Innovative Charging

Assessing fleet acceptance of shared and “as-a-service” models for electric trucks

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The Pembina Institute recognizes that the work we steward and those we serve span the lands of many Indigenous Peoples. We respectfully acknowledge that our organization is headquartered in the traditional territories of Treaty 7, comprising the Blackfoot Confederacy (Siksika, Piikani and Kainai Nations); the Stoney Nakoda Nations (Goodstoney, Chiniki and Bearspaw First Nations); and the Tsuut'ina Nation. These lands are also home to the Otipemisiwak Métis Government (Districts 5 and 6).

These acknowledgements are part of the start of a journey of several generations. We share them in the spirit of truth, justice and reconciliation, and to contribute to a more equitable and inclusive future for all.

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Executive summary

Charging infrastructure is essential for the rapid adoption of electric medium and heavy-duty vehicles (MHDVs). However, to accelerate charger deployment, there is a need to look beyond the most common forms of electric vehicle (EV) charging: private depot charging and public station charging. Innovative models such as shared charging and "as-a-service" charging could provide feasible alternatives by offsetting the high upfront costs of charging stations and supporting economically viable utilization rates.

In this report, we take the first step to creating a standardized typology of shared charging and "as-a-service" charging models for electric MHDVs, developing consistent model descriptions and designing a six-criteria framework to classify the different model types.

We also evaluate fleet operators' willingness to adopt shared and "as-a-service" charging models, being the first study globally to investigate this question. Interviews were conducted with a select group of short-haul and urban delivery fleet operators, largely based in British Columbia, Canada, who were in the early stages of EV adoption. Key findings from these interviews include:

- All interviewed fleet operators expressed willingness to adopt at least one shared or "as-a-service" charging model. The two most preferred shared charging models among interview participants were:
    - a charging point operator-led hub, where multiple fleet operators share a site, similar to a public charging station, but with exclusive access to the chargers for a fee.
    - peer-to-peer (P2P) shared charging, where hosts share their private chargers with guest fleets.
- Charging-as-a-Service (CaaS) was the preferred "as-a-service" model among private fleets. In this model, the fleet operator hires a third-party provider (e.g., ChargePoint, Flo) to install and manage the chargers for a monthly fee, usually at the fleet's private depot. It typically involves exclusive station access, and offers greater operational flexibility than a shared charging models, albeit at a higher fee.

Our research also identified key criteria that fleets perceive as barriers or motivators to adopting shared and "as-a-service" charging models. These include:

- **Cost contribution by fleets**: Fleets view shared charging as a way to cut infrastructure costs and earn revenue, with over two-thirds of the respondents willing to adopt such models if membership fees were 50% lower than their current fuel costs.

- **Charger location**: Fleets identified existing commercial truck parking lots and retail stores as top choices for shared charging locations, while also highlighting the need for new sites near Highway 1 in Burnaby, Coquitlam, Surrey and Langley.
- **Flexibility of usage, charger utilization and vehicle compatibility**: 70% of the fleets expressed willingness to charge two vehicles per charger per day in a shared charging arrangement, demonstrating opportunity for increased charger utilization. However, to encourage adoption, respondents recommended designing shared charging stations to increase vehicle compatibility, ensuring sufficient spacing for heavier-duty vehicles, and to reduce downtime during charging.
- **Third-party involvement**: While a few participants raised concerns around security and safety with partnership opportunities, most fleets prefer to partner with third-parties or other fleets to jointly manage charger operations, technical staff and other resources.
- **Policy**: The most requested policies were financial incentives for charging infrastructure that include support for shared charging, and the implementation of EV targets. Respondents emphasized the need to create a dedicated funding stream for shared electric MHDV charging infrastructure (or to carve out funding within existing programs), ensuring that operators considering shared models are not excluded from funding programs. Policy uncertainty was cited as a key barrier to adoption. Overall, fleet participants emphasized the need for policymakers to maintain supportive EV policies, facilitate data sharing and engage in smart planning in charger deployment.
- **Knowledge and awareness**: Almost all respondents agreed that greater awareness of shared and “as-a-service" charging models would increase their likelihood of adoption.

1. Introduction

Electric medium- and heavy-duty vehicles (MHDVs), also known as electric trucks, are an energy-efficient, zero-emission and fuel-cost-saving alternative to diesel MHDVs. As demand for electric trucks continues to rise, greater charging infrastructure is needed to support their adoption.

Currently, in Canada and elsewhere, two common models of electric vehicle (EV) charging are used by electric MHDV fleet operators:

- **Private depot charging**: Fleet operators install chargers at their home depot. These private chargers offer great flexibility, allowing operators to manage charging according to their duty cycles. Overnight charging at the fleet's own depot is typically the most economical and least restrictive option for return-to-base MHDV classes.
- **Public station charging**: Third-party operators, also known as charging point operators or CPOs (e.g., BC Hydro, FLO, ChargePoint, Hydro Quebec), install and operate the public charging stations. These stations typically offer several high-power Level 3+ chargers (100 kW or higher), which can recharge electric MHDVs within minutes. Some MHDVs like long-haul trucks typically do not make daily returns to a depot and must rely on public chargers. Fleets with private depot charging may also need to occasionally access public charging.

The deployment of both charging models remains slow, largely due to the challenges they face.[1]

Private depot charging currently has high upfront costs, limiting its feasibility to larger-sized fleet operators. The fleet operator bears the full upfront costs of purchasing, installing, operating and maintaining the charging station. Installation costs for on-site chargers vary widely, ranging from $65,000 for a 50 kW charger with overnight capacity for one truck to $1 million for a 1 MW fast charger that can charge multiple vehicles.[2]

[1] Auditor General of Canada, "The Zero Emission Vehicle Infrastructure Program—Natural Resources Canada," *Reports of the Commissioner of the Environment and Sustainable Development* (2023), 10. https://www.oag-bvg.gc.ca/internet/docs/parl_cesd_202311_08_e.pdf

Chandan Bhardwaj, *Helping Fleets Charge* (Pembina Institute, 2024). https://www.pembina.org/pub/helping-fleets charge

[2] Marie Rajon Bernard, Alexander Tankou, Hongyang Cui, and Pierre-Louis Ragon, *Charging solutions for battery electric trucks* (International Council for Clean Transportation, 2022), 3. https://theicct.org/publication/charging-infrastructure-trucks-zeva-dec22/

Public station charging, on the other hand, has been slow to roll out, particularly for high-capacity stations capable of serving electric MHDVs.[3] Representatives from industry (e.g., charging station operators, charging infrastructure equipment providers, utilities) argue that public charging currently faces a weak business case for further expansion.[4] The limited uptake of electric MHDVs, and in turn, the low utilization of existing public chargers means that they sit idle for most of the day and fail to generate enough revenue to offset electricity costs. Charging station operators are therefore hesitant to invest in additional chargers.

