Electrifying progress: Energy efficiency in electrified road transportation in British Columbia

Electric Mobility Canada

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EXECUTIVE SUMMARY

British Columbia is a North American leader in transportation electrification, but rapid adoption magnifies the importance of energy efficiency as a system planning issue. Electrification reduces emissions and fuel costs, but it does not, on its own, ensure manageable electricity demand growth or grid compatibility. Vehicle mix, winter performance, charging practices, and travel behaviour all determine whether electrification delivers its full environmental and economic value or creates avoidable pressure on generation, transmission, and local distribution networks.

This report examines how electric transportation efficiency can be improved in British Columbia over the next decade. It assesses vehicle-side technologies, behavioural practices, micromobility, charging infrastructure, and emerging vehicle-to-grid capabilities, and evaluates their implications for electricity demand, coincident peak load, and infrastructure costs. A scenario illustration shows that practical efficiency measures can materially reduce energy use and electricity load under both faster and slower electrification pathways.

The central conclusion is that **efficiency must be treated as a core policy objective alongside electrification**, particularly given B.C.'s cold climate, growing prevalence of larger vehicles, high share of multifamily housing, and evolving federal policy context. **Chapter 4** translates this analysis into a focused set of priority policy levers that can be implemented in the near term, emphasizing those that deliver the largest system value with the highest implementation confidence.

Prioritization matters

Not all efficiency measures deliver the same benefits, and not all are equally feasible or timely. Some reduce annual energy use but do little to address winter peaks. Others offer strong technical potential but depend on long-term behavioural change or future market conditions. British Columbia's policy and regulatory environment, including BC Hydro's planning framework and CleanBC governance priorities, favours measures that are predictable, cost-effective, and capable of delivering near-term impacts.

The priority levers identified in this report were assessed against five criteria:

- Magnitude of the efficiency effect enabled
- Ease and speed of implementation
- Short-term impact potential through the late 2020s
- Cost efficiency for government and utilities
- Fit with B.C.'s regulatory, market, and institutional context

Across sectors, the highest-value levers consistently share four characteristics. They lock in efficiency by default rather than relying on voluntary behaviour. They act on vehicles, buildings, or programs entering service now. They reduce coincident peak demand as well as total energy use. And they remain valuable under uncertainty about federal policy direction and future vehicle mix.

Priority policy levers for British Columbia

Lock in vehicle-side efficiency through procurement and information

The single most effective near-term action is to embed efficiency requirements upstream, at the point of vehicle purchase. Provincial and municipal fleet procurement, along with incentive-linked purchases, provide a direct mechanism to require technologies that deliver immediate and durable efficiency gains.

Priority actions include:

- Requiring heat pump HVAC systems, regenerative braking performance disclosure, and low rolling resistance tire specifications in public and funded fleet procurement.
- Introducing winter efficiency disclosure, including winter kWh per 100 km and thermal system configuration, to steer buyers toward grid-friendly vehicle trims without reintroducing purchase rebates.

These measures are particularly important in B.C.'s winter conditions, where HVAC loads and vehicle mass can significantly increase energy use and evening charging demand. They are low-cost to administer, build on established procurement processes, and deliver benefits every time a vehicle is driven and charged.

Scale behavioural efficiency through structured, low-cost programs

Behavioural measures are among the fastest and most cost-effective efficiency tools available. Unlike vehicle turnover, they can be deployed at scale immediately, producing measurable reductions in energy use and charging demand.

Two levers stand out:

- A province-wide EV eco-driving program delivered through the Insurance Corporation of British Columbia (ICBC), employers, municipalities, and fleet operators. Evidence shows eco-driving can reduce EV energy use by 5 to 15 percent for light-duty vehicles and 5 to 10 percent for medium- and heavy-duty vehicles, with corresponding reductions in charging frequency and peak load.
- Fleet efficiency reporting requirements tied to CleanBC and utility funding. Requiring funded fleets to track and report energy intensity embeds efficiency into operational culture, improves grid planning predictability, and helps avoid unmanaged fast charging spikes.

These measures are technology-mix robust. They deliver benefits for battery electric vehicles, plug-in hybrids, and remaining internal combustion vehicles, reducing system risk during a period of policy and market uncertainty.

Micromobility: Reduce electricity demand by avoiding vehicle trips

Micromobility delivers a different efficiency outcome by avoiding vehicle charging altogether. Replacing short car trips with e-bikes or cargo bikes produces energy savings that are orders of magnitude larger than marginal vehicle efficiency improvements, while adding negligible load to the grid.

Priority micromobility levers include:

- Making the provincial e-bike rebate permanent and income-conditioned. Evidence from B.C. shows the program drives new adoption, sustained use, and measurable reductions in car kilometres traveled, particularly for short trips that often trigger evening charging.
- Funding e-cargo bike pilots and micro-depots for last-mile deliveries in dense urban areas. These programs reduce van kilometres, ease depot charging requirements, and deliver congestion and air quality co-benefits.

From a power system perspective, micromobility is a unique efficiency lever because it directly suppresses electricity demand growth from transportation rather than reshaping it.

Manage charging to reduce peaks and defer infrastructure upgrades

Where and when charging occurs is often more important for grid outcomes than how many vehicles are electrified. Unmanaged evening charging in single-family homes, coincident charging in multifamily buildings, and end-of-shift depot charging can all create localized stress that outpaces average load growth.

Three charging-related levers are foundational:

- A province-wide EV-ready requirement for new residential construction, including detached homes and multifamily buildings. Ensuring panel capacity, conduit, and network-ready equipment at construction avoids costly retrofits and enables managed charging at scale. EV-ready should include smart and efficient chargers by default, so new load is controllable, not just connectable.
- Residential managed charging programs with default overnight scheduling. These programs can shift 40 to 70 percent of home charging to off-peak hours, delivering immediate and measurable peak reduction aligned with BC Hydro’s demand-side management objectives.
- Depot interconnection fast-tracking tied to managed charging commitments. Prioritizing projects that demonstrate controllable load reduces over-sizing, accelerates fleet electrification, and protects local distribution assets.

Together, these measures improve utilization of existing infrastructure and defer the need for upgrades driven primarily by charging coincidence rather than total energy demand.

Take a measured, enabling approach to V2X

Vehicle-to-grid and related applications offer long-term flexibility potential, but near-term value lies in preparation rather than broad deployment. The highest priority actions are enabling rather than capital-intensive.

Near-term focus should be on:

- Clarifying regulatory pathways for V2G energy exports, including compensation mechanisms and interconnection standards.
- Piloting V2H and depot-based V2G in strategic public and commercial fleets where duty cycles and charging behaviour are predictable.

This approach builds B.C.-specific evidence and readiness without exposing ratepayers to premature risk.

Implications for electricity planning and policy

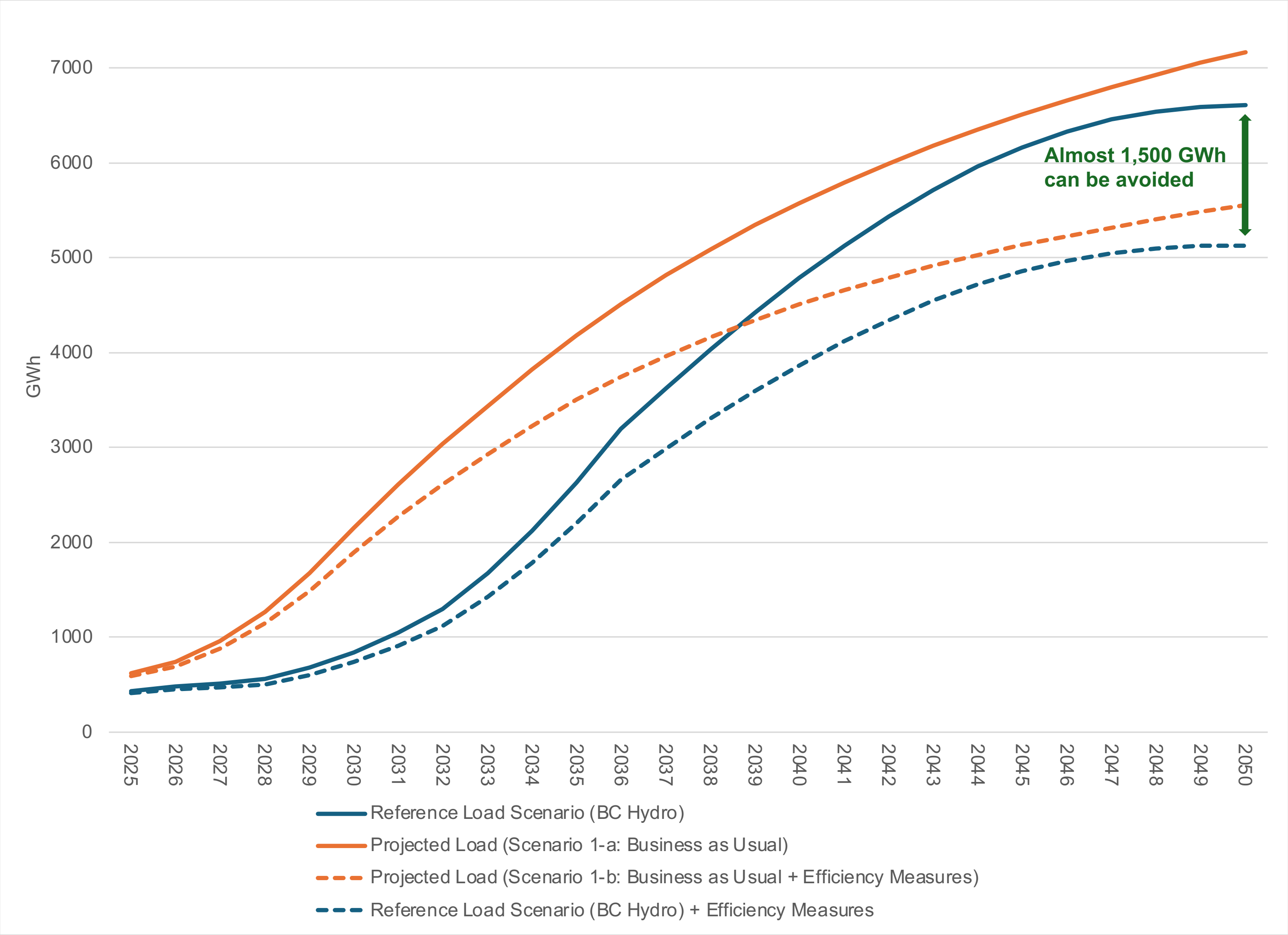
The scenario analysis in this report shows that combining electrification with practical efficiency measures can reduce cumulative electricity demand by roughly 17 to 18 per cent over the next decade compared to electrification alone, equivalent to tens of terawatt-hours of avoided load. More importantly for BC Hydro, these measures materially reduce winter peaks and defer distribution and feeder upgrades.

