

Infrastructure Deployment for Zero-Emission Medium- and Heavy-Duty Vehicles in Canada

Key measures to decarbonize trucks and buses

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This summary highlights the findings from our report, *Canada's Pathway to Net-Zero for Medium- and Heavy-Duty Trucks and Buses: Part 2: Charging and Refuelling Infrastructure*.

The introduction of zero-emission vehicles (ZEVs) has disrupted the transportation sector, which now enters a period of historic transformation, moving from the production of internal combustion engine vehicles to low-carbon, largely electric, ones. Market growth in ZEVs has shot upward, far surpassing projections — the International Energy Agency reports that global sales of electric cars grew by 55% in 2022, a record high of more than 10 million zero-emission passenger vehicles sold.

The market for zero-emission medium- and heavy-duty vehicles (ZE MHDVs) is off to a slower start and is in its early stages in Canada. Nevertheless, growth in sales is tracking upward. Electric MHDVs more than doubled in 2021 over 2020 volumes with sales totalling more than 14,200 in 2021. Notably, electric buses now represent 4% of the global bus fleet.

Truck and bus manufacturers are responding to the signals from the market, which strongly indicates imminent and rapid growth in the sector. Increasingly, significant investments are being directed to manufacturing capacity, and partnerships are forming between legacy automakers and ZE suppliers. Not only are truck and bus manufacturers preparing for increased demand, businesses and fleet operators have also announced ambitious sustainability and electrification commitments. Canada's electric bus sector in particular is experiencing impressive growth and Canadian producers now boast a 45% share of the North American electric bus market.

As markets for electric vehicles of all sizes heat up, successfully transitioning to zero-emission transportation hinges in part on the well-timed build-out of charging and refuelling infrastructure. The Government of Canada announced targets and timelines for sales of ZE MHDVs in its 2030 Emissions Reduction Plan (ERP). The sales target for 2030 is that 35% of all new MHDVs sold are zero-emission; the 2040 target is 100% of all new MHDV sales. Both private and public charging and refuelling stations will need to be scaled up significantly to

meet the energy requirements of the potentially exponential increase in the number of ZE MHDVs on the road.

Canada's 35% ZE MHDV sales target by 2030 will result in over 180,000 new ZE vehicles to our roads and more than 1 million by 2040.

Between 2015 and 2020, sales of ZE trucks and buses in North America had already grown more than 10-fold.¹ Modelling results show that if Canada meets its 2030 and 2040 ZE MHDV sales targets, approximately 156,000 ZE medium-duty vehicles (MDVs) and 32,000 ZE heavy-duty vehicles will be on the road by 2030, rising, respectively, to 852,000 and 195,000 by 2040.

Canada will need to build 2.5 to 3 times the charging and refuelling infrastructure currently in place to support the number of new ZE trucks and buses by 2030.

To fully capitalize on the opportunity to build out the next generation of modern transportation infrastructure, Canada will need to take the following actions:

- By 2030, 52,000 Level 2 (50 kW or higher) private fleet depot chargers will need to be installed. That number rises to 157,000 private fleet depot chargers by 2040 and 337,000 chargers by 2050.
- Approximately 19,600 Level 3 (100 kW or higher) chargers will need to be installed in private depots by 2030, increasing to 48,000 by 2040 and 87,500 by 2050.
- Approximately 6,500 Level 3 (100 kW or higher) public chargers will need to be installed by 2030, increasing to 34,000 by 2040 and 50,000 by 2050
- As many as 2,000 hydrogen stations (assumed to be mostly public) for refuelling will need to be installed by 2030, rising to 17,000 in 2040 and 30,000 in 2050.

While Canada has taken important steps forward, investments to date only cover 20% of the total cost of charging and refuelling infrastructure needed to support federal ERP 2030 ZE MHDV sales targets.

Our analysis finds that installing the charging and refuelling infrastructure needed to support the federal government's ERP 2030 ZE MHDV sales targets will incur total costs of about \$5 billion — additional investments will be required to support ZE MHDV sales targets post 2030. The federal government's commitment to date of about \$1 billion (\$680 million under the Zero Emissions Vehicle Infrastructure Program and \$500 million via Canadian Infrastructure Bank) is only 20% of the total investment needed to install sufficient charging infrastructure for ZE

¹ Ben Sharpe and Claire Buysse, *Zero-Emission Bus and Truck Market in the United States and Canada: A 2020 Update* (International Council on Clean Transportation, 2021). <https://theicct.org/publication/zero-emission-bus-and-truck-market-in-the-united-states-and-canada-a-2020-update/>

trucks and buses by 2030, assuming that the entirety of the \$1 billion commitment were to be invested in infrastructure for MHDVs. But the Zero Emissions Vehicle Infrastructure Program (ZEVIP) includes funding for electric car charging in multi-unit residential buildings, meaning that, in fact, the federal government's funding commitment will cover less than 20% of the cost for an adequate number of charging and refuelling stations intended for MHDVs.

To ensure that Canada's infrastructure network is installed at the scale and pace needed for a successful transition away from fossil fuels, the Pembina Institute has developed the ZeroX2040 national strategy, and proposes the following key recommendations. (For additional recommendations, see our report, *Canada's Pathway to Net-Zero for Medium- and Heavy-Duty Trucks and Buses: Part 2 Charging and Refuelling Infrastructure*.)

Recommendation #1: Extend the scope and increase funding for the Zero Emission Vehicle Infrastructure Program (ZEVIP).

