CANADA'S eMHDV ECOSYSTEM

GAPS

An industry view by EMC's MHDV Working Group

2024 update

ELECTRIC MOBILITY CANADA
ACCELERATING ELECTRIC TRANSPORTATION

MOBILITÉ ÉLECTRIQUE CANADA
ACCÉLÉRER L'ÉLECTRIFICATION DES TRANSPORTS

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CANADA'S eMHDV ECOSYSTEM

TOP GAPS

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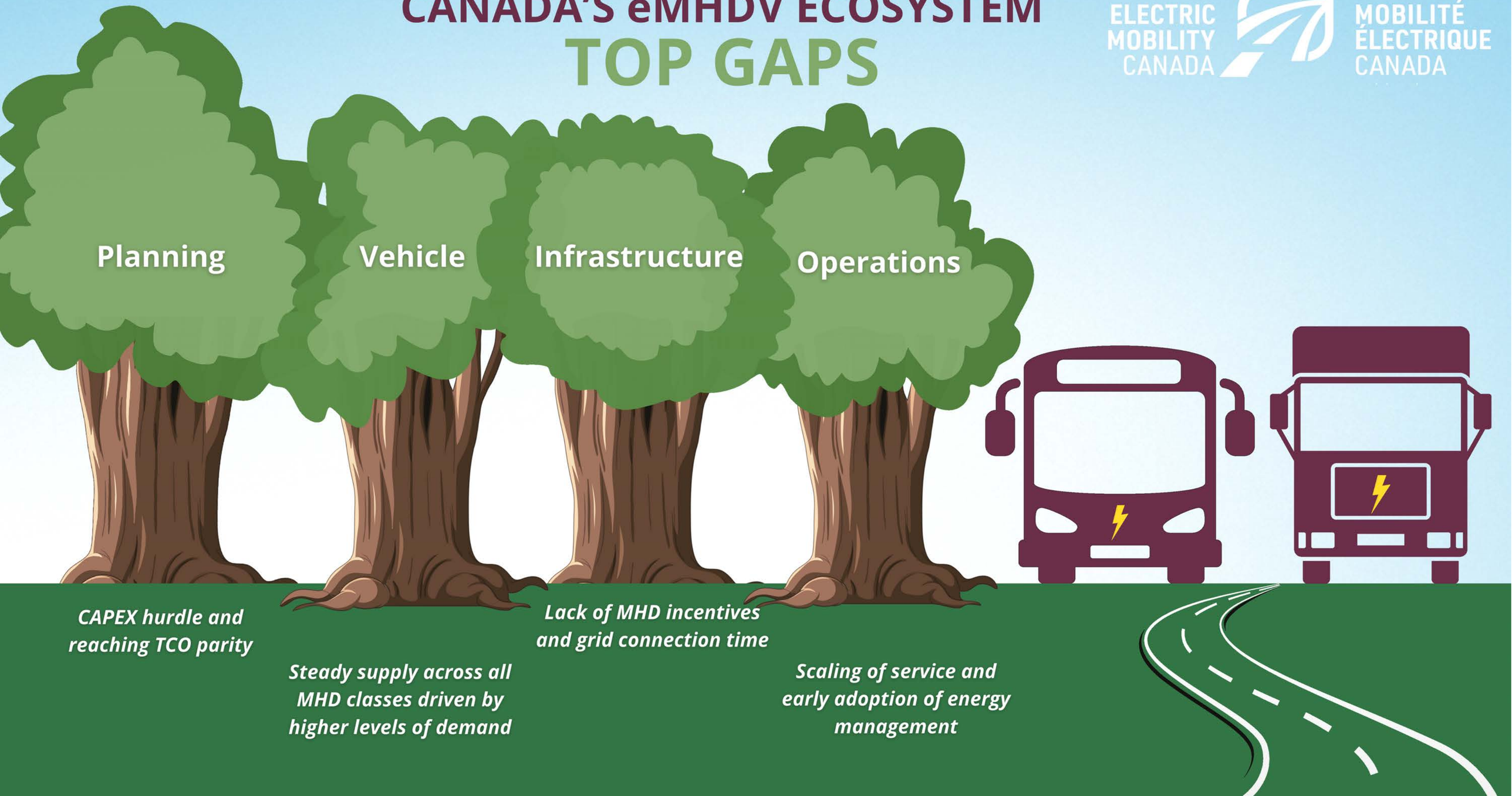

PRIORITY MHDV RECOMMENDATIONS

KEY BARRIER: <u>Capital Costs</u>

Continue and expand access to ZE MHDV incentives. Ensure support for both charging equipment and power capacity upgrades.