The priority policy levers identified here align closely with BC Hydro's emphasis on demand-side resources and CleanBC's focus on cost containment, equity, and system resilience. Implemented together, they form a coherent efficiency backbone that supports transportation electrification while controlling grid impacts and preserving affordability.

The overarching conclusion is clear. Early action on high-value efficiency levers is not optional. It is a prerequisite for delivering an affordable, reliable, and resilient electrified transportation system in British Columbia.

Simulation

The graph below shows one of our simulations: A basic energy efficiency package applied to BC Hydro's published light-duty EV electricity load forecast. Relative to the BC Hydro baseline, the simulation implies about **18.4 TWh** of cumulative electricity demand that can be avoided. By 2050, the avoided annual load is approximately **1.5 TWh**. Other simulations are presented in the full report.



Load of ZEV Passenger cars and trucks, Business as Usual, with and without efficiency measures (EMC Calculations)

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About Electric Mobility Canada

Electric Mobility Canada (EMC) is the unifying and authoritative voice for the transition to electric transportation across Canada. Founded in 2006, EMC is the **national industry association** that enables and accelerates the transition to sustainable electric mobility through advocacy, collaboration, education, and thought leadership, with the goal of creating a cleaner, healthier, and more prosperous future for all Canadians.

EMC has 190+ member organizations, including electricity suppliers; manufacturers of light, medium, heavy, and off-road vehicles; infrastructure providers; technology companies; mining companies; research centres; government departments and agencies; cities; universities; fleet managers; unions; environmental NGOs; EV owner groups and others.

Members of EMC collaborate under different working groups and task forces to identify barriers and solutions specific to multiple industry segments such as: Batteries (life cycle), Charging infrastructure (deployment and reliability), Utilities (best practices and grid planning), MHDV (Fleet electrification) and Research, Education and Training.

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BC Hydro
Power smart

1 Introduction

This report forms the second phase of EMC's economic report: *Electrifying progress – A complete economic outlook of the Canadian EV industry*. and shifts the analytical lens to a B.C.-focused examination dedicated to energy efficiency in road transportation. The purpose is to identify the current state of energy-efficient technologies and practices, examine where efficiency gains are achievable, and identify enabling policies that can improve system sustainability by reducing electricity demand growth and limiting coincident peak impacts on the grid.

The scope of this report covers light-duty as well as medium- and heavy-duty road transportation in B.C., while drawing on evidence from other jurisdictions when it can be adapted to B.C. conditions. The analysis focuses on the policy and market drivers that shape B.C.'s efficiency pathway, followed by a detailed assessment of the most important electric efficiency measures for the province. These include vehicle technologies, behavioural practices, micromobility, charging infrastructure, and emerging V2X capabilities. A scenario illustration is included to demonstrate how efficiency measures influence energy use and emissions trajectories.

Foundational technical material, general energy-efficiency concepts, and broader contextual research that support the analysis are consolidated in the appendices. Definitions of vehicle-side, charging-side, and system-level energy efficiency used throughout this report are consolidated in Appendix A. This allows the main report to focus on the specific efficiency levers that matter most for B.C.'s electricity system in the coming decade.

Energy efficiency in electrified transportation is shaped by both technology and behaviour. Technology includes vehicle hardware and software features, charging equipment and grid-interface solutions. Behaviour includes how people drive and travel, how commercial operators dispatch and schedule vehicles, and how travel demand is distributed across modes. This report treats these two dimensions as jointly determining energy intensity and peak demand outcomes.

Efficiency is also sensitive to context. Climate affects auxiliary heating and battery performance. Topography affects speed profiles and the effectiveness of regenerative braking. Urban structure affects congestion, trip lengths, and the feasibility of shared mobility. Where evidence is drawn from outside B.C., this report highlights transferability considerations and identifies where specific calibration will be required.

The policy environment is also evolving. Federal and provincial rules continue to shape the vehicle supply mix, technology availability, and consumer incentives. These changes influence both energy use and peak impacts on the electricity system, reinforcing the importance of efficiency measures that deliver value under a range of technology and policy conditions.

Financial implications of continued gasoline and diesel imports for B.C., and the associated economic rationale for electrification, are detailed in Appendix H.

2 Policy and market drivers relevant to British Columbia

Energy efficiency in transportation is shaped by policy signals that influence the vehicle mix entering the market, how vehicles are used and how electrification interacts with the electricity system. In British Columbia, these drivers matter for a specific reason. Two households can adopt EVs at the same rate and still produce very different impacts on electricity demand depending on charging patterns, vehicle classes, and operational efficiency. Policy determines these outcomes as much as technology does.

2.1 Why efficiency matters for B.C.'s electrification pathway

British Columbia has one of the highest EV adoption rates in North America. This is positive for emissions but increases sensitivity to peak electricity demand. Winter heating loads, a vehicle mix dominated by larger SUVs and trucks and rapid uptake in multifamily buildings all contribute to a growing risk of localized stress on distribution networks.

At the same time, the provincial inventory shows that transportation remains a major source of emissions and that achieving long-term climate goals will require both continued electrification and targeted efficiency measures that reduce total energy per kilometre and moderate peak demand growth. This is why efficiency must be treated as a central policy driver rather than a secondary benefit of electrification.

2.2 Federal direction and its implications for B.C.

The federal government has shifted from a regulated ZEV sales mandate to a framework centred on stronger greenhouse gas standards. This change modifies how manufacturers comply. Instead of meeting fixed ZEV sales per centages, they can meet fleet-wide emissions targets through a combination of ZEV sales, plug-in hybrids or improvements in the remaining internal combustion fleet.

For British Columbia, this introduces uncertainty about the exact composition of new vehicles entering the market. It also increases the policy value of efficiency measures that deliver benefits under any compliance mix. Whether manufacturers choose more BEVs, more PHEVs or more efficient combustion vehicles, B.C. will benefit from lower energy per kilometre and lower winter charging loads. A comparative assessment of federal, U.S., and provincial regulatory frameworks is provided in Appendix B.

2.3 B.C.'s regulatory and market context

The Zero Emission Vehicles Regulation continues to shape the supply of electric vehicles to the province. This supply signal affects not only the rate of electrification but also the charging mix, since range profiles influence whether charging occurs primarily at home, at depots or at public fast charging sites. B.C.'s decision to end vehicle purchase rebates and shift focus to charging infrastructure reinforces the need for efficient charging practices. Without supporting programs, unmanaged evening home charging could increase peak loads more quickly than energy demand grows.

Vehicle mix trends also matter. Registrations show a sustained shift toward larger SUVs and pickups. Even when electrified, these classes require more energy per kilometre and produce higher winter penalties. For this reason, B.C. faces an efficiency challenge tied directly to its market composition.

2.4 Effects of U.S. regulatory divergence on B.C. outcomes

The United States has removed the federal greenhouse gas standards that historically drove efficiency improvements. This is significant for British Columbia because North American platforms are integrated. Weaker standards in the U.S. can slow efficiency progress in the Canadian combustion vehicle fleet, increasing the electricity required to meet the same travel demand once these vehicles transition to electric replacements.

In a divergence environment, Canada and B.C. will need efficiency measures to preserve system level benefits while the market adjusts. The uncertainty created by this divergence strengthens the case for behavioural and operational measures that reduce kWh per kilometre irrespective of future vehicle mix.

2.5 Summary: B.C. needs a dual approach

The combined effect of B.C.'s high adoption rate, cold climate conditions, larger vehicle mix, federal policy shifts, and U.S. divergence means that electrification alone will not guarantee an efficient or grid compatible outcome. The province needs a dual approach: Sustained electrification supported by a coordinated program of efficiency measures that reduce winter energy intensity, lower peak demand, and improve the resilience of the electricity system.

A detailed review of Canadian, U.S. and provincial regulatory frameworks is provided in Appendix B.

3 Key measures in Electric efficiency and policy levers

3.1 Vehicle technologies (LDVs and MHDVs)

Vehicle-integrated efficiency measures can cut real-world energy per km by meaningful margins, preserve winter range, and lower system peaks driven by transportation electrification. The highest value measures for B.C. are **regenerative braking performance and standards, heat pump HVAC, lightweighting and low rolling resistance tires, drivetrain and inverter efficiency, and duty-cycle optimization for MHDVs.** Together, these reduce kWh per km and compress charging needs, which **eases generation and defers some T&D upgrades** when paired with rate design and managed charging. A deeper technical review of vehicle-side efficiency drivers, including drivetrain, thermal management, regenerative braking, and winter performance, is provided in Appendix C.

