space constrained are best suited for electrification.[24] The analysis acknowledged that these percentages would be expected to increase as further advances are made in zero-emission technologies. ZEV technology continues to change rapidly and that is why we recommend the Government of Canada reevaluate the most appropriate vehicle segment groupings and how different segments should be treated. In addition to evaluating the availability and suitability of ZEV technologies and their associated infrastructure to various applications, other criteria to consider in the assessment of readiness includes the total cost of ownership of ZEVs versus internal combustion engine vehicles, how quickly manufacturers can scale up supply, as well as fleet bias towards ZEV technology and the impact of technology risk/reliability perceptions on rates of adoption.

Recent demonstrations, like the North American Council for Freight Efficiency's (NACFE) Run on Less Electric, demonstrate that electrification can be achieved sooner than previously expected.[25]

While there are contextual differences between California and Canada, vehicles used for local and return-to-base applications are already well-suited for electrification. Urban freight delivery vans and trucks, for example, are primed to reduce freight GHG emissions.

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[23] California Air Resources Board, *Appendix E – Zero Emission Truck Market Assessment* (2019), 2. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/appe.pdf

[24] *Appendix E – Zero Emission Truck Market Assessment*, 4.

[25] North American Council for Freight Efficiency, *Run On Less – Electric Report* (2022). https://nacfe.org/run-on-less-electric-report/

CALSTART's beachhead strategy for ZE commercial MHDVs identifies delivery segment as the second "wave" of electrification, after transit.[26] In a recent study, the Pembina Institute found that cargo vans performing door-to-door deliveries in the Greater Toronto and Hamilton Area travel only approximately 59 km and 8 hours per day.[27] Overall, even under scenarios where the most stressful conditions were modelled — vehicles operating in cold temperatures, with heavy payloads, and many stops — fully electric cargo vans are relatively easy to charge using Level 1 and Level 2 chargers, are cost-effective, and can significantly reduce emissions in comparison to internal combustion engine vehicles. The payback period of an electric cargo van was determined to be approximately 7-8 years, on average, which would typically fall within a fleet's ownership cycle.[28]

One-time reporting requirements for fleets

As a part of the Advanced Clean Trucks Rule, the California Air Resources Board requires fleet operators to participate in a one-time reporting exercise. The requirement applies to state and federal agencies with fleets, as well as any MHDV fleets owners or brokers operating out of California with more than 50 vehicles or a gross annual revenue greater than $50 million in 2019. Fleet operators will be required to report on various characteristics related to the size and makeup of their fleet, as well as operations.[29] Details outlined in these reports will provide the California Air Resources Board with the data needed to inform the development of the Advanced Clean Fleets rule, which will identify MHDV market segments that are well-suited for accelerated ZEV deployment. The Government of Canada could consider mandating a similar one-time reporting requirement here in Canada to inform future regulations and also to more accurately quantify the impact of current policies on Canada's GHG emissions reduction targets.

Governmental accountability and reporting

The Government of Canada should report on progress made under a ZEV standard at regular intervals no greater than every five years. Progress reports should highlight the estimated impact of ZEV adoption to date on Canada's GHG emissions reduction targets, evaluate

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[26] Dan Welch, Cristiano Facanha, Rob Kroon, David Bruil, Floris Jousma and Harm Weken, *Moving Zero-Emission Freight Toward Commercialization* (CALSTART, 2020), 24. https://globaldrivetozero.org/site/wpcontent/uploads/2020/12/Moving-Zero-Emission-Freight-Toward-Commercialization.pdf

[27] Maddy Ewing, *Making the Case for Electric Urban Delivery Fleets in the GTHA* (Pembina Institute, 2021), 9. https://www.pembina.org/reports/making-the-case-for-electric-urban-delivery-fleets-2021-04.pdf

[28] *Making the Case for Electric Urban Delivery Fleets in the GTHA*, 18.

[29] California Air Resources Board, *Large Entity One-Time Fleet Reporting – Reporting Guide* (2021). https://ww2.arb.ca.gov/sites/default/files/2021-01/LER-Guide.pdf

whether the intended outcomes are being achieved, and assess the pace of progress of ZEV adoption to determine if future targets are still reasonable, or need to be adjusted.