- **Vehicles**: Simplify application processes for existing incentives and expand incentive offerings for vehicles.
- **Charging infrastructure**: Focus immediate funding on depot / return-to-base charging, with an outlook to funding en-route and/or shared installations as industry aligns on standards in the coming years. Include flexibility for different business models, allowing for both CAPEX and as-a-service options.

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PRIORITY MHDV RECOMMENDATIONS

KEY BARRIER: <u>Lack of data for TCO</u>

- **Canadian TCO calculator:** Work with a credible Canadian academic institution or economic consultancy to produce an ZE MHDV Total Cost of Ownership calculator[1] that includes communication and awareness tools related to regulatory credit programs like CFR and BC LCFS, and V2G/energy storage opportunities.
- **Data-sharing:** To broaden industry knowledge, make public data-sharing a requirement for providing funding to fleets.

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PRIORITY MHDV RECOMMENDATIONS

KEY BARRIER: Lack of data for TCO (cont'd)

- **CFR Education:** Provide on-demand educational assets on CFR benefits for fleets.

KEY BARRIER: Grid connection timeline

- **Faster grid connection:** Work with provinces to enable regulatory reform to allow proactive system upgrades by utilities.
- **Forecasting:** Fund utilities to establish real-time capacity maps so that stakeholders will know, when planning, when their properties will be ready to support which level of load.

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PRIORITY MHDV RECOMMENDATIONS

KEY BARRIER: <u>Vehicle supply</u>

- **ZE MHDV sales mandate:** Move forward to establish a ZE MHDV standard that ensures Canadian fleets have equal access to ZE MHDVs as US fleets do in ZE MHDV / ACT States.

KEY BARRIER: <u>Insufficient planning capacity</u>

- **Fund planning:** Continue to fund fleet electrification planning with special consideration for smaller fleets.
- **Leadership training:** Support the creation of leadership training programs for fleet managers, sustainability officers, procurement officers and facility managers.

ELECTRIC MOBILITY CANADA

MOBILITÉ ÉLECTRIQUE CANADA

A. PLANNING: Top gap is CAPEX hurdle and TCO parity

A1. Business case

Current state	Ideal state	Solutions - filling the gap
Despite existing incentives, CAPEX hurdle remains.	Total cost of ownership (TCO) parity (or beyond) and solutions to bridge higher CAPEX.	Continue and increase incentives on vehicle and infrastructure.
CFR: Lack of clear benefit & impact for fleet owners.	CFR impact is well-understood and leveraged by fleet owners, utilities, and other industry stakeholders.	Conduct awareness campaign on CFR with fleet owners and publish calculation examples.
Lack of data on vehicle technology risks and residual value makes it difficult to calculate the business case and secure financing.	Seamless fleet electrification with clear data on technology risks and strong financing support.	a) Build an open database comparing (TCO) of Electric Vehicles (EVs) to Internal Combustion Engine vehicles (ICE) b) Provide ready-to-use business case templates tailored for different industries. c) Develop software tools for efficient design and cost optimization. d) Advocate for a safety net from the CIB regarding vehicle and battery residual values.
Utility rate structures make predicting cost of ownership complex, particularly for fleets spanning multiple utility service territories.	TCO tools are available, and account for utility-specific rate structures.	Ensure TCO tools include utility-specific rate structures.
Grid benefits (esp. for school buses) cannot be factored into the business case due to technology, regulation, and industry maturity.	Grid benefits can be included in business cases.	Fund programs to allow fleets to monetize grid benefits of V2G.
Lack of strong evidence for reduced maintenance costs.	Robust maintenance cost savings data supports a lower TCO for MHD ZEVs.	Encourage sharing of maintenance cost data and methods to backstop risk if lower maintenance costs do not materialize.
Low adoption of Low Emission Zones in Canada and thereby no impact on business case.	Low Emission Zones help tip the business case in favour of electrification.	Assess effectiveness of Low Emission Zones in the UK on MHD EV demand as potential policy lever.
Lack of data on vehicles and chargers makes identifying suitable applications challenging.	MHD vehicle & charger data readily available.	Fund a central repository of data on MHD vehicles and chargers available in the Canadian market.
Fleets often lease their operating space, making it hard to invest in permanent charging infrastructure.	Infrastructure design makes it easier to move.	Fund innovation in modular / semi-permanent infrastructure design.