VEHICLE-INTEGRATED EFFICIENCY MEASURES AND GRID IMPLICATIONS

Measure	Typical efficiency effect*	Primary grid benefit	B.C. relevance
Regenerative braking performance and standards	15-25% energy recovery in stop and go; higher with mass and urban duty	Fewer kWh to replenish per route; shorter sessions at depots	High for urban delivery, port drayage
Heat pump HVAC	8 to 12 % better winter range vs resistive for LDVs, 5-10% for MHDVs	Reduces winter evening charging energy and coincident peak	Very high, interior, and northern communities
LRR tires	3-6% energy reduction; model dependent	Lowers annual energy and depot connection needs	Province-wide; highway users
Aerodynamic improvements	Reduced highway drag, vehicle specific (4-10% for LDVs, 5-12% for MHDVs)	Lower corridor DCFC energy, fewer ultra high power top ups	High for long haul and intercity
Drivetrain, inverter, and thermal optimization	Higher conversion efficiency; better charge curve behavior (2-5%)	Compresses high power charging time; eases feeder stress	Cross-cutting
Duty-cycle optimization in MHDV spec	Right-sizing packs and axles cuts energy per km (8-15%)	Smaller depot service sizes and deferred upgrades	High for fleets scaling depots

* These effects are not purely additive. When combining measures, the total effect will be lower than the sum of each measure's effect.

POLICY LEVERS TO CAPTURE VEHICLE-SIDE EFFICIENCY WHILE REDUCING GRID STRESS

Lever	What it does	Implementation notes
Procurement criteria for heat pumps, regen, LRR tires	Locks in vehicle-side efficiency in public and incentivized fleets	Pair with disclosure of winter kWh/100 km by model
Winter-efficiency consumer info	Shifts demand to grid-friendlier trims	Add to B.C. Hydro and provincial materials
Route-fit and right-sizing requirement for funded depots	Avoids oversizing packs and connection capacity	Integrate with fleet incentive and interconnection application
Regen performance guideline	Improves OEM transparency and fleet outcomes	Develop with OEMs and NACFE-style data
Tire information at point of sale	Makes LRR choice visible for EVs	Partner with major retailers and insurers

3.1.1 Energy efficient practices inside vehicles

a) Regenerative braking performance and standards

What it does: Captures kinetic energy that is otherwise lost to friction, reducing net energy per km and brake wear. Benefits scale with stop-and-go duty cycles and vehicle mass.

Evidence: Commercial EV truck datasets from NACFE show high shares of energy recovered via regen in urban and regional operations, helping make electric trucks viable in many duty cycles today. While regen fractions vary by route and OEM tuning, real-world fleet results confirm material energy savings and reduced friction-brake use.

Grid impact: Lower kWh per km reduces total energy throughput to vehicles and shortens charge sessions, moderating **daily depot load** and **public DCFC dwell**. For high-stop MHDVs, better regen tuning can reduce per-truck daily energy by several per cent, which scales to tens of MWh annually for large depots, marginally reducing **distribution transformer loading**.

Policy ideas

- Develop a **regen performance guideline** or reference test for fleets in B.C. procurement, requiring OEM disclosure of regen capability under loaded conditions and at low temperatures.
- Encourage **driver-selectable regen profiles** and training in eco-operation for commercial EVs, linking to provincial fleet incentives.

b) Heat pumps and thermal management

What it does: Heat pumps replace resistive heaters, sharply reducing HVAC load in cold weather.

Evidence: Large-sample telematics analysis shows vehicles with heat pumps retain ~83 per cent of nominal range near 0°C vs ~75 per cent without. Controlled testing found only ~8 per cent energy penalty with a heat pump vs ~26 per cent with resistive heating near freezing. DOE synthesis confirms cold temperature effects on both cells and HVAC loads.

Grid impact: In winter, HVAC is a major driver of **coincident evening peaks** when drivers arrive and charge. Heat pumps reduce energy needed per trip and compress charging volume, which **lowers residential peak charging energy** and **reduces depot overnight energy**. In aggregate this flattens winter peaks in regions with high EV density.

Policy ideas

- Require or bonus-weight **heat pump HVAC** in public procurement and provincial fleet incentives.
- Add a **winter-efficiency label** in B.C. communications so buyers understand heat pump value, similar to winter tire labeling logic.

c) Lightweighting and low rolling resistance (LRR) tires

What it does: Reduces rolling and inertial losses. LRR tires deliver several per cent efficiency improvements; replacement choices matter.

Evidence: ORNL testing documents material range differences from replacement tires and highlights rolling friction metrics that correlate with energy use. Independent syntheses report multi-per cent energy savings from LRR adoption in EVs, subject to trade-offs with grip and wear.

Grid impact: Even 3 to 6 per cent lower energy per km at population scale reduces **annual GWh for transportation**, and in freight corridors it can shrink **depot charging energy** enough to avoid or defer one service upgrade cycle for smaller sites.

Policy ideas

- Create a **tire-efficiency addendum** for provincial and municipal fleet procurements and encourage B.C. fleets to specify LRR tires where safety standards are met.
- Partner with tire retailers to **surface rolling resistance information** to EV owners at point of sale in B.C.

d) Aerodynamic improvements

What it does: Lowers drag at highway speeds; relevant to LDV commuters and long-distance MHDV routes.

Evidence: CFD and wind-tunnel studies confirm that body optimization and add-on aero elements reduce drag and improve energy efficiency; vehicle-specific gains vary, but directionality is robust.

Grid impact: For **highway-biased loads** into and out of Metro Vancouver and along Hwy 1, aero gains cut corridor DCFC energy and **reduce the need for very high-power top-ups** during peak travel windows. For long-haul MHDVs, aero measures translate to lower depot energy per turn and fewer en-route fast charges, relieving **corridor substation demand**.

Policy ideas

- Use targeted incentives or recognition for fleets installing **validated aero packages** on electric tractors operating B.C. corridors.
- Incorporate aero specs in public freight pilots.

e) Drivetrain and inverter efficiency, optimal charge-curve, and thermal pre-conditioning inside the vehicle

What it does: Higher-efficiency motors, inverters, gearsets, and battery thermal management reduce conversion losses during drive and during the battery conditioning that precedes charging.

Evidence: Engineering literature shows round-trip efficiency differences between AC on-board charging and DC power paths and highlights the role of thermal management to reduce high-power losses. Though exact per centages vary by model and temperature, modern systems routinely achieve mid-80s to low-90s per cent electrical round-trip during charge events, with better outcomes when thermal management and SOC windows are optimized.

Grid impact: Higher drivetrain and thermal efficiency lower **fleet energy intensity** and reduces time spent in high-power charging bands, cutting **local feeder stress** at sites with multiple vehicles arriving warm from highway duty.

Policy ideas

- Encourage OEM disclosure of **vehicle energy intensity in winter and summer** on standardized routes, to guide fleets in B.C. terrain.
- Integrate **eco-operation training** to reinforce pre-conditioning while plugged in, which keeps peak draw lower once fast charging begins.

f) Duty-cycle optimization for MHDVs

What it does: Matching pack size, axle configuration, and torque management to route length, payload, and stop density prevents over-spec’ing and cuts energy per km.

Evidence: NACFE’s Run on Less Electric DEPOT found that electric trucks perform well in many duty cycles today, with small depots ready now and larger depots progressing as infrastructure catches up. Results underscore the importance of route matching to avoid unnecessary battery mass and energy consumption.

Grid impact: Right-sized packs and vehicles reduce **overnight depot charging energy** and connection capacity needs. At scale this can **defer primary service upgrades** and simplify transformer sizing.

Policy ideas

- Require **route-fit assessments** for provincial or utility fleet funding.
- Support **spec guidance** for B.C. operators in hilly terrain and winter conditions.

3.1.2 B.C. socio-demographics and market dynamics that shape impact

- **High urban concentration and condominium living** in Metro Vancouver increase sensitivity to winter HVAC loads and building charging access. Heat pumps yield larger system benefits where evening home charging clusters. Public data show B.C. among the highest EV adoption rates in

Canada and a rapidly scaling public network, intensifying the value of per-vehicle efficiency improvements.

- **Freight patterns** include dense last-mile in the Lower Mainland and regional haul to ports and resource communities. Duty-cycle optimized regen, aero, and right-sizing will matter most for these segments, moderating **depot and corridor loads** as fleets scale.
- **Policy environment** federal and provincial ZEV policies continue to shape automaker supply decisions. More recently, British Columbia revised its ZEV framework and targets in an effort to align with federal goals.[1] Stable or strong targets keep B.C. a priority market for the most efficient trims.

3.1.3 Implications for generation, transmission, and distribution

- **Generation**: Vehicle efficiency lowers total energy growth from transport electrification. While BC Hydro projects rising load, capturing 5 to 10 percent per-vehicle efficiency through thermal, rolling, and regen measures can offset a material slice of EV-driven GWh by 2035, improving capacity margins in winter mornings and evenings. DER studies for B.C. highlight EV load management as a scalable flexibility resource, which is more effective when per-vehicle energy needs are lower.
- **Transmission**: Efficiency that reduces on-route DCFC energy and peak session power can modestly ease planning for **highway corridor stations** tied to regional substations, particularly on long-distance routes. Combined with separate charging-side solutions, this lowers the probability of near-term transmission reinforcements tied solely to transport peaks.
- **Distribution**: The most immediate benefit is at **depots and neighbourhoods**. Lower kWh per km, better winter HVAC, and right-sizing reduce **transformer loading, secondary voltage drop risks, and service size requirements**. NACFE's depot data show that small depots are electrification-ready now; vehicle-efficiency gains reduce required charger counts and nameplate capacity.