As a result, there is a pressing need to find alternative innovative models for electric MHDV charging that address these challenges. These innovative charging models must offset the high upfront costs of charging stations and maintain high utilization rates to be economically viable. Innovative charging models can be classified into two categories: shared charging models and "as-a-service" models.[5] Both categories of models are available in several different formats, which are discussed later.

Shared charging models can increase utilization rates, enable cost and risk sharing, and support more effective placement of facilities (i.e., locating chargers where they are most likely to be used).[6] Our recent study, *Planning to Charge*, found that shared charging can reduce electric MHDV charging infrastructure costs by 15% in the Greater Toronto and Hamilton Area over the next five years.[7] Similarly, "as-a-service" models like Charging-as-a-Service offer fleet operators a way to avoid high upfront costs by using a third-party network service with flexible payment plans.

That said, there are gaps in our understanding of alternative charging models for electric MHDVs. The existing literature is limited and scattered, presumably because only a few real-

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[3] Office of the Auditor General of Canada, Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada: The Zero Emission Vehicle Infrastructure Program—Natural Resources Canada (2023), 10. https://www.oag-bvg.gc.ca/internet/docs/parl_cesd_202311_08_e.pdf

Chandan Bhardwaj, *Locating Charging Stations: Identifying zones for early deployment in the GTHA using real-world truck data* (Pembina Institute, 2025). https://www.pembina.org/pub/locating-charging-stations

[4] Chandan Bhardwaj, *Charging Solutions for Electric Fleets* (Pembina Institute, 2024). https://www.pembina.org/blog/charging-solutions-electric-fleets

[5] In this document, we define shared charging as a hybrid model between public and private charging. It involves dedicated or shared charging stations that are not fully open to the public. Multiple fleets use a common charging station that is typically located at an oft-visited, easily accessible site outside a fleet's private depot. Access is restricted to fleets that jointly invest capital in the station or share its operating costs.

[6] Energy Saving Trust, "Case study – First Bus shared charging." https://fleetdecarbonisationtoolkit.energysavingtrust.org.uk/t/charging-infrastructure/case-study-first-bus-shared-charging/

Alicia Bennett, "First Charge: How First Bus and Fuuse deliver the benefits of shared infrastructure, https://fuuse.io/blog/first-charge-and-fuuse-benefits-of-shared-infrastructure

[7] Chandan Bhardwaj, *Planning to Charge: Electric truck charging infrastructure and electricity demand in the GTHA, (*Pembina Institute, 2026), https://www.pembina.org/pub/planning-charge

world models are currently in operation. Additionally, a standardized typology, with consistent model descriptions, and a unifying framework for classifying different models is missing in existing literature.

To fill these knowledge gaps, we conducted a jurisdictional scan and interviews with industry experts and fleet operators to identify examples of shared and "as-a-service" charging models that may exist globally. Drawing on this research, we developed a six-criteria framework to classify and assess different charging models. Using this framework, we describe each model and accompany it with a real-world case study illustrating its successful application. As a novel contribution of this study, we also engaged with fleet operators in Canada to assess their willingness to adopt these shared and "as-a-service" charging models. Through semi-structured interviews, we examined the following:

- Fleet operators' familiarity with shared and "as-a-service" charging models.
- Barriers and motivators that fleet operators perceived in adopting these models.
- Fleet operators' willingness to adopt the identified charging models.

2. Criteria for classifying charging models

Currently, there are few well-established, market-tested business use cases globally for shared and "as-a-service" charging models for electric MHDVs. Since most models are at the pilot stage and remain low in uptake, the "rules of the game" have yet to be firmly established. The structures of these models are therefore fluid and evolving, often overlapping in ways that make it difficult to clearly distinguish between them.

To improve our understanding of these models, we devised a simple six-criteria classification framework outlined below, building on Axsen and Pickell-Barr's study.[8] In that work, the authors conducted interviews with British Columbia fleets to better understand their views about EV adoption, and identified criteria such as financial considerations, operational fit, etc. We modify their criteria to suit our study needs. A comparative summary of charging models across the six criteria is presented in section 5.

These criteria, as well as the subsequent model descriptions, are framed from the fleet operator's point-of-view. The models may look slightly different from the perspective of a charging station operator. For instance, the nature of the business model can vary depending on whether the operator owns the land or if it is provided by a site host like a municipality. However, from a fleet operator's point-of-view, the station is simply a site owned by a third party, and the ownership details matter less.

Criteria

1. **Cost contribution by fleets**: The share of charging costs that fleets must cover to gain access differs according to the model. In public charging, fleets typically pay only for the electrical energy they draw from the charger. In contrast, shared charging requires fleets to contribute more to the costs to secure guaranteed scheduled access to charging. This may include partial payment for charger installation, rent for dedicated charging space and membership or subscription fees.

2. **Flexibility of usage**: The degree of control a fleet operator has over when, how, and for how long they use the charging station. Levels of flexibility range from unlimited access

[8] Jonn Axsen and Julianne Pickrell-Barr. "What drives fleets? Organizations' perceived barriers and motivators for alternative-fuel vehicles," *Transportation Research Part D: Transport and Environment* 132 (2024). https://www.sciencedirect.com/science/article/pii/S1361920924001779

to dedicated charging spaces at any time to scheduled access during fixed timeslots. It may also include the ability to right-size chargers (i.e., align charger capacity and quantity) to meet demand, with the option to upgrade as the fleet expands. Generally, flexibility of usage is directly proportional to a fleet's cost contribution — greater financial contribution ensures greater flexibility of usage.