A. PLANNING: Top gap is CAPEX hurdle and TCO parity

A2. Capacity for planning and procurement

Current state	Ideal state	Solutions - filling the gap
Fleets lack planning capacity in this new multi-disciplinary domain.	Fleets have easy access to expert resources both internally and externally, and mature planning tools and methods.	Continue funding for planning to help fleets get started and build capacity.
Funding application process is complex, and approvals can take many months, which requires added resources over potentially extended periods of time.	Funding is easy to apply for and quick to receive, requiring little internal resources or, funding easily available for such supporting resources.	Simplify application processes, reduce approval times, and consider point-of-sale rebates or approaches which are less cumbersome for fleets.
Buying decisions take a long time due to high number of internal stakeholders involved, newness and rapid change of technology.	Buying decisions are made quickly by widely available experts running an efficient and well-understood process, with mature technology and robust data sets.	Showcase examples of fleets who have matured their internal processes (e.g. transit fleets) and continue to fund sharing of data and case studies to increase confidence.
Smaller fleets may be at risk of lagging behind due to lack of resources to plan, apply for funding and make buying decisions.	Small fleets electrify at the same rate as large ones.	Determine whether small fleets indeed face greater hurdles and, if so, create a resource centre / program providing access to additional resources to plan, apply for funding and make buying decisions (e.g., fleet and grid assessment tools, grant-writing assistance, RFP templates).

A. PLANNING: Top gap is CAPEX hurdle and TCO parity

A3. Grid planning

Current state	Ideal state	Solutions - filling the gap
Utilities receive information on fleet plans late in the process, leaving insufficient time to implement upgrades if required.	Utilities are involved early on, and both fleets & utilities have early understanding of grid upgrade required.	Utilities have a proactive strategy to engage early with fleets (e.g. BC Hydro best practices guide, Fleet advisory service).
Fleets lack awareness of potential multi-year wait for grid upgrade at desired site.	Fleets can easily access a map of grid upgrade times.	Fund study to map grid capacity / upgrade times which fleets can access in planning.
Fleet and facility operators lack guidance and process for alternative infrastructure options that may accelerate grid connection such as battery storage or portable chargers.	Locations where battery storage can help accelerate are clear so business cases can be put forth.	Fund study and provide guidance for where battery storage can accelerate fleet electrification.

A4. As-a-service

Current state	Ideal state	Solutions - filling the gap
Current deployments are CAPEX-funded pilots with heavy government funding; in the absence of government funding, unclear how CAPEX will be funded.	Successful deployments of Truck- or Transportation-as-a-Service (TaaS) and/or Charging-as-a-Service (CaaS) enable operators to electrify while easing CAPEX and OPEX burdens.	Ensure funding streams allow for both CAPEX and as-a-service models.
Lack of OPEX funding due to current focus on CAPEX may result in operational risk; 70% of skills of fleet manager are different and as-a-service models can help mitigate risks.		Consider including uptime requirements and resulting OPEX needs in funding streams.

B. VEHICLE: Top gap is supply across all MHD classes driven by higher levels of demand

B1. Incentives & policy

Current state	Ideal state	Solutions - filling the gap
Federal: No sales regulation in Canada for ZE MHDVs, however following incentives in place: a) Incentives for Medium- Heavy-duty Zero-Emission Vehicles (iMHZEV) b) Zero Emission Transit Fund (ZETF)	Ideally the ZEV decision no longer requires incentives, however in the interim, incentives must be continued and improved.	As interim, we need a MHD ZEV Sales mandate: Conclude consultations on regulatory design and implementation, with special focus on school buses. Also: a) ZETF: simplify application process and reduce turnaround time; b) iMHZEV: increase amount per vehicle and consider demand-side regulation for government and large fleets similar to California ACF; c) Consider that tax credit mechanisms come with a long wait-time and do not help address the need for upfront cash.
Provincial incentives / policies in place only in BC and Quebec: a) Québec: Écocamionnage, Programme d'électrification du transport scolaire / school bus operators mandated to purchase a ZEBs (Nov 2021) + Consultation to come on MHD ZEV Mandate b) BC: Go Electric Rebate/ CVP, EV Ready Fleets/CleanBC Go Electric fleets program/Go Electric School Bus Program + Consultation on MHD ZEV Mandate (June 2023)	Provincial incentives available across the country.	Provincial incentives / programs to be deployed, especially in Ontario.
Limited procurement incentives for local content (e.g. Ecocamionnage in Québec).	Expanded procurement incentives for local content.	Consider how incentives can drive local economic benefit.