3.1.4 Priority recommendations for B.C.

a) **Procurement standards for efficiency:** Adopt provincial fleet procurement criteria that require heat pumps, regen performance disclosure, and tire efficiency information for LDVs and MHDVs. Add bonus scoring for validated aero packages on electric tractors.

b) **Winter-performance consumer and fleet information:** Publish clear winter efficiency guidance and require OEMs receiving incentives to disclose winter kWh per 100 km and heat pump configurations. This drives market pull toward the most grid-friendly trims.

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[1] Government of BC, Updating zero-emission vehicle targets, expanding charging network. Accessed 12/04/2026. URL: https://news.gov.bc.ca/releases/2026ECS0009-000355

c) **Right-sizing requirement for funded depots:** For any public funding, require a route-fit and pack-size analysis to avoid over-spec'ing. This reduces depot connection size and defers distribution upgrades.

d) **Tire efficiency visibility:** Work with retailers to present rolling resistance data at point of sale and offer a modest incentive for LRR tires on EVs used in commercial operations. Aligns safety and efficiency.

e) **Standards and training:** Collaborate with industry to define a practical **regen performance guideline** and integrate eco-operation modules in driver training programs for electric trucks and vans. Low cost, measurable benefit.

3.1.5 What this means for grid stress and costs

- **Reduced coincident peaks**: Heat pumps and efficient drivetrains reduce energy that must be replenished during peak evening residential windows and overnight depot cycles. This trims the tail of the load duration curve.
- **Deferred upgrades**: For depots, right-sized vehicles and efficiency measures can be the difference between staying within an existing service or triggering a new transformer or primary upgrade. NACFE depot findings back the feasibility of scaling in many duty cycles when vehicles and routes are optimized.
- **Lower total energy growth**: Even modest per-vehicle savings compound across B.C.'s leading EV adoption trajectory. Combined with managed charging in a separate bucket, the system needs fewer fast ramping resources and less distribution reinforcement.

3.2 Behavioral efficiency measures (LDVs + MHDVs)

Behavioral measures are among the **lowest-cost and fastest-deploying tools** for reducing EV energy demand, moderating peak load, increasing utilization efficiency, and supporting a more efficient transportation system across B.C. Unlike technology changes that require new models or fleet turnover, behavioral interventions **scale immediately** through training, information, incentives, and operational protocols.

The most important behavioral levers for energy efficiency in LDVs and MHDVs include:

- Eco-driving for EVs (smooth acceleration, regenerative braking optimization, speed moderation)
- Trip and route planning for EVs and e-trucks
- Vehicle right-sizing and utilization behaviors
- Shifted travel timing (where feasible for fleets and commercial users)
- Awareness and literacy about winter driving and preconditioning
- Organizational culture and driver training for commercial operators

Collectively, these can deliver 5 to 20 per cent reductions in energy consumption, depending on segment, which translates directly into lower daily charging volumes, fewer high-power charging events, and deferrable grid upgrades.

The empirical evidence base supporting eco-driving, carsharing, ridesharing, and related behavioural efficiency measures is summarized in Appendix E.

BEHAVIORAL EFFICIENCY MEASURES AND GRID IMPLICATIONS

Behavioral measure	Typical efficiency effect	Primary grid benefit	B.C. relevance
Eco-driving (smooth driving, regen use, speed moderation)	10–15% LDV; 6–12% MHDV	Lower home and depot charging energy; shorter charging windows	High in urban corridors and stop-and-go delivery zones
Route and trip optimization	5–10% depending on elevation and congestion*	Fewer mid-shift fast charges; less corridor peak load	High for freight and commuters in mountain regions
Right-sizing and utilization behavior	Energy savings are route-dependent and material where initial packs were oversized.	Lower annual energy draw; smaller service sizes	Strong for commercial and multi-vehicle households
Winter efficiency practices and preconditioning	Preconditioning: Up to ~19% range gain (vehicle and ambient dependent)	Loads shift to off-peak (plugged-in morning); lower evening peaks	Critical for interior and northern B.C.
Fleet driver training and organizational practices	5–12 per cent MHDV efficiency improvements	Reduced depot load spikes; consistent charging demand	Very high for delivery, port, municipal fleets

* ROUTE OPTIMIZATION: Energy-aware routing has demonstrated 5–10% savings in constrained operations and 10–30 per cent or more under favorable conditions; fleet-level studies with coordinated routing and charging report up to 31 per cent energy reduction in validation.

POLICY LEVERS TO SCALE BEHAVIORAL EFFICIENCY

Policy lever	Impact on behavior	Grid benefit	Implementation notes
Province-wide EV eco-driving program	Improves driving patterns for LDVs and fleets	Cuts per-trip energy; lowers charging volumes	Delivered via the Insurance Corporation of British Columbia (ICBC), employers, municipalities
Fleet efficiency reporting requirements	Codifies efficiency practices for funded fleets	Eases depot electrification barriers and load spikes	Integrate with CleanBC grant conditions
Preconditioning communication toolkit	Encourages off-peak HVAC load	Lower winter evening peaks	Target multifamily and single-family EV owners
Winter best-practice outreach	Reduces cold-weather inefficiency	Reduces winter peak load from EV clusters	Tailor by region and temperature band
Routing optimization support	Enhances commercial efficiency	Reduces corridor fast-charging peaks	Partner with logistics/dispatch software providers

3.2.1 Core behavioral practices that improve EV efficiency

a) Eco-driving for EVs

Eco-driving techniques for electric vehicles emphasize:

- Smooth acceleration and deceleration
- Maximizing regenerative braking
- Avoiding unnecessary speed variability

- Maintaining moderate speeds
- Eliminating idling with climate systems

Why it matters: Energy consumption rises steeply with aggressive acceleration and higher speeds. Eco-driving can lower kWh per km for LDVs by **10 to 15 per cent**, and for MHDVs **5 to 10 per cent**, depending on terrain and loads.

Grid implication: Lower energy per trip means:
- Reduced home charging volume in evening peaks
- Lower depot energy requirements overnight
- Lower cluster loads in multifamily buildings

Eco-driving is especially important in B.C.'s **corridor commuting patterns** and **freight routes** featuring significant elevation changes.

b) Route and trip optimization

Drivers and fleet managers can adopt:
- Efficient routing to minimize elevation gain, congestion, and stop-and-go conditions
- Consolidation of errands or deliveries
- Avoiding high-speed routing if alternatives exist
- Adjusting departure times to avoid peak traffic

For MHDVs, dispatching strategies that maintain consistent speeds and minimize cold start cycles also improve energy efficiency.

Grid implication: Route optimization reduces total charging demand and can cut **mid-shift fast charging events**, which otherwise impose unpredictable loads on DC stations and local feeders.

c) Vehicle right-sizing and utilization behaviors

Right-sizing is partly technical but significantly behavioral:
- Choosing an EV that matches actual use patterns
- Avoiding oversizing battery packs when daily distances are modest
- Increasing load factors (e.g., filling delivery vans, shared errands, coordinated logistics)

Grid implication: Smaller packs and higher utilization reduce:
- Aggregate annual demand growth
- Peak depot charging needs
- Pressure on residential transformers from larger-battery LDVs charging at higher power levels

d) Seasonal and preconditioning behaviors

Cold-weather efficiency depends heavily on driver practices:
- Pre-heating the cabin while plugged in
- Clearing snow from wheels and body to reduce rolling and aerodynamic resistance
- Using seat heaters while lowering cabin heat
- Keeping tires properly inflated in colder months

Grid implication: When drivers precondition while plugged in (especially at home in the early morning), this **avoids large HVAC loads during the first minutes of driving**, lowering the total energy that must be replenished in evening charging peaks.

e) Fleet operational behaviors

Commercial driver training and fleet management protocols influence efficiency more than technology alone. Effective measures include:

- Mandatory eco-driving certification
- Driver dashboards showing real-time energy intensity
- Incentive programs tied to efficiency metrics
- Load consolidation and backhaul planning
- Idle-minimization policies for HVAC during layovers

Grid implication: Fleet behavior change is one of the most powerful ways to avoid **uncoordinated fast charging bursts**. Reducing mid-shift charging demands lowers both corridor congestion and local distribution stress at commercial sites.

3.2.2 B.C.-specific socio-demographic and travel behaviour considerations

Urban concentration and trip profiles

B.C. has the highest EV adoption rate in Canada, with a large share located in **Metro Vancouver, Victoria, and Kelowna**. Urban users typically have:

- Shorter trips (good for eco-driving and regen gains)
- Limited home charging in multifamily dwellings (behaviour matters more for reducing shared infrastructure load)
- Higher exposure to congestion patterns (eco-driving and routing are relevant)

The congestion reduction and public health co-benefits associated with efficiency and mode-shift measures are examined in Appendix F.

Rural and northern patterns

In B.C.'s interior and northern regions:

- Trips are longer
- Elevation changes are more significant
- Winter temperature swings are larger

Behavioural efficiency measures like speed moderation, HV/AC management, and preconditioning deliver higher proportional benefits in these regions.

Demographic differences in adoption

- Younger urban residents have higher uptake of carshare, rideshare, and multi-modal travel, reducing per-capita vehicle energy consumption.

- Higher-income households with larger homes are more likely to have home charging and larger-battery vehicles, efficiency behaviours here significantly reduce **evening peak clustering**.

Fleet sector dynamics
B.C. has significant:

- Port-related freight
- Municipal and commercial delivery
- Public sector fleets

These sectors benefit enormously from structured driver behaviour programs, which have typically delivered **5 to 12 per cent operational efficiency improvements** in other electrification contexts.