3. **Utilization**: The extent to which chargers are being used. Low utilization occurs when chargers are used for a few short sessions followed by long periods of inactivity, reducing the cost-effectiveness of a charging station. Shared charging models can help increase utilization but the degree of utilization feasible differs for each model. Some models allow multiple vehicles to share a charger through scheduled time slots, ensuring high utilization. However, careful planning is needed to ensure that increased utilization does not compromise flexibility of usage for fleets.
4. **Charger location**: The siting of the charging station relative to where a fleet operator parks their vehicle overnight. This affects the feasibility of certain models, such as those initiated or led by a third party.
5. **Vehicle class compatibility**: The suitability of the charging model to handle different vehicle classes, given that MHDVs vary significantly in terms of their use cases, daily distances travelled and energy needs.
6. **Third-party involvement**: The degree to which a charging model relies on a third party to initiate or lead the charging infrastructure.

3. Shared charging models

3.1 Charging point operator-led hub

A charging point operator (CPO)-led hub is similar to a public charging station with multiple fleet operators sharing the site, but unlike public stations, fleets enjoy exclusive, dedicated access to chargers. A third party, usually a CPO (e.g., BC Hydro, Charge Point, Flo), owns the station and covers the upfront costs of installation, operation and maintenance, enabling fleets to simply drive in and charge their trucks.[9]

The CPO (or alternatively the hub operator) may offer fleets various payment options, such as pay-as-you-go pricing based on electricity consumed during charging or a flat monthly fee.[10] Alternatively, fleet owners may have the option to rent bays.[11]

Fleet operators benefit from dedicated scheduled charging that eliminates the upfront and ongoing maintenance costs of owning chargers, while saving time avoiding queues at public stations. This model is also cost-effective. By hosting multiple fleets, costs are spread out across several companies over time and charger utilization rates remain high.[12]

[9] Act News, "Financing a Successful Transition to Electric," March 4, 2024. https://www.act-news.com/news/financing-a-successful-transition-to-electric/

[10] Financing a Successful Transition to Electric."

Christian Hinton, "Terawatt Infrastructure Opens EV Charging Hub in Rancho Dominguez," *Fleet Equipment*, May 21, 2025. https://www.fleetequipmentmag.com/terawatt-ev-charging-hub/

[11] Michael Joseph, "Shared Charging Sites: Accelerating the ZEV Market and Delivering Public Benefits," *CALSTART*, November 2024, 3. https://calstart.org/wp-content/uploads/2024/11/241113-SCD-Paper.pdf

[12] "Financing a Successful Transition to Electric."

Case study: Lysara

Lysara, a pan-European energy infrastructure platform, provides integrated parking and charging facilities for all types of MHDV fleets along established freight routes and in prime locations. As the hub operator, Lysara purchases land in strategic locations, funds site upgrades and hardware installation, secures access to grid capacity and designs energy systems for commercial fleets.[13]

By securing anchor tenants such as Starbucks or Amazon that commit to minimum four-year leases, Lysara is able to attract investment capital, purchase sites and carry out electrification while ensuring investor returns.

Variations

Adjustments can be made to the standard CPO-led hub model to further improve charger efficiency and utilization.

- **CPO-led hub with occasional public access**: The hub operator provides public access during off-peak daytime hours or overnight. During public charging hours, the hub will operate similarly to public charging stations.
- **CPO-led hub under shared ownership**: The hub operator shares ownership with other stakeholders (e.g., municipalities). This approach could be particularly effective in remote communities. For instance, smaller towns and cities can attract hub operators by offering land; contributing funding for hub development; or committing to charge municipally owned vehicles at the local hub, thereby serving as an anchor fleet. Two versions of this approach are presented below.
    - *Site-host owned, operator-managed hub*: A stakeholder such as a municipality hosts the multi-tenant hub on their land, covering both capital and operational expenses, while a CPO manages operations.
    - *Operator-owned and -led, stakeholder-backed hub*: A CPO installs, owns and operates the multi-tenant hub on land provided by the municipality. The operator covers capital and operational costs.[14]

[13] Transport Scotland, "Challenge 2: New financial models supporting decarbonisation." https://www.transport.gov.scot/publication/hgv-decarbonisation-pathway-for-scotland-zero-emission-truck-taskforce/challenge-2-new-financial-models-supporting-decarbonisation/

[14] BC Hydro Power Smart and Powertech, EV Fast Charging: Design & Operational Guidelines (2024), 7. https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/power-smart/electric-vehicles/ev-fast-charging-design-operational-guidelines-2024-feb.pdf

3.2 Multi-fleet cooperation

The multi-fleet cooperation model involves several fleet operators contributing to a shared funding pool to cover the cost of installing and operating the charging infrastructure.[15] Collaborating fleets hold joint ownership and may opt to deploy a single shared station or multiple chargers along key overlapping routes.

Compared to the CPO-led hub model, this arrangement requires a higher cost contribution from participating fleets but offers greater autonomy over station location and usage. Shared upfront costs make it significantly more affordable than an independent installation. When enough fleets participate, this model also ensures high charger utilization.

Case study: I-10 Consortium

The I-10 consortium is a shipper-carrier collaboration between Microsoft and PepsiCo, and logistics powerhouses Maersk, DB Schenker, AIT Worldwide and others.[16] These shippers and carriers are partnering to develop a shared charging infrastructure pilot for long-haul battery-electric trucks along the I-10 corridor between Los Angeles, California and El Paso, Texas. EV solutions provider Terawatt Infrastructure was brought in to install, operate and maintain ultra-high-power, rapid charging infrastructure (i.e., Megawatt Charging System capable chargers) at six of its charging hubs.[17] The goal of the pilot is to raise awareness, generate real-world data and facilitate knowledge sharing to accelerate the uptake of electric MDHVs among other shippers and carriers.[18]

3.3 Business-fleet collaboration

A business-fleet collaboration involves a large business funding or subsidizing the installation of charging stations to support the electric MHDVs operated by its fleet partners (e.g., transport or logistics companies), ensuring that they have efficient and reliable access to charging

[15] Nick Nigro and Matt Frades, *Business Models for Financially Sustainable EV Charging Networks* (Center for Climate and Energy Solutions, 2015), 49. https://www.c2es.org/wp-content/uploads/2015/03/business-models-ev-charging-infrastructure-03-15.pdf