Align heavy-duty vehicle GHG emission regulations to the most stringent North American standards

When it comes to triggering the adoption of GHG emission-reducing technologies among MHDVs, GHG emission standards have shown to be a powerful driving force.[30] Canada has historically aligned its Heavy-Duty Vehicle and Engine Greenhouse Gas Emission Regulations with the United States' Environmental Protection Agency (EPA)'s Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines. The current standards in place (Phase 2) are expected to lead to GHG emissions reductions as high as 27% for tractor trucks, 24% for vocational vehicles and 16% for heavy-duty pickup trucks and vans by MY 2027 relative to a MY 2017 baseline.[31] In addition to the Phase 2 standards, the State of California also requires tractor-trailer owners operating in the state to adopt fuel-efficient tires and aerodynamic devices, as set out under Tractor-Trailer Greenhouse Gas Regulation introduced in 2008.[32]

Under U.S. President Biden's Executive Order "Strengthening American Leadership in Clean Cars and Trucks," the U.S. EPA has been directed to update the Phase 2 GHG standards for MY 2027 to MY 2030 HDVs.[33] The EPA plans to finalize new standards by December 2022 under the banner of the Clean Trucks Plan.[34]

We support Environment and Climate Change Canada's intention to update post-2025 regulatory requirements for MHDV manufacturers and importers in alignment with the most stringent standards at the U.S. or state level.[35] The next phase of regulations should include the

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[30] Maddy Ewing, *Costs, Benefits and Uptake of Trailer Fuel-Saving Devices in Canada* (Pembina Institute, 2021), 40. https://www.pembina.org/reports/2021-03-trailer-fuel-saving-devices.pdf

[31] *Final Second-Phase Greenhouse Gas Emissions Standards for Heavy-Duty Engines and Vehicles in Canada*, International Council on Clean Transportation (2018), 2. https://theicct.org/wp-content/uploads/2021/06/ECCC_Phase2_hdv_standard_20181109.pdf

[32] California Air Resources Board, "Tractor-Trailer Greenhouse Gas Regulation." https://ww2.arb.ca.gov/our-work/programs/ttghg

[33] Executive Office of the President, *Strengthening American Leadership in Clean Cars and Trucks*, Federal Register (2021). https://www.federalregister.gov/documents/2021/08/10/2021-17121/strengthening-american-leadership-in-clean-cars-and-trucks

[34] Environmental Protection Agency, *EPA Announces the "Clean Trucks Plan"* (2021), 3. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1012ON0.pdf

[35] Environment and Climate Change Canada, *A Healthy Environment and a Healthy Economy*, 20. https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/climate-plan/healthy_environment_healthy_economy_plan.pdf

CO_2 emission credit system with multipliers for ZEV technologies, as is in place in the current Phase 2 regulations, in order to incentivize the transition to ZE MHDVs.

Swiftly implement the Clean Fuel Standard regulations

In addition to a mandated sales requirement and more stringent GHG emission regulations, the forthcoming Clean Fuel Standard regulations (CFS) is another tool to incent the adoption of ZEVs. The CFS allows companies to generate credits by undertaking GHG emission-reducing activities along the life cycle of a transportation fuel. Businesses and fleets that transition to ZEVs will earn credits to help them pay for further decarbonization efforts. The CFS will further generate a market imperative to move to ZEVs.

3. Stronger investment strategy

Meeting Canada's target of 30% ZE MHDV sales by 2030 and 100% by 2040 will require significant investment to support the full transition of public and commercial fleets. Increased transparency and certainty on the long-term renewal of government financial incentives would provide businesses and fleet operators with the ability to procure vehicles and deploy the related infrastructure and systems, as well as build the confidence and expertise they need to plan their transition to ZEVs over time. That is why we recommend the federal government create a comprehensive investment strategy, including:

- incentives for ZEV charging and fuelling infrastructure for public and commercial entities
- incentives for vehicle procurements
- funding for skills training programs to develop the expertise and skills to manage and operate a new clean technology system
- mobilization of private sector investments
- demonstration projects
- support for clean tech innovation, research and development

All of these pieces are critical to growing a zero-emission economy in Canada.

Financial incentives

Financial incentives are crucial not only for reducing upfront vehicle costs and the deployment of charging infrastructure, but also to help spark the creation of skills training programs. In 2017, it was estimated that current ZEV financial incentives in Canada could increase the ZEV

domestic [36] could increase the new market share by an estimated 15 to 20 percentage points. Financial incentive policies are viewed by some researchers as the most effective demand-focused policy in encouraging ZEV uptake.[37]

It is critical that financial incentives precede the establishment of mandated ZEV sales requirements. Financial incentives can help prime the ZE MHDV market in advance of more stringent regulation. This approach has proven successful in California, where the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) program was introduced a decade prior to the establishment of the ACT rule in 2020.