3.2.3 Implications for generation, transmission, and distribution

Generation: Behavioural measures meaningfully reduce overall GWh needed for transportation, softening future generation requirements. With high EV adoption:

- A 10 per cent per-vehicle efficiency improvement can translate to **hundreds of GWh annually** avoided by the mid-2030s.
- This helps maintain winter energy margins, particularly important for a hydro-dominant system.

Transmission: Lower average vehicle energy demand reduces:

- Peak loads at highway fast-charging corridors
- Reinforcement needs at nodes serving heavy-use depots
- The need for incremental transmission capacity to support roadside hubs

Transmission benefits are modest per vehicle but **large when aggregated** across B.C.'s long inter-regional routes.

Distribution: Behavioral changes are especially effective for:

- **Multifamily residential transformers**, already stressed by coincident evening charging
- **Commercial depots**, where multiple vehicles arriving "hot" from inefficient trips can spike loads
- **Cold-weather peaks** because HVAC-related inefficiency compounds grid stress

Behavioral measures can defer distribution upgrades by **reducing both total kWh and power intensity of charging events**.

3.2.4 Priority behavioral recommendations for B.C.

a) Province-wide EV eco-driving campaign

Develop standardized training for LDV drivers and fleet operators focused on:

- Regenerative braking maximization
- Smooth acceleration

- Winter efficiency practices

Target workplaces, municipalities, and newcomers to EVs.

b) Fleet efficiency certification and reporting

Require fleets receiving public incentives to:
- Track per-trip energy efficiency
- Document driver training
- Report annual improvements

This helps align fleet expansion with grid planning.

c) Promote preconditioning while plugged in

Public communication messaging should highlight:
- Morning preconditioning as one of the largest efficiency wins
- Guidance for multifamily buildings on enabling early-morning scheduled preconditioning

d) Winter driving best-practice tools

Provide region-specific guidelines for:
- Interior and northern communities
- Mountain corridor driving
- Tire and HVAC management

e) Route optimization tools for commercial fleets

Partner with logistics platforms to integrate:
- Elevation-aware routing
- Efficiency scoring
- Pack-size matching recommendations

f) Behavior nudges for multifamily residents

Provide building operators with:
  - Posters, signage, building-level apps encouraging efficient driving
  - Support for carshare EV installation (shifting trips from private vehicles to shared fleets)

3.3 Micromobility (E-bikes, E-cargo bikes, E-scooters)

Micromobility displaces short car trips at a fraction of the energy use of even the most efficient EVs. Typical real-world e-bike electricity use is in the **single-digit Wh per km** — two orders of magnitude below light-duty EVs — which means **negligible incremental load** on the grid compared with the avoided car energy and peak demand.

- **E-bikes**: Empirical monitoring shows on the order of **0.8 kWh per 100 km** for mixed city riding, vastly lower than cars at 15 to 20 kWh per 100 km.
- **E-scooters**: Life-cycle performance depends heavily on **device lifespan and operations**. Long-lived devices with efficient operations can be climate-positive; short lifespans and inefficient rebalancing can erase benefits. The design and operations choices are therefore policy-relevant.

B.C. context

- B.C. has **the highest EV adoption rate** alongside strong **active transportation** ambitions in CleanBC, including a 2030 target of ~30 per cent of trips by walking, cycling, and transit. Micromobility is a practical lever for those mode-share goals and relieves local grid stress by **avoiding car charging altogether**.
- **Provincial e-bike rebates** since 2023 catalyzed new adoption, with UBC-led research showing many purchases would not have occurred without the incentive, sustained weekly riding after 12 months, and **measurable car-kilometre reductions**.
- **Regional coordination** on shared micromobility is maturing; TransLink's guidelines give municipalities a common framework for data, safety, and system planning, which supports grid-friendly siting and charging logistics for shared fleets.

MICROMOBILITY MEASURES, GRID IMPLICATIONS AND EFFICIENCY ELASTICITIES

Measure and Mechanism	Typical efficiency effect	Primary grid benefit	B.C. relevance
Private e-bikes replacing short car trips Households substitute several weekly short trips (typically under 10 km) with e-bike trips; ~0.8 kWh/100 km vs 15–20 kWh/100 km for cars	**−85% to −95% energy per passenger-km** for displaced trips; **−5% to −10% car-km** at household level where networks and storage are available	Fewer EV GWh and fewer evening home charges; negligible added load from e-bike charging	High — aligns with CleanBC 2030 mode-share goals: strong uptake with income-based rebates
E-cargo bikes replacing urban van drops Shift last-mile deliveries and service calls to e-cargo with micro-depots	**−70% to −90% energy per drop**; **−10% to −20% van-km** in high-density zones with curb access and short drop distances	Reduced depot energy and corridor charging for vans; less congestion that inflates HVAC loads	Strong in Vancouver, Victoria, Kelowna cores; needs curb access and bike-friendly routes
Shared e-bikes with good station density Bikeshare significantly increases probability of spontaneous mode shift for short trips and first/last mile	**−80% to −95% energy per passenger-km** for displaced car trips; **−3% to −8% car-km citywide** when networks are dense	Avoided EV/public DCFC events on short trips; trivial depot charging, off-peak capable	Metro Vancouver and regional centers; benefits amplified near rapid transit

Shared e-scooters with high device lifespan and electric operations Net LCA benefits depend on long lifetimes and low-emission rebalancing	**−50% to −85% energy per passenger-km** for displaced car trips when lifetimes ≥5,400 km and ops efficient; **0% or negative** if lifetimes short and ops fossil-intensive	Net avoided car charging when car trips displaced; very small depot loads; operations must be electric	Suitable for municipalities with clear ops standards; pilot with strict KPIs
Micromobility-transit integration (secure parking, charging, wayfinding) Increases first/last-mile capture to transit, suppressing car access	**−2% to −6% car-km** regional car-km reduction where integration is systematic	Fewer park-and-ride car trips and associated EV charges; shifts load to human power	High — leverage TransLink and B.C. Transit hubs; use Active Transportation Grants
Income-conditioned e-bike rebates Lowers barriers for high-potential adopters; targets suburban car users	**+30 to +60 km/week** riding sustained; **−10% to −20% household car-km** among recipients	Suppresses evening EV charging by eliminating short-trip top-ups	Proven in B.C.; consider permanent program with equity lens

POLICY LEVERS TO SCALE MICROMOBILITY WHILE REDUCING GRID STRESS

Policy lever	What it does	Grid benefit	Implementation notes
Make the provincial e-bike rebate permanent and income-conditioned	Sustains new e-bike adoption among price-sensitive households; locks in mode shift from short car trips	Avoided EV charging GWh and fewer evening residential peaks, since short local trips no longer require car charging	Maintain tiered, income-tested rebates; prioritize suburban municipalities with short car trips; coordinate with retailers for equitable access
Fund e-cargo bike pilots and micro-depots with curb access	Shifts last-mile deliveries and service errands from vans to e-cargo bikes in dense districts	Lower depot kWh and reduced corridor fast charging for urban delivery vans; less congestion that inflates HVAC loads	Create a provincial challenge fund; require electric support vehicles and transparent KPI reporting (drops shifted, van-km avoided)
Province-wide operating standards for shared micromobility	Ensures shared fleets are net energy-positive; reduces lifecycle emissions sensitivity to short device life and fossil rebalancing	Keeps shared fleet depot charging small and schedulable; prevents backsliding from fossil service vans	Align municipal permits to TransLink's regional guidelines; require monthly reporting on device lifespans, swaps, and rebalancing km
First/last-mile integration at SkyTrain and B.C. Transit hubs	Raises micromobility–transit capture, reducing car access to stations	Fewer park-and-ride car trips and associated EV charges; shifts energy demand from vehicles to human power	Use Active Transportation grants to fund protected approaches and parking; standardize wayfinding and e-bike charging lockers

Complete, protected bikeway networks in suburban corridors	Unlocks e-bike substitution for short car trips where latent demand is highest	Reduces household reliance on evening car charging for errands; marginal relief at neighborhood transformers	Tie capital grants to network connectivity metrics and collision-risk reduction; coordinate with municipalities for curb policies
Battery-swap and charging standards for shared fleets	Minimizes operational truck miles; enables off-peak charging in depots	Keeps operational load controllable and off-peak; avoids feeder spikes from ad-hoc charging	Require electric service vehicles, depot siting near distribution capacity, and off-peak charging plans
Data-sharing and performance KPIs	Verifies car-trip displacement and lifecycle performance to manage permits and funding	Confirms that programs are producing real GWh/MW relief via avoided car charging	Standardize datasets across municipalities per TransLink guidance; tie permits to energy-positive results
Public safety and education programs	Improves acceptance and sustained use, supporting durable mode shift	Stable mode shift maintains avoided EV charging over time; fewer disruptions to transit integration	Coordinate provincial guidance with municipal bylaws and operator training; improve incident data quality

3.3.1 Core efficiency practices and their grid implications

a) Mode shift from car to micromobility (private and shared)

What it does: Substitutes short car trips with e-bike/e-scooter trips, cutting energy per passenger-km by an order of magnitude and **removing** the need to charge a car later that day. North American modeling and program evaluations show substantial car-trip displacement when micromobility is available and incentivized.

Grid impact

- **Generation**: Reduces total provincial transport electricity needs by avoiding EV charging GWh, which is more material than the tiny e-bike charging increments.
- **Transmission**: Reduces corridor fast-charging events on short urban and suburban errands.
- **Distribution**: Avoids evening residential EV charging for many short-trip households; minimal added load from e-bike chargers (tens to hundreds of watts).

b) E-cargo bikes for goods and service trips

What it does: Shifts a subset of last-mile deliveries, service calls, and errands from vans to e-cargo bikes. International evidence (and B.C. pilots) indicates high feasibility for dense areas with safe routes. Energy per drop falls sharply and depot charging for vans is reduced.