Given the anticipated number of ZE medium-duty vehicles in operation by 2030, we can determine that, in all likelihood, as many as 200,000 chargers must be installed by 2029 to meet the energy consumption patterns of both light-duty vehicles and MHDVs. ZEVIP has been given a budget that will cover the cost of less than half that number — approximately 84,000 chargers. (It is worth noting when making this estimation that a charger for an electric MHDV can cost 10 to 25 times more than a charger for an electric light-duty vehicle. Consequently, the quantity of chargers ZEVIP will pay for depends in part on the kinds of chargers being installed.)

In addition to the uncertainty surrounding what kind of chargers — ones for passenger cars or ones for MHDVs — will be funded through ZEVIP, is the question over what period of time the funding will be spent. Given these uncertainties, we can only provide a range of what the ZEVIP funding will cover to underwrite the cost of MHDV-dedicated charging infrastructure, which could fall anywhere between 37% to 70% of the required financing for MHDV-dedicated stations to align with the number of ZE MHDVs anticipated to be on the road by 2025.²

We expect that charging requirements for MHDVs will increase exponentially post-2025. Best estimates are that, between 2027 and 2030, approximately \$2 billion will be needed to deploy sufficient station infrastructure for ZE MDVs. Separately, the cost to support ZE heavy-duty vehicles (HDVs) is estimated to exceed \$2 billion for installing chargers, with additional costs

² ZEVIP funding is available for chargers used for light-duty vehicles as well (e.g., slow Level 2 charger installed at multi-use residential buildings). Public chargers required by 2025 are estimated to be about 58,000 to 62,000 (roughly 48,000 Level 2 chargers, 5,000 public fast chargers for light-duty vehicles and 4,000-5,000 public fast chargers for ZE MHDVs). Under the ZEVIP, the federal government expects to install 84,000 chargers by 2029. We assume a quarter of the targeted 84,000 (that is, 21,000) will get installed by 2025. The federal funding thus effectively covers about 70% of the charging investment needed by 2025.

of nearly \$1 billion for hydrogen refuelling stations. Combining costs for MDVs and HDVs, we anticipate a total outlay of \$5 billion by 2030.

ZEVIP financing stipulates that it provide 50% of installation costs for each MHDV charging and refuelling infrastructure project eligible for funding. The balance, then, will need to be sourced from private funding. Assuming 50% (or \$2.5 billion) is covered by private investment, government support will need to cover the balance of \$2.5 billion. Our recommendation is that the federal government increase its funding envelope for ZEVIP from the current \$680 million and that the government quickly explore opportunities for new revenue sources to supplement this balance.

We further recommend that, in addition to support offered to electric cars, funding streams under ZEVIP differentiate between vehicle types. Charging needs differ between HDVs and MDVs, with ZE MDVs primarily relying on private depot infrastructure and ZE HDVs depending on access to publicly available, high-power charging and refuelling stations. In addition, a third dedicated revenue stream should be created for financing the infrastructure needs of small owner-operators whose businesses are both highly vulnerable to market fluctuations and chronically under-resourced.

Recommendation #2: Partner with provinces to identify, by 2025, additional locations along trucking corridors and arterial roads for installing charging and hydrogen refuelling stations.

In collaboration with provincial governments, municipalities, and utilities, the federal government can facilitate coordinated efforts to identify places along in-province trucking corridors and arterial roads for charging and refuelling stations for ZE HDVs. Our analysis shows that approximately 11,000 public charging and refuelling stations will be required by 2030, given the anticipated number of ZE HDVs on the road. Because it takes years to install stations, we recommend that, by 2025, geospatial maps of proposed public charger station sites (to be activated by 2030) be made publicly available. Further, provinces should develop plans detailing the types of chargers to be installed, their power capacity, activation dates, operational costs, and other useful information. Public availability of the charger location maps will allow drivers to optimize delivery routes.

Recommendation #3: By 2030, build out charging and refuelling stations for ZE HDVs every 60 km at strategic goods movement segments along the Trans-Canada highway and the Ontario-Quebec Continental Gateway.

Public charging and refuelling stations are a prerequisite for long-haul ZE HDVs to travel long distances. Prior to 2030, uptake of ZE HDVs will be low (less than 10% of new MHDV sales). Even so, governments must start building infrastructure straightaway in anticipation of rapid

uptake post-2030. In the short term, governments should prioritize the busiest corridors and highways.

To that end, the federal government needs to set targets for the maximum distance between charging and hydrogen refuelling points along highways that are heavily used. The government also needs to set targets for minimum charging capacity per station. Our recommendation is that the charging capacity of each station should be 1400 kW or higher, and that a charging station be built every 60 km along the Trans-Canada highway and the Ontario-Quebec Continental Gateway by 2030. For hydrogen refuelling stations, the distance between each station should be 150 km (or less), and each station should have refuelling capacity greater than 2 tonnes/day.

Conclusion

Canada's automotive sector is now contending with a marketplace that is undergoing an historic transformation. Resource extraction, supply chains, the labour force, and auto manufacturing centres are all being reconfigured. The transportation industry is central to the Canadian economy, and Ontario and Quebec's economies in particular, making the scope of the transition especially daunting.

Government and automakers alike are responding to the challenge, and the production of ZEVs has rapidly become a growth sector. With policies in place that are designed to encourage investment and uptake, demand is expected to spike in the near term. Because charging and refuelling infrastructure is key to managing this transition, Canada must be highly attentive to the increasingly urgent need to establish a clear and comprehensive strategy for infrastructure deployment — including mapping out where, how and when installation will take place. The expedient build-out of charging infrastructure is critical to ensuring that ZE MHDVs on the road in 2030 and beyond can rely on being able to recharge and refuel, and that investors can feel confident in allocating capital toward infrastructure and ZE fleets.

See also our companion report on a ZE MHDV sales standard, *Canada's Pathway to Net-Zero for Medium- and Heavy-Duty Trucks and Buses: Part 1: Zero-Emission Vehicles*.