[16] Keiron Greenhalgh, "PepsiCo, Maersk, Others Team Up on Electric Truck Pilot," *Transport Topics News*, September 2024. https://www.ttnews.com/articles/electric-truck-coalition

[17] PR Newswire, "I-10 Shipper-Carrier Coalition Adds New Members Including C.H. Robinson, DHL Supply Chain, Electrolux Group," April 28, 2025. https://www.prnewswire.com/news-releases/i-10-shipper-carrier-coalition-adds-new-members-including-ch-robinson-dhl-supply-chain-electrolux-group-and-ikea-302437970.html

[18] Smart Freight Centre, *Powering Forward: Scaling Electric Truck Projects* (2025), 4. https://smart-freight-centre-media.s3.amazonaws.com/documents/Report_I10LessonsLearned_Final_04072024_ExternalReport.pdf

infrastructure.[19] The business and its fleet operators may jointly determine station locations, with the business potentially hosting the charging stations on its property. These stations can be operated by the host or a third-party provider but access remains limited to the business and its fleet partners.

Under this model, fleet operators gain access to charging stations at no cost or subsidized rates. Businesses stand to benefit as investments in charging infrastructure can advance their sustainability goals, provide opportunities for sustainability-focused branding and potentially unlock new revenue streams. For instance, large automakers (e.g. Tesla) can use this strategy to offer exclusive charging access to fleet customers purchasing commercial vehicles, potentially boosting EV sales. Similarly, large retailers can attract environmentally conscious customers by highlighting their role in the EV transition.

Case study: IKEA Canada

IKEA Canada installed four commercial EV charging stations at its Ottawa location, operated by ChargePoint. This initiative enabled its last-mile delivery partner, GoBolt, to use EV delivery trucks for local home deliveries.[20] In light of its success in contributing to the company's goal of achieving 100% zero-emission home deliveries, IKEA added 25 EV chargers for transport service providers across 14 retail stores and a distribution centre in Ontario and Quebec. The stations were funded by IKEA and by the federal government through the Zero-Emission Vehicle Incentive Program.[21]

3.4 Peer-to-peer shared charging

The peer-to-peer (P2P) shared charging model is common among light-duty EV users, allowing charging station hosts to share their private chargers with nearby EV owners. A digital platform is typically used to schedule charging sessions, manage the logistics and handle payment.[22] Foresta is one such Canadian platform that facilitates shared charging services between a charger host and an EV driver.[23] It allows fleets, multi-use residential buildings, and hospitality

[19] *Business Models for Financially Sustainable EV Charging Networks.*

[20] IKEA, "IKEA Canada leads the way as a sustainable retailer by investing in its electric vehicle charging infrastructure," media release, April 18, 2023. https://www.ikea.com/ca/en/newsroom/corporate-news/ikea-canada-leads-the-way-as-a-sustainable-retailer-by-investing-in-its-electric-vehicle-charging-infrastructure-pubaded23d0/

[21] Emma Jarratt, "Ikea Canada expands its EV charging footprint by 25 stations at five locations," *Electric Autonomy*, April 18, 2023. https://electricautonomy.ca/charging/2023-04-18/ikea-ev-charging-network-ontario-quebec/

[22] Julie Perrissel, "Peer-to-Peer EV Charging: How It Works and Its Benefits," *ivygo*, July 22, 2024. https://ivygo.com.au/peer-to-peer-ev-charging-how-it-works-and-its-benefits/

[23] Foresta Energy, "Drive ROI From Every kWh." https://www.foresta.energy/

and commercial site operators to list idle chargers on Foresta's network. EV drivers who join the network can pre-book a dedicated charging spot at a time convenient to them. The charger hosts, in turn, can earn revenue from previously underutilized chargers.

MHDV fleet charging depots or stations can adopt this model by making their chargers available to fleets travelling on nearby routes, generating extra revenue for host fleets.[24] Moreover, guest fleets benefit from reduced wait times and fewer detours. The P2P model also improves charger utilization.

MHDV fleet associations could implement this model using software to connect fleet operators. For example, in the United Kingdom, the Association of Fleet Professionals is planning an online platform that will enable fleets to share their EV charging facilities with other businesses.[25] Alternatively, fleet operators could share charging opportunities through more informal ways. For example, a host fleet operator could coordinate shared access to its station for operators lacking chargers by leveraging existing networks (e.g., British Columbia Trucking Association).

Case study: First Bus

First Bus, a large bus company in the U.K., has charging stations at multiple sites in the country. Partnering fleets have exclusive access to the chargers during the day, when First Bus vehicles are away from the depot. A variety of payment options are available to meet the needs of the partnering fleets.[26]

[24] "Shared Charging Sites: Accelerating the ZEV Market and Delivering Public Benefits."

[25] Gareth Roberts, "Shared EV charging platform for fleets moves step closer," *Fleet News*, September 2024. https://www.fleetnews.co.uk/news/shared-ev-charging-platform-for-fleets-moves-step-closer

[26] First Bus, "First Bus and Openreach announce powerful new Electric Vehicle charging partnership," media release, January 11, 2024. https://news.firstbus.co.uk/news/first-bus-and-openreach-announce-powerful-new-electric-vehicle-charging-partnership

4. "As-a-service" models

4.1 Charging-as-a-Service

In a Charging-as-a-Service (CaaS) model, the fleet operator typically hires a charging station operator for the installation and management of charging stations.[27] The CaaS provider installs charging stations at the fleet operator's chosen location, which is usually their private depot, and delivers tailored charging services for a monthly fee.[28] Unlike shared charging models, where multiple different fleets share the same charging site, CaaS typically involves a single fleet operator having exclusive access to the entire station. This means that the membership fee for exclusive station access is likely higher than fees incurred under the shared charging models. However, with exclusive access, the CaaS model offers much greater operational flexibility compared to a shared ownership model.

Compared to private depot charging, where fleet operators bear the full upfront cost of charger installation, CaaS lets fleet operators avoid substantial upfront costs, as payment is distributed over multiple years through subscription or membership fees, while still retaining the benefits of on-site charging.[29]

Case study: ChargePoint

ChargePoint, a CaaS provider operating in Canada, offers businesses one-, three- and five-year contracts with flexible options for the deployment of EV chargers.[30] While ChargePoint retains ownership, businesses avoid high upfront costs and gain other benefits such as site planning and preparation, charger installation and ongoing maintenance and monitoring of the stations — all for a predictable monthly fee.