Incentives for ZEV charging and fuelling infrastructure

Charging and fuelling infrastructure investments will be the backbone of a strong ZE MHDV strategy. Without a broad charging infrastructure network and a clean grid, confidence in ZEVs is unlikely to grow. The Pembina Institute recommends that the Government of Canada enhance and extend access and uptake for the Zero Emission Vehicle Infrastructure Program. The program should be inclusive and accessible for businesses of all sizes and types. This includes federal crown corporations, small, medium and large private sector businesses and not-for-profits. The program should be developed such that smaller players are not limited by size restrictions. The program should cover a broad range of eligible costs including those associated with electrical upgrades, as well as feasibility and planning studies for related capital work.

For ZE HDVs that travel long distances, the availability of public charging infrastructure will be critical. Currently, there is very little charging infrastructure that connects remote communities, which prevents the movement of used HDVs from one region to another. For example, the Yukon's shipping rebate for used passenger ZEVs was created because individuals were unable to drive used vehicles purchased in provinces like B.C. up to the Yukon.[38]

Incentives for vehicle procurements

The federal government should expand the iZEV program to include MHDVs. The program should cover the same portion of the cost of an MHDV as it currently covers for light-duty

[36] Stronger policy was defined as point-of-sale incentives of $6,000 per vehicle sale offered between 2018 and 2038. Source: Noel Melton, John Axsen, Suzanne Goldberg, Barbar Moawed and Michael Wolinetz, *Canada's ZEV Policy Handbook* (Sustainable Transportation Action Research Team, 2017), 29. https://sfustart.files.wordpress.com/2017/12/zev-policy-handbook_web.pdf

[37] *Canada's ZEV Policy Handbook*, 29, 58-59.

[38] Government of Yukon, "Apply for a Shipping Rebate for a Used Zero-Emission Vehicle." https://yukon.ca/en/driving-and-transportation/clean-energy-rebates/apply-shipping-rebate-used-zero-emission-vehicle

passenger vehicles and should be structured as a rebate. Electric vehicle subsidies can be phased out as technological improvements and increased manufacturing scale push the cost of ownership of electric vehicles closer to that of non-electric vehicles.[39] It is expected that battery electric truck prices will decrease notably over time, with some predicting even greater price reductions for hydrogen fuel cell trucks.[40] Some analysis suggests that certain classes of battery electric trucks may reach cost parity with diesel by as early as 2030.[41]

Skills training

Building a labour force with the appropriate competencies, skills and leadership qualities is a critical success factor and driver of Canada's transition to ZEVs. Industry workers, including mechanics, drivers, engineers, electricians, and fleet managers, need to adapt to changes in job requirements and may need to acquire new skills. Therefore, we recommend the federal government provide funding to support existing programs that advance skills training with practical sessions in charging infrastructure, electrical installation, mechanical installation, maintenance of MHDVs, EV fleet management, and creation and maintenance of fleet charging infrastructure.

Mobilization of private sector investments

We recommend the Canada Infrastructure Bank (CIB) be directed to play a leadership role in driving investments and financing for an integrated ZEV system that is suitable for public and private sector commercial purposes. The CIB should play a role in advising and supporting the development of a near- and long-term sustainable infrastructure and capital plan for ZEV-related infrastructure. It should also be prioritizing investments in major capital projects that drive ZEV technology and a clean transportation supply chain, including funding for demonstration projects and commercialization, alternative refuelling/charging infrastructure and ZEV manufacturing, and battery leasing. In addition, the government has a role to play in cultivating the conditions to support greater financing and loan options for businesses and fleet operators. Accessing the right financing for capital investments has been a barrier to ZE commercial fleet deployment.

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[39] Peter Slowik and Nic Lutsey, *Evolution of Incentives to Sustain the Transition to a Global Electric Vehicle Fleet* (International Council on Clean Transportation, 2016), iii-iv. https://theicct.org/sites/default/files/publications/EV%20Evolving%20Incentives_whitepaper_ICCT_nov2016.pdf

[40] *Comparison of Medium- and Heavy-duty Technologies in California: Part 2*, 4-5.

[41] North American Council for Freight Efficiency, "Medium-Duty Electric Trucks Cost of Ownership." https://nacfe.org/future-technology/medium-duty-electric-trucks-cost-of-ownership/

Demonstrations to build market confidence

Real world testing of publicly and privately owned ZE MHDVs across all vehicle classes and common duty cycles to demonstrate the operational capabilities of ZEVs under difficult Canadian conditions (e.g., cold weather, mountainous terrain) can help improve fleet operators' confidence in ZEV technologies.

