EMC Medium- & Heavy-Duty Vehicle Working Group

eMHDV Ecosystem Gaps

CANADA'S eMHDV ECOSYSTEM

Building blocks for a successful transition

eVehicle

- Mineral supply
- Battery supply chain
- Battery recycling
- Vehicle supply chain

eInfrastructure

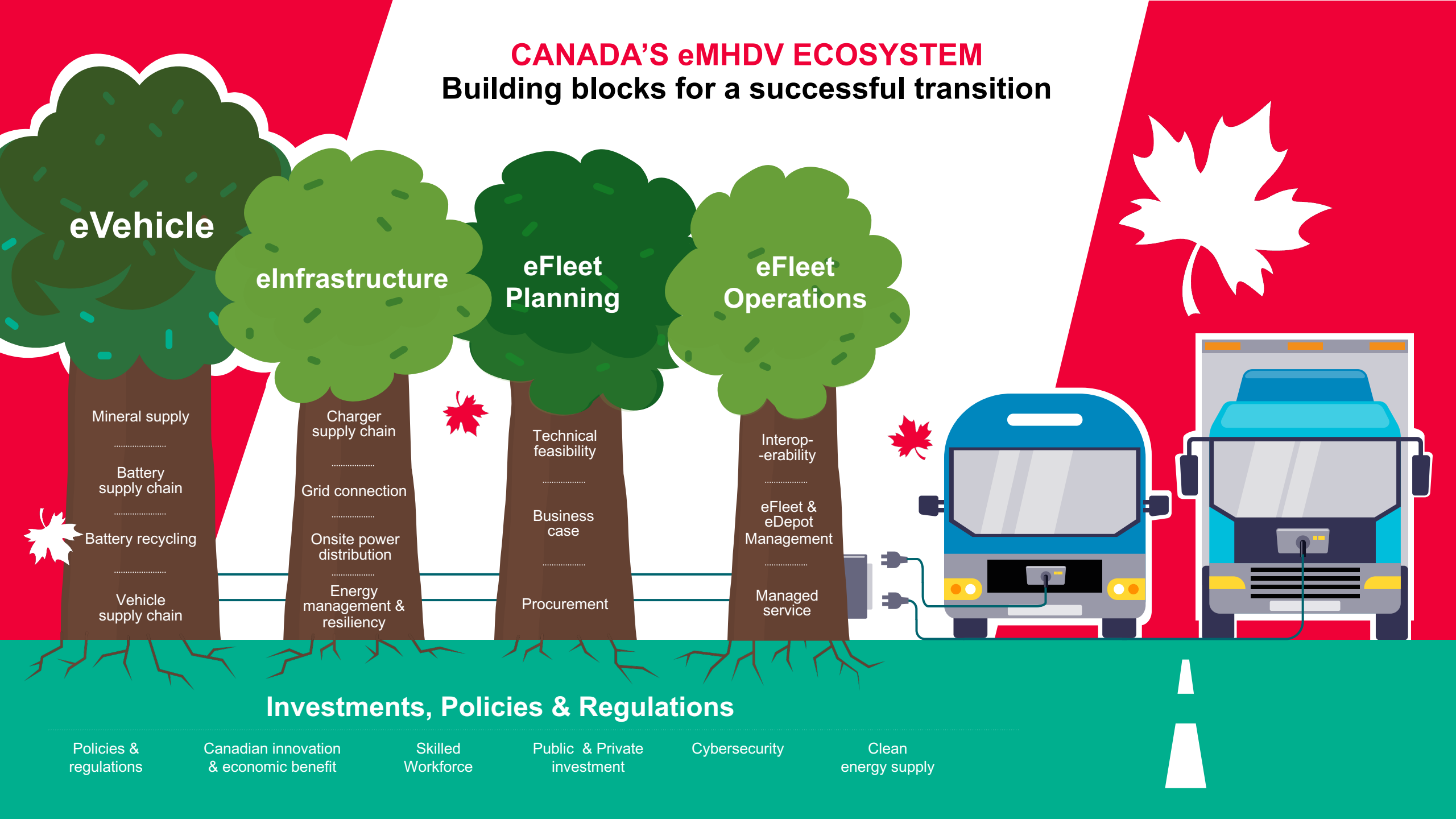
- Charger supply chain
- Grid connection
- Onsite power distribution
- Energy management & resiliency