[27] Terawatt Infrastructure, "What is Charging-as-a-Service (CaaS) and how can it add value to your growing EV fleet?" 2024. https://www.terawattinfrastructure.com/blog/what-is-charging-as-a-service-caas-and-how-can-it-add-value-to-your-growing-ev-fleet

[28] Stephen Lapp, "What Is Charging as a Service?" *Advanced Energy*, April 10, 2024. https://www.advancedenergy.org/news/what-is-charging-as-a-service

[29] NovaCHARGE, "A Quick Look at EV Charging as a Service," August 14, 2023. https://novacharge.net/ev-charging-as-a-service/

[30] ChargePoint, "ChargePoint as a Service." https://www.chargepoint.com/en-ca/products/cpaas?srsltid=AfmBOoq-pgxs9QkwAdLQnRUdPoY4C5uZ5m3-HCpNGIjhwslSwUR481pe

4.2 Truck-as-a-Service

Under the Truck-as-a-Service (TaaS) model, the TaaS provider, typically an electric truck manufacturer, rents or leases out their trucks to fleets.[31] Fleet operators pay TaaS providers to use an electric truck, usually at a fixed rate per kilometre.[32] The TaaS provider may continue to own the trucks for the initial years of the contract, though the fleet and TaaS provider may arrange for a transfer of vehicle ownership later. The TaaS provider typically also offers exclusive parking spots with charging access for the electric trucks.

Case study: Volvo-on-Demand

Volvo-on-Demand is a usage-based TaaS program available at 59 Volvo Trucks Certified EV dealerships across the U.S. and Canada. Businesses can use a Class 8 Volvo VNR electric truck at a fixed per-mile rate paid monthly.[33] Volvo-on-Demand subscription also includes access to the company's most comprehensive truck service package, as well as options to bundle insurance, route planning and optimization, and exclusive charging at Volvo Trucks Certified EV dealerships.[34]

4.3 Battery-as-a-Service

The Battery-as-a-Service (BaaS) approach reduces both charging time and dependence on charging infrastructure by relying on battery swaps, which take just a few minutes.[35]

In this model, fleet operators swap depleted batteries for fully charged ones. A third-party BaaS provider owns the batteries and offers them for a subscription fee or on a pay-per-use basis. In Japan, Ample Inc., a BaaS provider, is using its battery swapping technology to replace batteries for Mitsubishi Fuso's eCanter electric truck.[36] Ample's battery swapping stations offer a gas-

[31] PacLease, "Electric Trucks," https://www.paclease.com/our-trucks/electric-trucks

[32] Traton Group, "What is Truck-as-a-Service?" February 19, 2025. https://traton.com/en/newsroom/stories/what-is-truck-as-a-service.html

[33] Volvo, "Volvo Trucks North America and Volvo Financial Services Launch Volvo on Demand to Accelerate Battery-Electric Vehicle Adoption," media release, May 2020, 2024. https://www.volvotrucks.us/news-and-stories/press-releases/2024/may/volvo-trucks-north-america-and-volvo-financial-services-launch-volvo-on-demand-to-accelerate-battery-electric-vehicle-adoption/

[34] "Volvo Trucks North America and Volvo Financial Services Launch Volvo on Demand."

[35] Rio Tinto, "Rio Tinto and China's State Power Investment Corporation partner to trial battery swap truck technology," November 6, 2024. https://www.riotinto.com/en/news/releases/2024/rio-tinto-and-chinas-state-power-investment-corporation-partner-to-trial-battery-swap-truck-technology

[36] Ample, "Next: Trucks. Announcing Our Partnership with Mitsubishi Fuso Truck and Bus Corporation." https://ample.com/2023/07/25/next-trucks-announcing-our-partnership-with-mitsubishi-fuso-truck-and-bus-corporation/

station-like experience, allowing electric trucks to receive a fully charged battery within five minutes. Similarly, QIJI Energy has built and operates battery swapping stations for heavy-duty trucks in China.[37]

Case study: State Power Investment Corporation

As of 2022, State Power Investment Corporation, a Chinese-based grid company, has built over 100 battery swapping stations and deployed more than 10,000 heavy-duty trucks equipped with battery swapping technology for mining operations across the country. The corporation plans to expand its fleet to 200,000 heavy-duty trucks and build 4,000 battery swapping stations by 2025.[38]

Ample, "Yamato, Let's Electrify Last-Mile Delivery." https://ample.com/2024/08/15/yamato-lets-electrify-last-mile-delivery/

Battery swapping technology allows EVs to replace depleted batteries with fully charged ones in roughly 3 to 5 minutes, typically using automated stations to remove and replace batteries. A quick video explainer is available at International Council for Clean Transportation, "How it works: Battery swapping for commercial vehicle fleets in China." https://theicct.org/vid-battery-swapping-for-commercial-vehicle-fleets-in-china-june24/

[37] CATL, "China's First Battery Swapping Trunk Line for Heavy-Duty Trucks Put into Operation." https://www.catl.com/en/news/6107.html

[38] Bernard et al., *Charging solutions for battery electric trucks*, 6.

"Rio Tinto and China's State Power Investment Corporation partner to trial battery swap truck technology."