Although ZEV technology exists today and there are examples of ZE MHDVs operating in some global and Canadian cities, the deployment of ZE MHDVs in Canada outside of the transit segment is still in its infancy. For example, there have yet to be any full-speed commercial ZE MHDVs deployed in Canada's largest city, Toronto.

In the short term, we recommend funding demonstration projects that:

- Align with CALSTART's Beachhead Strategy, prioritizing short-haul, return-to-base ZEV operations. This strategy maximizes potential GHG emissions reductions and solidifies the business case for electrification. This can mean supporting electrification projects for vehicles that travel 200 km/day or less.
- Operate in "high-potential geographic regions". The North American Council for Freight Efficiency (NACFE) and Rocky Mountain Institute (RMI) have identified both British Columbia and Ontario as high-priority regions for ZE MHDV deployments.[42] These provinces have attributes that are favourable to the deployment of ZE technologies, exhibit a need for ZE MHDVs, and provide support for ZE MHDVs.
- Are located in mid-sized to large municipalities with significant freight and goods movement volumes and where transportation has been identified by municipal governments as a priority for climate action.
    - NACFE and RMI identify Vancouver, the Greater Toronto Area, and Greater Montreal as cities with high potential for electric truck deployments.[43]
    - We also recommend demonstration projects in the Region of Peel, as it is one of Canada's most significant freight hubs and a strategic location for national goods distribution with an estimated $1.8 billion worth of commodities travelling to, from, and through Peel every day.[44] Approximately 68,000 vehicles transport goods

[42] Jessie Lund and Mike Roeth, *High-Potential Regions for Electric Truck Deployments* (North American Council for Freight Efficiency and Rocky Mountain Institute, 2020), 29. https://rmi.org/insight/high-potential-regions-for-electric-truck-deployments/

[43] *High-Potential Regions for Electric Truck Deployments*, 8.

[44] Region of Peel, *Goods Movement Strategic Plan 2017-2021* (2017), 2. https://www.peelregion.ca/pw/transportation/goodsmovement/pdf/goods-movement-strategic-plan-2017-2021.pdf

across the region on a daily basis.[45] The region is home to over 86,600 businesses involved in goods movement, ranging in size from small family trucking companies to large companies like Canadian National. The Region of Peel has taken a leadership role in goods movement planning and climate action, and was recently designated as a UN Regional Centre of Expertise.[46]

- Work with the Federation of Canadian Municipalities to advance truck electrification projects in the seven municipalities that are part of the Low Carbon Cities Canada (LC3) Initiative.

In the long term, we recommend ramping up demonstration projects to understand the operational capabilities of ZE heavy-haul and long-haul trucks (i.e., those weighing between 53,000 to 63,500 kg) as vehicles of this weight are not commonly used in other markets like the U.S.

Encouraging innovation

To advance the development and scale-up of ZEVs and ZEV-related infrastructure for various MHDV applications, it is critical that the federal government enhance and expand its support for research and development. The Government of Canada should accelerate collaborative research and development into zero-emission MHDVs, by working with cross-jurisdictional partners, including provincial and municipal governments, think tanks, academia, manufacturers, utilities, the trucking industry, and leading U.S. states. We recommend the Government of Canada develop a Research and Development Plan for vehicles, batteries, and charging infrastructure to ensure that technology is available to meet the needs of the MHDV industry and support the target of 100% ZE MHDV sales by 2040. Continued support for programs like the Strategic Innovation Fund and Climate Action and Awareness Fund will be critical.

Moving forward

We thank you for the opportunity to provide comments on the *Discussion paper for heavy-duty vehicles and engines in Canada: Transitioning to a zero-emission future*. We would be pleased to discuss any of our comments with you in more detail and answer any questions you have. We would also welcome the opportunity to engage regularly with Environment and Climate Change Canada as we conduct our ongoing research project to develop a national zero-emission MHDV

[45] Region of Peel, "Goods Movement Planning in Peel." https://www.peelregion.ca/pw/transportation/goodsmovement/

[46] Region of Peel, "Region of Peel Receives UN Designation," February 16, 2021. https://peelregion.ca/news/archiveitem.asp?year=2021&month=1&day=16&file=2021116.xml

strategy to achieve Canada's target of 30% zero-emission MHDV sales by 2030 and 100% by 2040.