eFleet Planning

- Technical feasibility
- Business case
- Procurement

eFleet Operations

- Interop--erability
- eFleet & eDepot Management
- Managed service



Investments, Policies & Regulations

- Policies & regulations
- Canadian innovation & economic benefit
- Skilled Workforce
- Public & Private investment
- Cybersecurity
- Clean energy supply

Pillar 1 eVehicle: Top gap is supply chain

	CURRENT STATE	IDEAL STATE	When does gap become acute?
Mineral supply	1 Multiple challenges for new mines, expansions, processing facilities to supply EV industry (e.g. permits, infrastructure) 2 Canadian miners have limited local customers (e.g. refiners or end users) for various EV-related commodities 3 Volatile federal-provincial and international politics and commodities markets	1 Reliable access / production / processing of metals and minerals for Canadian EV supply chains 2 Canadian miners have national and global optionality and incentives to supply and build capacity within Canada's EV supply chain 3 Stable, balanced and growth-oriented relationships between industry and government within Canada and with trusted trading partners	2 – 3 Year
Battery supply chain	1 Limited but burgeoning battery manufacturing operations in Canada 2 Inconsistent imports, anticipated shortage of cylindrical HV cells in 1–3 years as demand greatly exceeding capacity 3 Current batteries provide limited range; lack ICE cost parity	1 Design/supply of batteries in Canada 2 Reliable/consistent imports 3 Batteries provide equivalent range to ICE at same or lower costs	2 – 3 Year
Battery recycling	Limited number of recyclers with a positive business case	High rates of material/component recycling, enabling battery technologies to supplant the geopolitics of fossil fuel with a more circular economy and lower net footprint transportation technologies	4+ Year
Vehicle supply chain	1 Long lead times + lack of supply for some MHD classes 2 Buy America and other measures pull supply chain towards US 3 Limited number of plants ready to build at scale	Robust supply chain with numerous OEMs focusing on full EV assembly and parts manufacturing in Canada in support of MHD truck and bus deployment	Immediate & Major

Pillar 2 eInfrastructure: Top gaps are charger incentives and grid connection

	CURRENT STATE	IDEAL STATE	When does gap become acute?
Charger supply chain	1 Lack of financial instruments to fund charging infrastructure 2 Long lead times 3 Limited number of local suppliers/local value-add	1 Easy ability to pay for charging infrastructure 2 Fast lead times 3 Multiple strong suppliers with large amount of local value-add 4 Experienced installers that can handle volume at scale	Immediate & Major
Grid connection	1 Tendency for utilities to treat MHD fleet connections in an undifferentiated manner to other load connection requests 2 Connection process can be bureaucratic, slow and costly 3 Lack of utility pilots for DC electricity service 4 Unclear roles of regulators, ministries, and utilities for MHD	1 Utilities have proactive strategies, outreach and commercial structure for EV customers to facilitate their connection 2 Utilities predict, plan, spend, and upgrade with high priority to serve new load growth and find efficiencies 3 Utilities offer competitive DC service 4 Clear division of responsibility between regulators/ministries/utilities	Immediate & Major
Onsite power distribution	1 Many existing sites need substantial, costly upgrades 2 Lack of full site assessment and understanding of what changes required for electrical upgrades and options to optimize cost/space 3 Solutions slow to design and deploy	1 Single point of industry expertise to understand best practices for on-site distribution 2 Accessible expertise / software for full site assessment and upgrades 3 Fast design and deployment of onsite power	2 – 3 Year
Energy management & resiliency	1 Smart charging solutions new to the market 2 Backup power/microgrids in early stages of deployment 3 Preventative maintenance market in start-up mode	1 Effective smart charging/fleet-wide energy management software running at scale 2 Low-carbon yet cost-effective backup power systems effectively deployed and tested; benefitting both grid & site 3 Mature preventative maintenance offers	2 – 3 Year