5. Comparative summary of models

Charging models	Cost contribution by fleet	Flexibility of usage	Utilization	Charger location	Vehicle class compatibility	Third-party involvement
Shared charging models						
CPO-led hub	Rent for secure access to charger spot	Medium, given dedicated bays	Medium	Operator determined	Suitable for all classes, more apt for heavy trucks	Yes, typically led by charging network operator
Multi-fleet cooperation	Partial contribution to upfront installation costs	High	High	Fleet determined	Suitable for all classes	Not essential, typically fleet-led
Business-fleet collaboration	Upfront costs borne by business	Medium	Medium	Business site	More common for urban delivery trucks	Not essential, typically business-led
Peer-to-peer (P2P)	Upfront cost by host fleet, no upfront cost by guest fleet, membership fee for usage	Medium	High	Host fleet site	Commonly lighter trucks	Not essential, host fleet-led
"As-a-service" models						
Charging-as-a-Service (CaaS)	No upfront installation cost, monthly service fee	High	Low to medium	Fleet determined	Suitable for all vehicle classes	Yes
Truck-as-a-Service (TaaS)	No upfront installation cost, monthly service fee	Low, as the truck is third-party owned	Medium to high	Third-party determined	Suitable for all classes, more common for long-haul trucks	Yes
Battery-as-a-Service (BaaS)	No upfront installation cost, monthly service fee	High	High	Third-party determined	Suitable for all classes, more apt for heavy trucks	Yes

6. Fleet operator interview findings

Semi-structured online interviews were conducted with fleet operators and managers to document their experiences and perspectives on shared and "as-a-service" charging models for electric MHDVs. Interviews typically lasted 30 to 45 minutes and included a mix of open-ended and closed-form questions. The interview questions built on Axsen and Pickell-Barr's methodology exploring fleet motivators and barriers.[39] Interviews assessed fleet operators' familiarity with the charging models and explored perceived barriers and motivators to adoption. Participants were also asked to rank adoption criteria by importance and discuss their willingness to adopt different charging models.

Sixteen interviews were conducted between October 2025 and February 2026 with participants from municipal, government, and small and large private fleets. The economic sectors represented by the interviewed fleets included local government (public administration), healthcare, vehicle rental and leasing, transportation and warehousing, educational services, and arts, entertainment and recreation (classified as per the North American Industry Classification System, or NAICS). All interviewees operated vehicles that had duty cycles of less than 300 km/day and were used primarily for short-haul and urban delivery operations.

This study is not without limitations. First, the study sample size was small.[40] Second, although outreach was conducted via email and LinkedIn, only those who responded were interviewed (around 20%), indicating potential self-selection bias. Third, the study focused on fleets in a single Canadian province, British Columbia. This jurisdiction was selected because of its higher EV adoption rates and supportive policy environment, increasing the likelihood of engaging early adopters who could provide informed responses. Fleet opinions about shared and "as-a-service" charging models may vary in regions that are slower to adopt EVs. Fourth, because the study focused on easier-to-electrify MHDV segments (e.g., short-haul and urban delivery trucks), the sample did not include fleets operating heavy-duty long-haul trucks. Findings should be interpreted with these limitations in mind.

[39] "What drives fleets? Organizations' perceived barriers and motivators for alternative-fuel vehicles."

[40] Our sample size is comparable to that in the MHDV survey on zero-emission vehicles conducted by Natural Resources Canada in 2023. The NRCan survey sample included 42 respondents from British Columba, and only 5% of fleet operators reported that they currently have zero emission vehicles in their fleet. Abacus Data, *Medium and Heavy-Duty Vehicles (MHDV) Fleet Awareness, Knowledge and Attitudes Related to Zero-Emission Vehicles (ZEVs) Survey,* prepared for Natural Resources Canada (2023). https://publications.gc.ca/collections/collection_2023/rncan-nrcan/M4-234-2023-eng.pdf

6.1 Charging model acceptance among fleet operators

Overall, fleet operators expressed a positive willingness to adopt shared and "as-a-service" charging models. All respondents indicated they would be likely to adopt at least one model if the opportunity arose, with 70% reporting they were "very likely" and 30% "somewhat likely." This finding reflects a high level of interest in alternative charging models among fleets that are early EV adopters. This high level of acceptance appears to be supported by strong awareness. All respondents were familiar with at least one shared or "as-a-service" charging model. Familiarity with the benefits of the different models is likely to further encourage adoption.

Across fleets, the two most preferred shared charging models were the CPO-led hub model and the P2P model. Eighty per cent of respondents expressed a likelihood to adopt either model (Figure 1). There are different reasons for each model's popularity. Some interviewees view the CPO-led hub model as the dominant option as truck electrification increases, because it eliminates the need for additional infrastructure investments by relying on the services of a charging network operator. For instance, one participant noted that if EV charging was required for 10 to 20% of their total fleet, they would consider third-party owned charging models such as the CPO-led hub model. With the P2P model, fleets with available chargers see it as an opportunity to generate revenue. For example, a municipal fleet shared that the "P2P model could be an interesting additional revenue source as they could open their chargers to other fleets."

The CaaS model was the third-most preferred, with 60% respondents indicating they would consider adopting it. Different organization types exhibited varying preferences for the CaaS model. All private fleet interviewed, with two exceptions, reported being very likely to adopt the CaaS model. The first exception cited insufficient parking spaces for trucks as a key reason for not considering CaaS. The second exception, a small private fleet, noted that CaaS did not make financial sense for them. Instead, they "would prefer a model with greater ownership, allowing them to generate carbon credits and earn revenue by selling them." In comparison, preferences for the CaaS model were mixed among government-owned fleets, with a few expressing interest while others did not.

Other charging models were relatively less preferred, with only half or fewer participants indicating a likelihood of adoption. Notably, while multiple fleets expressed interest in the BaaS model, this interest did not translate into a willingness to adopt. Respondents identified the limited availability of BaaS models in Canada as a primary reason for their reluctance.