B. VEHICLE: Top gap is supply across all MHD classes driven by higher levels of demand

B2. Vehicle supply chain

Current state	Ideal state	Solutions - filling the gap
Due to inconsistent demand and lengthy period of time from OEM investment to cash (long return period), EV OEMs can find it hard to commit to suppliers, worsening supply chain risk.	Stronger demand and better cash flows ease the financial risk for OEMs (and creates more financial stability in those entities).	Continue demand stimulation and other programs to help provide financial stability including cash flow (e.g., operating capital loans).
Current supply of vehicles is fragmented, impacting the ability to scale sales and service coverage.	Robust supply & demand across all classes makes Canada a competitive market so that companies invest in manufacturing footprint expansion, and robust sales and service coverage.	Continue demand stimulation until market reaches scale.
Full battery supply chain (including all elements required for battery packs) is at an early stage.	A robust, local battery supply chain.	Continue efforts to localize battery supply chain; assess if battery second-life and recycling can help address materials supply.
Restrictions on import/export with Europe.	Vehicle & component import/export is easy with Europe, leveraging CETA.	Examine the Comprehensive Economic Trade Agreement (CETA) to find common ground between Euro and Canadian regulations to ease import and export restrictions.

B3. Awareness

Current state	Ideal state	Solutions - filling the gap
Lack of understanding of the fact that many applications can be electrified with currently available MHD vehicle models.	Strong understanding of applications that can be electrified with currently available technology.	Run awareness campaign on availability of MHD vehicles and applications which can be most readily electrified.
Concerns about introduction of new technologies (including battery management).	New technology is well-understood and widespread, including in the perception of all stakeholders.	Continue training and awareness as the technology is evolving to manage changes.

C. INFRASTRUCTURE: Top gap is lack of dedicated MHD incentives and grid connection time

C1. Grid connection

Current state	Ideal state	Solutions - filling the gap
MHD connections treated equivalently to other load connection requests; utilities are regulated to be reactionary for capacity upgrades of distribution system, which are several times longer than commercial fleet electrification timelines.	Utilities proactively upgrade capacity so they are ready when MHD fleets need to connect.	Regional jurisdictions enable regulatory reform to allow for proactive system upgrades by utilities with focus on geographies with most potential to reduce GHGs.
Utilities lack clarity on where demand will arise.	Utilities have market intelligence to efficiently target system upgrades.	Fund temporal & spatial MHD-driven demand forecast for top geographies and utilities (e.g. EPRI).
Process to contact utility and request connection upgrade is lengthy.	Utilities provide a quick connection process for fleets.	Reduce time for grid connection (via funding incentives / requirement / new prioritization).
Lack of skilled electrical trades to support increased number and scale of grid upgrades.	Plentiful skilled labour in the utility sector.	Ensure gaps in utility skilled labour are well-understood and being actioned by colleges.

C2. Electrical design

Current state	Ideal state	Solutions - filling the gap
Fleets & dealers lack expertise to translate operational needs into load inputs for a utility.	Easy access to funding & expertise for fleet & site assessments.	In each jurisdiction, ensure that fleets, dealers & utilities have access to a list of proven entities who can provide fleet & load studies.
Risk of assets being oversized due to lack of optimization study.	Studies conducted to ensure loads are optimized.	Create awareness of need for optimizing loads before making new investments.

C. INFRASTRUCTURE: Top gap is lack of dedicated MHD incentives and grid connection time

C3. Incentives

Current state	Ideal state	Solutions - filling the gap
No dedicated MHD infrastructure incentive.	Dedicated MHD infrastructure incentive.	Create dedicated funding for MHD charging infrastructure and include planning.
Complicated financial instruments to fund MHD charging infrastructure and related planning.	Streamlined point-of-purchase incentive and tax rebates or exemptions to pay for charging infrastructure and planning.	Augment existing sources with preference for point-of-purchase – especially beyond QC & BC.
Applicants face long wait times to their funding requests.	Fast turnaround on any programs that require application.	Add resources to provide faster decisions to ZEVIP & ZETF applicants.