Pillar 3 eFleet Planning: Top gap is CAPEX hurdle

	CURRENT STATE	IDEAL STATE	When does gap become acute?
Technical feasibility	1 Less range and slower charging makes 1-1 replacement difficult 2 Reliability of EVs and chargers needs further improvement + lack of performance data 3 Consulting services are scattered and high-cost	1 Longer ranges and faster charging across all classes 2 Proven MHD vehicle and charger performance backed by real-world, Canadian data, industry use cases and FAQ from a single, trusted source	2 – 3 Year
Business case	1 Despite vehicle incentive program and CFR credits, CAPEX hurdle remains, especially for charging infrastructure 2 Lack of data on technology deployment risk and residual value make business case hard to calculate and financing hard to secure 3 Utility rate structures make predicting cost of ownership complex, particularly for fleets spanning multiple utility service territories 4 Inability to include grid benefits into the business case due to technology, regulation, and industry maturity	1 TCO parity; Key next step is charging infrastructure incentives 2 Open database on EV vs ICE TCO + business case templates per vertical + SW tools to easily optimize designs & costs 3 TCO tools available that account for utility-specific rate structures 4 Grid benefits can be monetized and included into business cases	Immediate & Major
Procurement	1 Fast technology change mean that RFPs can be outdated by the time RFPs are published and contracts are signed 2 Procurement leads facing a steep learning curve; RFPs take a long time to develop due to lack of expertise 3 Smaller fleets lack access to information on technology, costs and investments 4 Delay due to complexity of funding approval prior to RFPs	1 Accessible expertise in public and private procurement incl. standard RFP documents/template and T&C for each vertical 2 Accessible expertise on how to leverage funding opportunities and easier funding processes 3 Access to easily bundled procurements for smaller fleets and companies to access latest knowledge 4 Confidence and speed in accessing funding, regardless of vehicle delivery wait times	2 – 3 Year

Pillar 4 eFleet Operations: Top gap is interoperability

	CURRENT STATE	IDEAL STATE	When does gap become acute?
Interop-erability	1 Standards are still in development and/or implementation is open to interpretation 2 Operational issues often arise due to complex software (SW) integration 3 Lack of standardized testing; testing happens on-site at time of deployment	1 Certified North American interoperability standards for charger-vehicle communication 2 Robust software, improving charger availability 3 Public test centres and/or agreed test protocols to certify interoperability	Immediate & Major
eFleet & eDepot management	1 Solutions are mostly proprietary and not communicating with each other, making it challenging for fleets to understand vehicle optimization, route planning, maintenance scheduling, etc. 2 Lack of mandatory communications/data accessibility standard hampers provision of third-party or in-house analysis	1 Open communication protocols allowing for interoperability for holistic management of vehicles, charging and energy 2 Standardized communications protocols for EV data via the CAN bus (e.g., SAE J1939) 3 Access to a mature set of tools and solutions that enable optimization of vehicles and chargers	2 – 3 Year
Managed service	1 Most current deployments are CAPEX-funded pilots with heavy government funding 2 Lack of proven managed service offerings at scale 3 Hesitancy to move from owner-managed to as-a-service models	1 Widely accessible Truck- or Transportation-as-a-Service (TaaS) and/or Charging-as-a- Service (CaaS) to enable operators to electrify without a large CAPEX burden 2 Dynamic pay-per-mile leasing schemes (where leasing payments reflect vehicle usage) to facilitate collaboration and risk-sharing across multiple stakeholders	2 – 3 Year