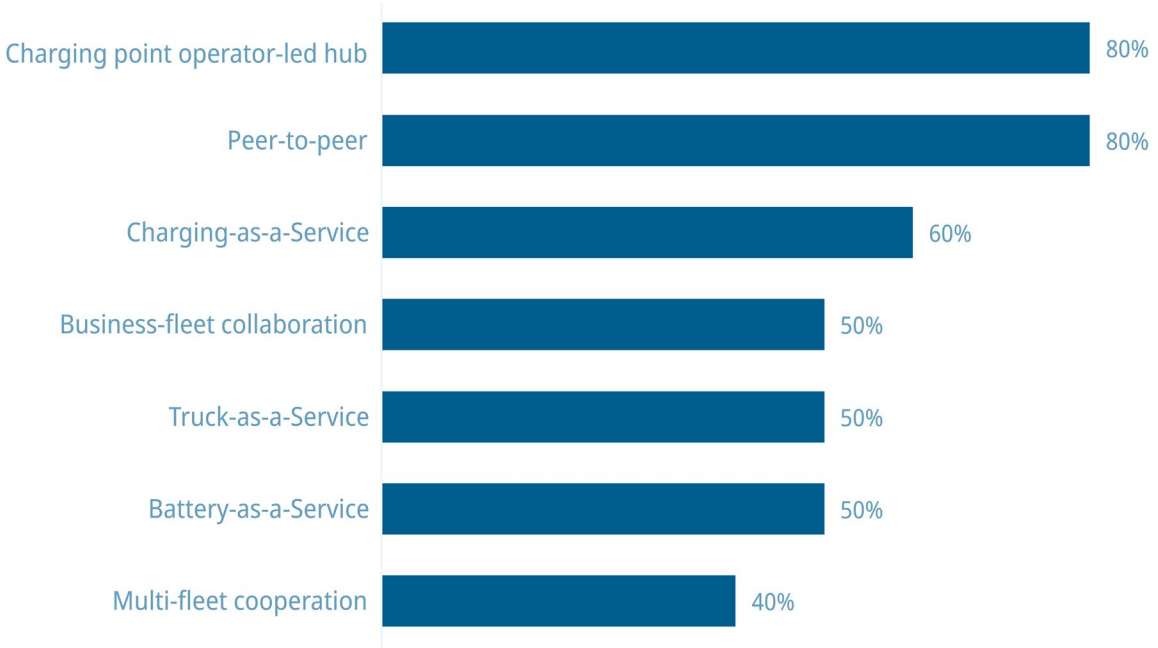

Figure 1. Share of fleet operators indicating likelihood of adopting different charging models

6.2 Motivators and barriers to model adoption

During the interviews, the six-criteria framework (outlined in section 2) was used to identify key motivators and barriers influencing fleet operators' acceptance of the various shared and "as-a-service" charging models. Figure 2 illustrates how fleets rated the importance of each criterion when selecting among the models.

Financial considerations

Financial considerations (i.e., cost contributions by fleets) emerged as the most important motivator and barrier to adoption. All participants rated this criterion as either "very important" or "somewhat important." Most private fleets viewed cost factors as "very important" in determining which charging models would be suitable for adoption, while some public and municipal fleets considered it only "somewhat important."

Cost contributions such as high membership fees can act as a barrier for some fleets. However fleet operators also highlighted long-term cost-savings as a key motivator for adopting shared and "as-a-service" charging models. For example, a private fleet participant said that models like the CPO-led hub or P2P would enable them to "save money from not having to put their own chargers in." Among respondents, 70% expressed willingness to adopt shared charging models if the membership fees were 50% lower than their current fuel costs. An additional 20% reported they would consider the models if fees were moderately lower, around 5 to 10% below their

current fuel and maintenance costs, while 10% indicated they would adopt even if fees were slightly higher.

Charger location

Charger location was the second most important criterion, with 80% of respondents rating it as either "very" or "somewhat" important. Some fleet operators expressed concern about distant overnight charging spots. Reflecting this view, a municipal fleet participant explained that their vehicles park overnight in their own work yard and relocating them could introduce security concerns. In contrast, fleets that work with owner-operator drivers and do not centrally manage vehicle parking were generally more open to varied charger locations.

Respondents identified existing commercial truck parking lots and large retail sites as the most suitable locations for shared charging hub placement.[41] Participants shared that many small fleets (with less than four vehicles) park their trucks overnight at existing commercial parking lots (e.g. truck parks in Surrey), often having to pay a monthly rent (~$700) for dedicated parking spots. Some suggested that setting up shared charging sites (e.g. CPO-led hubs) at existing or new parking lots would be ideal as charging hubs could also address fleets' parking needs.[42] Certain participants, such as private fleets working with owner-operators, suggested potential new sites just off Highway 1 in Burnaby, Coquitlam, Surrey and Langley.

Flexibility of usage, charger utilization, and vehicle compatibility

Flexibility of charger use, charger utilization rates, and vehicle compatibility were also important considerations for adoption, with 70% of fleet participants ranking them as "somewhat" or "very" important. One private fleet emphasized the need for flexible charger usage, noting that they "don't want operations to change due to charging." Another participant raised concerns that existing chargers do not have enough space to accommodate MHDVs. Fleets see shared charging as an opportunity to increase charger utilization, with 70% of the respondents reporting that they are comfortable charging two vehicles per charger per day in a shared charging arrangement. However, to encourage adoption, respondents recommended designing shared and "as-a-service" charging stations with adequate space for heavier vehicles and optimal charger power to minimize downtime.

[41] While selecting commercial parking lots as a top preference, some respondents advised careful planning, noting that, "many of these trucks need clearance, and regular parking spaces would not be sufficient for maneuvering these vehicles."

[42] City of Surrey, "Surrey looks to expand truck parking with new proposed site on City-owned land," April 2025. https://www.surrey.ca/news-events/news/surrey-looks-expand-truck-parking-new-proposed-site-city-owned-land

Third-party involvement

Third-party involvement, including potential partnership opportunities, was rated as "somewhat" or "very" important by 60% of respondents. While some fleet operators expressed concerns about partnering with other fleets due to safety or security reasons, many others viewed third-party involvement as a key motivator. To illustrate, a municipal fleet noted that they "only have so much staff capacity and would need to partner with third-parties or other fleets" to set up charging stations. Partnership opportunities have also been found to support charging model adoption among fleets in other regions. Di Foggia's survey of Italian fleet managers found that 80% of respondents perceived partnership and the involvement of third-party charging network operators as a motivator.[43]