Grid impact

- **Distribution**: Reduces depot overnight energy and DCFC demand for urban delivery vans by cutting van-kilometres and associated charging sessions.

- **Public realm**: Less curbside delivery dwell, lowering congestion that can exacerbate EV HVAC loads in traffic.

c) Shared micromobility operations efficiency

What it does: Operational choices, battery swapping, electric service vans, smart rebalancing, determine whether shared fleets yield **net positive** energy and climate outcomes. Studies show that **device longevity** and **efficient operations** are decisive; longer-lived devices and low-emission service fleets shift the life-cycle balance clearly positive.

Grid impact

- **Distribution**: Concentrated depot charging (for swappable batteries) is small relative to EV depots and can be scheduled off-peak.
- **System**: By substituting car trips, shared fleets lower aggregate EV charging needs; the key is to ensure operations do not introduce significant fossil transport back into the system.

3.3.2 B.C. socio-demographics, market dynamics, business models

- **Equity and uptake:** Income-conditioned provincial rebates significantly increased adoption among lower-income households, with sustained riding and **reduced car use** over at least 12 months. This matters for B.C. where suburban trip distances are often within e-bike range, but car dependence is high.
- **Regional leadership and data:** TransLink's region-wide guidelines help avoid a "patchwork" of municipal rules; better **data sharing** supports evidence-based siting and integration with transit.
- **Safety and education:** Provincial leadership and municipal practice are moving toward stronger rules, education, and data for incident tracking — prerequisites for durable mode shift.

3.3.3 Implications for generation, transmission, distribution

Generation: Micromobility replaces car energy with **minuscule charging loads**. At scale, this yields **net GWh savings** in transportation electrification scenarios (fewer EV GWh), easing resource adequacy needs in winter.

Transmission: By removing short EV trips that would otherwise top up at DCFC on busy days, micromobility marginally reduces **corridor fast-charging peaks** in the Lower Mainland.

Distribution: The largest near-term value is **deferring residential transformer upgrades** by cutting the number of households that cluster evening EV charging for short, local travel needs. Shared fleet charging can be batched off-peak with trivial capacity.

3.3.4 Priority policy recommendations for B.C.

a) **Make the e-bike rebate permanent and targeted:** Maintain **income-conditioned** e-bike rebates that emphasize suburban areas and job centers, where mode shift from short car trips is highest. Evidence shows a high share of purchases would not have occurred without the rebate, sustained use, and measurable car-km reductions.

b) **Support e-cargo bike logistics:** Launch a provincial challenge fund with municipalities for **e-cargo bike depots**, curb access, and lockers near high-demand corridors; require electric operations for any support vehicles to lock in energy gains.

c) **Standardize shared micromobility operations:** Adopt **province-wide minimum standards** for shared fleets on device lifespan, battery safety, rebalancing practices, and reporting — aligned with TransLink guidelines — to ensure net energy benefits.

d) **Integrate with transit and active networks:** Expand **active transportation grants** for continuous, protected routes that directly connect to SkyTrain and B.C. Transit hubs, including secure parking and charging. This improves first/last-mile access and maximizes mode shift.

e) **Data and disclosure:** Require shared operators to publish **monthly mode-shift and operations data** (battery swaps, service-vehicle km, device retirements). Tie permit renewals to energy-positive life-cycle performance.

3.4 Efficient charging infrastructure

B.C. is scaling to **700,000–900,000 EVs within the next decade**, with public fast-charging expanding rapidly; BC Hydro tripled its network to **591 ports by March 2025** and targets **800+ by 2026**, including 350–400 kW hardware on major corridors. That growth is positive for adoption, but **when and where** charging happens will determine **peak demand, local feeder stress, and upgrade needs**.

BC Hydro's resource planning points to **roughly 1.4 per cent annual load growth** overall, yet electrification clusters (transport, buildings, industry) can create **localized peaks**. Flexible demand, including managed EV charging, is explicitly part of the planning toolkit, and B.C. studies identify **EV load management** as a **scalable distributed energy resource (DER)** with much higher potential than currently deployed.

International analyses underscore that **behavior and infrastructure access** drive grid outcomes more than headline EV counts: heterogeneous charging behavior can **amplify load variability** if unmanaged, while planning and control strategies **flatten peaks** and reduce equipment aging.

EFFICIENT CHARGING MEASURES, GRID IMPLICATIONS, AND ELASTICITY

Measure & mechanism	Typical efficiency effect (elasticity)	Primary grid benefit	B.C. relevance
Default overnight home charging (SFD/TH). App or vehicle schedules to start after midnight	**Shift 40–70% of home kWh to off-peak; reduce evening feeder peaks 15–25%** in high-EV neighborhoods	Flatter evening load; lower transformer thermal stress; preserves hydro flexibility	High — large SFD share; simple to deploy via OEM/utility collaboration
MURB smart load sharing. Serves many stalls on fixed capacity; rotates sessions	**Cut coincident kW 30–50%; serve 2–4× more stalls per panel**	Defers service upgrades; enables equitable home charging in condominiums	Critical for Metro Vancouver; aligns with EV-ready guidance
Residential TOU + automation. Price + default schedules	**Increase off-peak share 20–40%; reduce 5–10 pm peaks 10–20%** among enrolled customers	System peak reduction and avoided peaker use	Deployable province-wide
Depot managed charging (MHDV/LDV) Staggered starts, power caps, route-aligned windows	**Reduce depot peak 30–60%; cut interconnection size 20–40%** vs unmanaged	Defers primary upgrades; faster interconnection	High near ports/logistics; proven in NACFE depots
Right-size packs and charger power at depots. Match SOC windows to routes; avoid over spec	**Lower daily kWh 8–15%; reduce DC demand events 20–30%**	Smaller service sizes; lower feeder stress	Strong for urban delivery, municipal fleets
Corridor hub staggering + battery buffers. Sequencing sessions; site-level storage	**Reduce site max kW 15–35%; shave travel-peak spikes**	Avoids local feeder/substation overload on weekends	Important on Hwy 1 / Sea-to-Sky / Interior corridors
Siting near strong nodes / substations Lower impedance, better capacity headroom	**Avoid site reinforcement in 1–2 planning cycles** (qualitative)	Transmission and primary distribution cost avoidance	Applies to new 350–400 kW hubs
Siting near strong nodes / substations Lower impedance, better capacity headroom	**Avoid site reinforcement in 1–2 planning cycles** (qualitative)	Transmission and primary distribution cost avoidance	Applies to new 350–400 kW hubs
EV-ready new-build codes. Make-ready conduit, spare capacity, network capability	**Cut retrofit costs 50–75%; enable off-peak automation from day one**	Faster adoption with lower local peaks	Province-wide standardization recommended
Micromobility + station access. First/last-mile shifts some trips away from cars	**Reduce short-trip EV charging frequency 10–20%** in catchments	Lowers evening home charging need	Supports CleanBC mode-share targets

POLICY LEVERS TO SCALE EFFICIENT CHARGING AND REDUCE GRID STRESS

Policy lever	What it does	Grid benefit	Implementation notes (B.C.)
Province-wide EV-ready requirement	Ensures panels, conduits, and network-ready gear at construction	Defers upgrades; enables off-peak automation at scale	Adopt model bylaw and guidance; coordinate with BC Hydro make-ready
Residential managed charging program	Shifts kWh out of 5–10 pm, automates overnight	Reduces system and feeder peaks	Integrate with DSM/IRP; publish MW results
Depot interconnection fast-track + demand-charge reform pilots	Rewards controllable load and staged build-outs	Smaller requested capacity; faster timelines	Queue priority for managed-charging depots; test subscription or kW-coincident alternatives
Corridor hub standards	Controls site spikes and locates hubs on strong nodes	Avoids local reinforcements, improves reliability	Standard conditions for public funding/permits
Data-driven pricing	Smooths arrival patterns; discourages peak-window queues	Cuts simultaneous charger starts	Use dynamic or time-blocked pricing; report outcomes to BCUC
Land-use alignment	Increases share with home/work AC charging, reduces DCFC dependence	Flatter load; lower corridor spikes	Tie grants to EV-ready codes and station-area micromobility

3.4.1 Core efficiency practices by charging context

a) Home charging (single-family, townhouse)

What it does: Shifts the bulk of energy to **low-cost, low-carbon overnight hours** and reduces reliance on high-power DCFC. With simple TOU nudges or automated schedules, home charging can cut **coincident evening peaks** and enable battery pre-conditioning before morning trips.

B.C.-specific notes

- Easy access to home charging is a major **grid stress reducer**: households that overnight-charge typically draw at **lower power for longer**, avoiding corridor DCFC micro-peaks.
- Province-wide **EV-ready new-build requirements** reduce retrofit costs and make scheduling easier in the long run, and Clean Energy Canada urges standardization to avoid a patchwork of bylaws.

b) MURBs/strata (multi-unit residential buildings)

What it does: Smart panels and load-sharing (networked Level 2) allow **dozens of spaces** to be served on a fixed service with **per-circuit power modulation** and scheduled rotation. This **defers transformer upgrades** and reduces coincident evening clustering.