C4. Lead times

Current state	Ideal state	Solutions - filling the gap
Long lead times >12 months on key electrical equipment.	Lead times < 3 months on key electrical equipment.	Close supply chain gaps in power distribution equipment including transformers and switchgear (in consultation with Electrofederation Canada).

C. INFRASTRUCTURE: Top gap is lack of dedicated MHD incentives and grid connection time

C5. Interoperability and standards

Current state	Ideal state	Solutions - filling the gap
Lack of robust interoperability between charger & charger management software (OCPP).	All components of charging infrastructure are interchangeable.	Support approaches to test / standardize OCPP implementations.
Lack of standard roaming protocols to ensure interoperability between charging networks.	Roaming protocols are widespread.	Promote adoption of OCPI to facilitate roaming across charging networks for MHD vehicles.
Lack of finalized Megawatt Charging Standard (MCS) to enable large truck electrification.	MCS is defined and standardized products commercially deployed and available.	Support finalization of MCS and Canadian pilots / technology.

C6. Ownership

Current state	Ideal state	Solutions - filling the gap
Individual owners are responsible for all power-distribution upgrades from utility meter.	Clear understanding of best models for infrastructure upgrades (leave to fleet owner or mandate utilities to do so, like California).	Study whether shifting responsibility to utility could speed up deployment.
MHD fleet owners bear full responsibility and cost of providing charging, without possibility of sharing infrastructure.	A nationwide charging system is available, helping fleets manage risks of traffic and weather (esp. for long-haul).	Consider funding MHD charging network with DCFC + MW charging / rest stops in each jurisdiction (following Quebec model).

D. OPERATIONS: Top gap is scaling of service and early adoption of energy management

D1. Fleet readiness for EV operations

Current state	Ideal state	Solutions - filling the gap
Fleets are in an early stage of the transition and are pioneering the first operational processes, with few operational metrics or data and a major change in management process ahead of them.	Fleets have a strong talent bench, robust internal processes, and operational data across all parts of their organization which allows them to efficiently run their mixed fleets.	Make public data-sharing a requirement for providing public funding to fleets to broaden knowledge base.
		Create leadership training programs for fleet managers, sustainability officers and facility managers to help them lead the transition.
		Create awareness of the job changes which happen to traditional fleet roles when electrification is introduced.
		Create a fleet manager toolkit to help navigate the operational process change.

D2. Energy management

Current state	Ideal state	Solutions - filling the gap
Smart charging solutions new to the market; without software, load may not be optimized.	Effective energy management software ensures lowest cost of energy.	Ensure energy management is considered when providing funding.
Backup power/microgrids in initial stages of deployment.	Low carbon yet cost-effective backup power systems effectively deployed and tested, benefitting both grid & site.	Fund pilots to assess microgrid solutions for fleet resiliency
Software & programs to ensure optimization between fleet sites and local distribution grid are in their infancy.	Proven programs running that co-optimize local grid and fleet operations.	Fund innovation in software development to co-optimize fleet & grid sites.

D. OPERATIONS: Top gap is scaling of service and early adoption of energy management

D3. Skilled workforce for operations

Current state

Lack of skills and expertise in EVs, charging management and maintenance.

Ideal state

Trained workforce equipped with knowledge and skillset needed to manage and operate an EV fleet for all MHD vehicle classes & infrastructure.

Solutions - filling the gap

Standardization for qualified technicians (310T) regularly updated and accredited (SAE).

Subsidy programs for technician up-skilling.

Perform gap assessment of MHD ZEV skills training programs vs. market demand to ensure sufficient supply of trained management- and technician-level labour force and fund ZE MHD-specific curriculum development. Areas of skills to consider include mechanics, first responders, fleet managers, risk managers, facility managers (charging operations and maintenance), IT personnel, vehicle recyclers, etc.

D4. Service

Current state

Service offerings in start-up mode (both vehicle & infrastructure).

Ideal state

Mature service offerings in the market including uptime guarantees, backed by robust staffing.

Solutions - filling the gap

Continue to stimulate demand so that service offerings and required staffing scale while keeping costs economical.

D5. Cybersecurity

Current state

Lack of awareness on which systems / standards are required to ensure cybersecure operations.

Ideal state

Clear standards in place for cybersecure operations of electric fleets and fleets are aware of the standards.

Solutions - filling the gap

Efficiently communicate cybersecurity requirements / standards for electric fleets and make access to information easy for all (e.g. cybersecurity checklist and best practices).

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