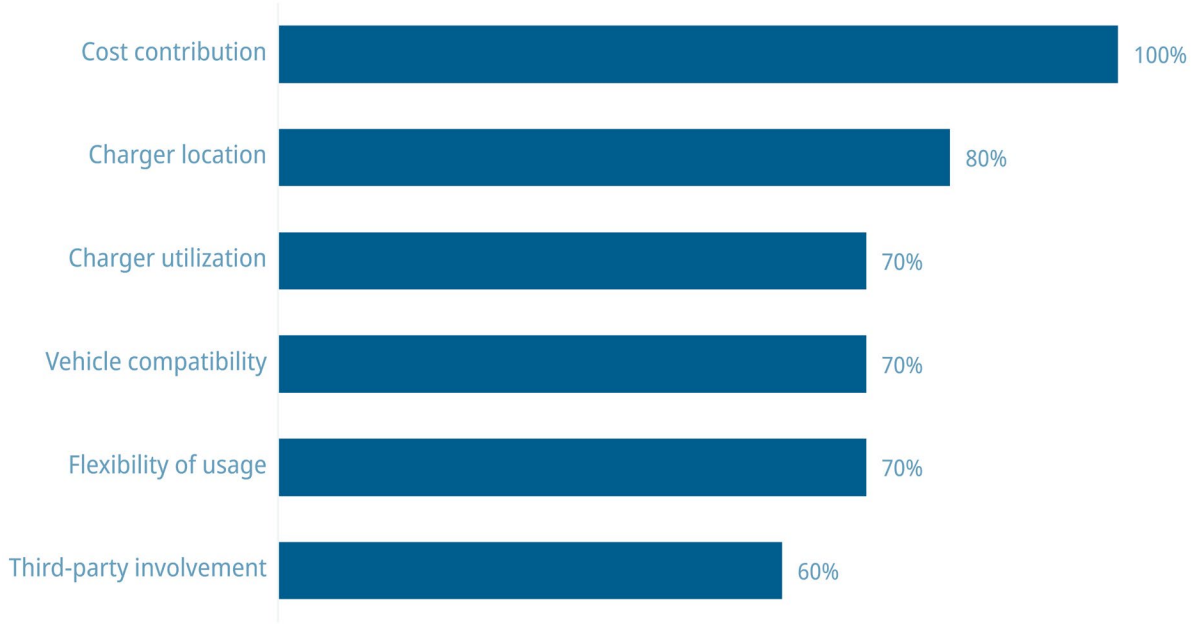

Figure 2. Key criteria influencing charging model choice, by percentage of respondents rating each as "very" or "somewhat" important

6.3 Additional motivators for model adoption

Fleets identified additional motivators that may drive the adoption of shared or "as-a-service" charging models, including policy support, knowledge and awareness of different charging models, and internal support for sustainability initiatives.

[43] Giacomo Di Foggia, "Drivers and challenges of electric vehicles integration in corporate fleet: An empirical survey." *Research in Transportation Business & Management* 41 (2021). https://www.sciencedirect.com/science/article/pii/S2210539521000109

Policy support

All participants identified policy support as a key external motivator. Financial incentives for shared and “as-a-service" charging models were the most requested form of policy support, a view expressed by 70% of the respondents.

Discussions with fleets highlighted an important policy gap. Existing financial incentives for charging infrastructure across jurisdictions, such as the Government of Canada’s Zero Emission Vehicle Infrastructure Program, focus largely on public charging stations, requiring publicly accessible chargers at all times.[44] This requirement acts as a constraint for shared charging models, which rely on the promise of restricted or exclusive access to chargers. Hence, fleets recommended that financial incentives should include support for shared charging models. Fleets did not ask for financial incentives for the “as-a-service" charging models.

The second most requested policy was the implementation of EV targets (or the EV mandates), with 40% of the respondents supporting EV adoption targets, and expressing concern about the uncertainty created by recent policy rollbacks. For example, a private bus operator noted, “Both federal and provincial governments initiated mandates around electrification, and now they’re both backing off somewhat and I think that’s a mistake.” A municipal fleet participant echoed this concern, “Climate targets did help push for chargers, but those are being relaxed and we don’t know what the next steps will be.”

Fleets also identified additional areas for policy improvement. A few participants called for further expediting the regulatory approval process needed for charger installation, noting that obtaining permissions for grid connections can sometimes be lengthy and complex. Some participants highlighted the need for better land-use planning. For instance, one municipal fleet shared that they would like policymakers to explore “ways to make public land more easily accessible for charging.” A few participants cautioned that uniformly deploying chargers everywhere could lead to under-utilized chargers, particularly in the near term.[45] Instead, they suggested prioritizing the deployment of shared charging hubs in zones with high truck traffic.[46]

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[44] Government of Canada, “Zero Emission Vehicle Infrastructure Program funding for owners and operators of charging and refuelling infrastructure.” https://natural-resources.canada.ca/energy-efficiency/transportation-energy-efficiency/zero-emission-vehicle-infrastrusture/zero-emission-vehicle-infrastructure-program-0

[45] Supporting this concern, a study by the National Renewable Energy Laboratory shows that 50% of EV chargers in the U.S. are under-utilized, accounting for only 10% of the charger needs. Brennan Borlaug et al. “Public electric vehicle charging station utilization in the United States,” *Transportation Research Part D: Transport and Environment* 114 (2023). https://doi.org/10.1016/j.trd.2022.103564

[46] Our recent report offers a data-informed approach for identifying locations charging station deployment in the Greater Toronto and Hamilton Area. Chandan Bhardwaj, *Locating Charging Stations: Identifying zones for early deployment in the GTHA using real world truck data* (Pembina Institute, 2025), https://www.pembina.org/pub/locating-charging-stations

Overall, fleet participants emphasized the need for policymakers to maintain supportive EV policies, to facilitate data sharing, and to engage in smart planning in charger deployment.

Knowledge and awareness

Increasing awareness about shared and "as-a-service" charging models emerged as a key enabler of adoption, with 90% of respondents identifying it as important. Overall, respondents demonstrated strong awareness of charging models. A 2023 survey by Natural Resources Canada found that 50% of fleet respondents lacked awareness of how an electric MHDV is fuelled.[47] In contrast, interviews in this study revealed a positive shift, with all participants demonstrating awareness of one or more charging models.[48] Webinars and EV-focused events were cited by fleet operators as key sources of information on EV technology. One participant, a small private fleet owner, explained, "EV focused events are helpful as we get to hear about real-world EV adoption from peer fleet operators."

Commitment to environmental sustainability

Commitment to environmental sustainability within organizations also emerged as a motivator. For 40% of the fleets, their organization's commitment to sustainability and electrification was the primary factor driving both electric MHDV adoption and the use of innovative charging models.

[47] *Medium and Heavy-Duty Vehicles (MHDV) Fleet Awareness, Knowledge and Attitudes Related to Zero-Emission Vehicles (ZEVs) Survey*.

[48] Though, we acknowledge that our sample was dominated by early EV adopters based in British Columbia, a jurisdiction which is a leader in EV adoption.

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