B.C.-specific notes

- **EV-ready bylaws** and make-ready designs are central to serving condominium dwellers (a large share in Metro Vancouver), with provincial guidance and BC Hydro support materials now available.

c) Fleet depots (return-to-base LDVs and MHDVs)

What it does: Depot charging concentrates load where it can be **engineered, scheduled, and staged**. NACFE's multi-depot demonstration shows **small depots are ready now** and that productivity hinges on aligning **shift cycles, charger counts, and interconnection timelines**. Right-sizing packs, staggering sessions, and using managed charging greatly reduce peak kW requirements.

B.C.-specific notes

- Interconnection and tariff design are the pacing items. BCUC proceedings on **public charging service rates** and BC Hydro pilots indicate rate design is evolving; aligning depot tariffs with controllable off-peak behavior is a near-term lever.

d) Public DCFC and highway corridors

What it does: Enables long-distance travel and charging for drivers without home access; can also create **short, sharp local peaks**. Siting hubs near substations, using **staggered start algorithms**, battery-buffered sites, and pricing that avoids the **late-afternoon "rush"** are core efficiency practices. BC Hydro's Electric Highway provides **~150 km spacing** and increasingly **high-power** sites, which reduces dwell but can increase instantaneous demand without controls.

e) Land-use and siting considerations

What it does: Land-use choices determine **who has home/work charging** and how much the system must rely on **fast charging**. EV-ready building codes, **infill near transit**, mobility hubs with **secure micromobility parking**, and curbside strategy in dense areas **reduce car charging needs** and shift energy to lower-power overnight environments. CleanBC targets an increase in non-auto modes by 2030, which indirectly **lowers EV energy and peaks**.

3.4.2 Implications for generation, transmission, distribution

Generation: The more energy we push to **overnight home/depot charging**, the less ramping and firming we need, improving the utilization of existing hydro assets and imports. DER (distributed energy resource) analyses for B.C. highlight **EV load management** as a potent capacity resource from now to 2040 if enrollment scales.

Transmission: Corridor DCFC hubs benefit from **co-siting near strong nodes** and **operational controls**; otherwise, a small number of hubs can drive localized transmission reinforcement on peak travel weekends. BC Hydro's network expansion and 350–400 kW deployments make siting discipline and pricing design increasingly important.

Distribution: The immediate value is in **MURBs and depots**: smart load sharing and off-peak schedules **defer transformer and feeder upgrades**. Empirical depot data from NACFE show that when charging is staged and routes are right-sized, many operations can scale before hitting capacity walls.

Analysis of charging losses, load coincidence, managed charging strategies, and grid-facing efficiency considerations is provided in Appendix D.

3.4.3 Priority recommendations for B.C. policymakers and utilities

a) **Province-wide EV-ready new-build standards** for all residential classes (including strata/MURBs), with model bylaws and technical specs for networked load management and panel capacity planning; this reduces retrofits and enables off-peak automation.

b) **Managed charging at scale**: Roll out residential and small-commercial programs with default overnight schedules and optional automation; integrate into IRP/DSM portfolios with measured MW impacts.

c) **Depot interconnection fast-lanes and tariff pilots**: Offer queue-jump criteria for projects with proven managed charging and right-sized capacity; test demand-charge alternatives that reward controllability.

d) **Corridor hub standards**: Minimum requirements for staggered starts, battery buffering where feeders are constrained, dynamic pricing to avoid tight afternoon windows, and substation-adjacent siting where feasible.

e) **Land-use alignment**: Tie Active Transportation and housing grants to EV-ready standards, micromobility/parking at stations, and curbside policies that prioritize lower-power neighborhood charging over expanding high-power hubs in dense cores.

3.5 V2X in B.C.: Potential Benefits, Early Use Cases, and Enablers

V2X refers to using the EV battery for services beyond driving:
- **V2G**: exporting power to the distribution grid
- **V2H**: powering a home
- **V2B**: powering a building
- **V2F**: supporting fleet operations
- **V2M/V2L**: mobile load, off-grid power, tools

V2X is a **DER** concept: EVs can shift when they charge and potentially **discharge** during peaks or outages. Several studies model EV flexibility as a large controllable resource but note that **charging behaviour heterogeneity** introduces variability and uncertainty without proper coordination.

BC Hydro's long-term planning documents emphasize **demand-side measures** and **EV load management** as key options to meet electricity needs as EV adoption rises.

This makes V2X a logical complementary pathway, once technical and regulatory prerequisites mature.

3.5.1 Potential system benefits for B.C.

a) Peak shaving and capacity deferral

In a hydro-dominant system with winter peaks, the largest potential value comes from **reducing peak loads**, especially the **5–9 PM window**, where uncontrolled EV charging adds load. V2X could help counter the variability introduced by diverse EV charging behaviors, which can significantly impact power system reliability and load profiles.

Value for B.C.:
- Defers or reduces local distribution upgrades
- Reduces reliance on peaking resources
- Enhances system flexibility to support electrification targets

b) Resilience and backup power (near-term practical)

V2H or V2B offers near-term reliability value: Homes/businesses can draw on EV batteries during outages. This aligns well with BC Hydro's emphasis on resilience and planning for climate impacts.

c) Fleet applications: Depot flexibility and load shaping

Fleet depots already use **managed charging** to reduce peak demand. NACFE depot findings confirm that matching vehicle duty cycles to charging windows and optimizing infrastructure sequencing improve readiness and manage load growth. V2G can extend this by enabling fleets to export power during peak periods.

d) Integration with distributed solar and future renewables

B.C.'s resource mix may evolve with more customer-side solar and storage. V2H/V2B can provide **midday storage** and **evening discharge**, improving the utilization of behind-the-meter renewables.

3.5.2 Early, practical V2X opportunities for B.C. (realistic 2026–2032)

V2H in single-family and rural/regional communities

- Straightforward value proposition: resilience + rate optimization
- Requires bidirectional-enabled vehicles and UL-certified home inverters
- Does **not** require BC Hydro to buy power back (lower barrier)

MURB V2H-lite solutions for strata

- Bidirectional wall boxes can support building backup systems or critical loads
- Aligns with ongoing EV-ready building requirements and smart panel adoption in MURBs (important in Metro Vancouver)

Fleet depots providing local grid support

- Fleets already have centralized charging, telematics, and strong operational control
- Depot-based V2G can help flatten peaks caused by heterogeneous driver charging patterns and reduce infrastructure needs when properly integrated into grid operations.
- Pilot candidates: municipal fleets, school buses, utility service vehicles

Micro-hubs and "resilience nodes"

- Public buildings or community hubs powered by EVs during outages
- Could complement B.C.'s emergency planning objectives

3.5.3 Key barriers and constraints

Technical maturity

- Limited models support bidirectional charging today
- CHAdeMO supports V2G; CCS bidirectional standards emerging
- Interoperability not guaranteed
- Smart chargers, inverters, and vehicle firmware are still maturing

Regulatory gaps

- BC Hydro tariffs and BCUC frameworks do not yet formalize V2G export compensation
- Standards for safety, metering, and islanding protection needed

Battery warranty and degradation concerns

- Automakers remain cautious; standardized warranty frameworks are still emerging

Consumer awareness and program design

- Behavioral uncertainty in charging is already a major factor affecting load variability; bidirectional programs require **highly predictable participation** to provide reliable grid services.

3.5.4 What B.C. can do next (near-term enablers)

a) Clarify regulatory pathways for V2G exports

- Develop BCUC-approved mechanisms for V2G energy export and value streams (capacity, resilience, peak reduction)
- Align with evolving national standards for bidirectional interconnection

b) Pilot V2H and V2G in strategic segments

- Municipal fleets, transit, school buses, and utility fleets
- Leverage NACFE-style methodology for data transparency and replicability
- Prefer sites where managed charging is already established to maximize reliability.

c) Require bidirectional readiness in public procurement

- Begin with public sector fleets (aligned with CleanBC targets)

d) Build V2X-ready charging and building codes

- Extend EV-ready requirements in new buildings to permit future bidirectional chargers
- Standardize panel pre-wiring, breaker capacity, and islanding protection

e) Integrate V2X into BC Hydro's DER planning

BC Hydro emphasizes demand-side measures, system upgrades, and new customer-acquired, renewable energy resources in its long-term plans. Integrating V2X into this existing demand-side portfolio can enhance flexibility and asset utilization during periods of high demand.

3.5.5 Conclusion: A cautious but high-potential frontier for B.C.

V2X is not yet a mainstream EV feature, but it **matches B.C.'s system characteristics exceptionally well**:
- Hydro-dominant generation
- Significant winter peaks
- Growing electrification loads
- Policy alignment with flexibility, DERs, and resilience under CleanBC

B.C. should adopt a **measured, enabling posture**: pilot where conditions are right, standardize for future readiness, and build regulatory clarity.

This creates a pathway where, by the mid-2030s, V2X could evolve from niche pilots into a **scalable grid resource** that complements managed charging, depots, and load flexibility — all without leaving ratepayers exposed to uncertainty or premature commitments.

4 Priority policy levers for B.C.

British Columbia enters the next decade of transportation electrification with strong adoption momentum, but also with heightened exposure to peak load growth, localized distribution constraints, and winter system stress. The analysis in Chapter 3 demonstrates that efficiency outcomes are not automatic consequences of electrification. They are shaped by policy choices that influence vehicle specifications, behaviour, charging practices, and system design. In this context, prioritization matters. Not all efficiency measures deliver the same grid value, and not all can be implemented with the same speed, cost-efficiency, or institutional feasibility.

The table below distills the preceding analysis into a focused set of priority policy levers that B.C. can implement in the near term. The prioritization is guided by five criteria: The magnitude of the enabled efficiency effect, ease and speed of policy implementation, short-term impact potential through the late 2020s, cost-effectiveness for government and utilities, and alignment with B.C.'s regulatory, market, and governance context. Emphasis is placed on levers that lock in efficiency by default, reduce coincident peak demand, and remain robust under uncertainty in federal policy direction and vehicle mix. The objective is not to catalogue every possible tool, but to identify where early action yields the highest system value and the greatest risk reduction for the electricity system.

The **highest near-term value levers** consistently share four traits:

1. They **lock in efficiency by default** (procurement, codes, standards).
2. They **act immediately** on existing behaviour or assets.
3. They **reduce peak risk first**, not just annual energy.
4. They **do not depend on perfect long-term policy certainty**.

Priority lever	Rationale
VEHICLE TECHNOLOGIES	
Procurement criteria for heat pumps, regen performance, and LRR tires *This lever locks in efficiency at the point of purchase and avoids relying on behaviour change.*	• **High efficiency impact**: Heat pumps and regen deliver measurable winter and urban savings immediately. • **Very high ease of implementation**: Procurement rules are well-established levers in B.C. • **Short-term effects**: Applies to fleets and incentive-linked vehicles entering service now. • **Cost efficient**: Low administrative cost, no additional incentive stream required. • **Strong B.C. fit**: Cold climate, large public and utility fleets, CleanBC procurement alignment.
Winter efficiency consumer information and disclosure *The fastest ways to influence vehicle mix without reopening rebate design.*	• **Moderate to high efficiency impact** when it shifts buyers toward heat-pump-equipped trims. • **Very fast deployment** through BC Hydro and provincial materials. • **Low-cost** relative to incentives. • Addresses a **clear B.C.-specific risk**, winter peak amplification in EV charging.

BEHAVIORAL EFFICIENCY MEASURES	
Province-wide EV eco-driving program *This is the fastest "megawatt and GWh per dollar" efficiency lever available.*	• **Large and immediate efficiency gains** (5 to 15 per cent). • **Deployable almost immediately** through ICBC, fleets, and employers. • **Extremely cost efficient** compared to vehicle subsidies or infrastructure. • Works for both **ICEs and EVs,** hedging policy uncertainty.
Fleet efficiency reporting requirements (for funded fleets)	• Ensures behavioural efficiency is **institutionalized**, not voluntary. • **Low administrative cost** if tied to existing CleanBC conditions. • Improves **grid planning predictability** by reducing charging volatility.
MICROMOBILITY	
Make the provincial e-bike rebate permanent and income-conditioned *This delivers avoided EV charging rather than marginal EV efficiency gains.*	• **Very large, avoided energy effect per trip**. • **Immediate behavioural shift**, especially for short trips that drive EV top-up charging. • **Proven in B.C.**, de-risked by existing program evidence. • Strong **equity and CleanBC alignment**.
Fund e-cargo bike pilots and micro-depots	• High efficiency and congestion benefits in dense urban areas. • Clear **freight electrification support**, especially for last-mile delivery. • Modest pilot costs with strong replication potential.
EFFICIENT CHARGING INFRASTRUCTURE	
Provincewide EV ready newbuild requirement *This is foundational and time-sensitive. Every year of delay creates stranded inefficiency.*	• **Locks in future efficiency at lowest lifecycle cost**. • Prevents retrofit-driven grid stress. • **High certainty impact**, strong B.C. precedent. • Essential for MURBs, where unmanaged charging risk is highest. • Requires **smart and efficient chargers** as the default, so new load is controllable, not just connectable.
Residential managed charging program (default overnight)	• **Large peak reduction potential**. • Technically easy with existing OEM and charger capabilities. • Strong BC Hydro alignment and fast measurable results.
Depot interconnection fast-track tied to managed charging	• Avoids unnecessary over-sizing. • Speeds fleet electrification while protecting the grid. • High value for ports, logistics, and municipal fleets.
V2X	
Clarify regulatory pathways for V2G exports	• **Enabling lever**, not capital-intensive. • Removes uncertainty for pilots already technically feasible.

	- Necessary precondition for any future V2X value capture.
Pilot V2H and depot-based V2G in strategic fleets	- Focuses limited resources where control and predictability exist. - Builds B.C.-specific evidence for future scaling. - Strong resilience co-benefits.

Taken together, these priority policy levers point to a clear near-term strategy for British Columbia. The most effective actions are those that embed efficiency upstream in purchasing, buildings, and infrastructure design, rather than relying solely on ongoing behavioural change or long-term market shifts. Procurement standards, EV-ready building requirements, managed charging defaults, and targeted behavioural programs consistently rank highest because they deliver measurable efficiency gains quickly, at relatively low public cost, and with high confidence in a B.C. context.

This prioritization also reflects institutional realities. BC Hydro's planning framework values predictable, dispatchable demand-side resources, while CleanBC governance increasingly emphasizes cost containment, equity, and system resilience. The levers highlighted here align with both objectives by moderating peak growth, deferring infrastructure upgrades, and preserving the emissions and economic benefits of electrification under a range of future policy and market conditions. Implemented together, they form a coherent efficiency backbone that supports continued electrification without amplifying grid stress or investment risk. The implication is straightforward: acting early on high-value efficiency levers is not a secondary consideration, but a prerequisite for delivering an affordable, reliable, and resilient electrified transportation system in British Columbia.

5 Scenario simulation for passenger cars and light trucks

We developed a compact scenario illustration for passenger cars and passenger light trucks from 2022 to 2035. The scenario analysis examines how alternative ZEV pathways and practical efficiency measures could affect energy use and GHG emissions over the next decade under plausible policy and market conditions. The scenario results should be interpreted as order-of-magnitude trajectories that can be refined with additional calibration inputs specific to B.C. Details on data sources, assumptions, and modelling methodology for the scenario analysis are provided in Appendix G.

The analysis is built on historical series from the Comprehensive Energy Use Database as the baseline for activity and intensity in cars and passenger light trucks.[2] Annual energy use is computed from passenger travel activity and energy intensity (MJ per passenger-km), and annual emissions are derived using the corresponding GHG intensity parameters available in the same dataset. This ensures the projections remain consistent with observed historical relationships between travel activity, energy use, and emissions.

Two pathways to ZEV adoption are considered, each paired with an efficiency package variant. In both scenarios, we include a U.S. efficiency drag parameter after 2026 to represent weaker efficiency progress in the remaining ICE fleet under a less stringent U.S. regulatory environment.

To translate sales targets into on-road impacts, the ZEV share of passenger travel is allowed to evolve gradually over time. Similarly, passenger travel activity is projected with a turnover factor that permits a portion of the fleet to be retired and renewed year to year. This keeps the scenario trajectories stable and avoids attributing near-term changes to unrealistically fast behavioural or fleet transitions.

Each baseline pathway is then paired with an efficiency package that adds eco-driving and carsharing as joint measures. Eco-driving is represented as a reduction in per-km energy use for both ICE vehicles and ZEVs, using controlled experimental estimates from Kato et al (2016).[3] Carsharing is represented as a reduction in total passenger vehicle travel for the participating share of travel, using mid-range estimates reported in the literature.[4]

Scenario 1: (Business as usual) assumes B.C. maintains the current ZEV trajectory that reaches 100% ZEV share of new light-duty sales by 2035, accelerating the shift of passenger travel toward ZEVs.

– **Variant 1-a (baseline)** represents the B.C. ZEV pathway under its ZEV sales trajectory to 100% ZEV new sales by 2035, accelerating turnover of passenger travel toward ZEVs. A post-2026 U.S. "efficiency drag" term reduces the rate of efficiency improvement in the remaining ICE fleet. Vehicle mix drift toward larger vehicles is assumed to continue as well.

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[2] Data Source: Natural Resources Canda. National Energy Use Database. Accessed 20/02/2026. URL: https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/data_e/databases.cfm /

[3] AIMS Energy. The eco-driving effect of electric vehicles compared to conventional gasoline vehicles. Accessed 09/12/2025. URL: https://www.aimspress.com/article/id/1020

[4] Victoria Transport Policy Institute. Evaluating carsharing benefits. Accessed 22/01/2026. URL: https://www.vtpi.org/carshare.pdf

- **Variant 1-b (efficiency)** integrates eco-driving and carsharing applied as additional reductions to per-km energy use and total travel, implemented using empirical parameters from the literature.

Scenario 2: (B.C. Aligns with the federal pathway) assumes a slower ramp that reaches 75% ZEV share of new light-duty sales by 2035 and includes an additional continuation of the historic drift toward larger vehicles.

- **Variant 2-a (baseline)** shows B.C. following a slower ZEV sales trajectory toward 75% ZEV new sales by 2035, in line with the federal announcements, while the U.S. drag term again reduces the rate of ICE efficiency improvement after 2026. Vehicle mix is assumed to continue the recent drift toward SUVs/pickups similar to Scenario 1.
- **Variant 2-b (efficiency)** Integrates eco-driving and carsharing to illustrate the value of behavioural efficiency under slower electrification.

Across both policy pathways, eco-driving and carsharing function as a policy package to produce a material and stable reduction in both road passenger energy use and GHG emissions. In the scenario results, adding these measures reduces energy demand and emissions by **nearly 18% over the period**. The magnitude is essentially the same whether electrification proceeds faster or slower because many of these measures act directly on kilometres travelled and energy per kilometre for both ICE and ZEV travel. In practical terms, this means that behavioural efficiency measures are technology-mix robust as they deliver meaningful savings even under uncertain policies.

Figure 1 to Figure 4Figure 4 (following pages) show the resulting trajectories for energy use and GHG emissions under the four cases modelled for the overall LDVs fleet.

Across both policy pathways, the projected ZEV electricity load shows that vehicle-side efficiency improvements combined with eco-driving produce a clear and persistent reduction in annual electricity demand relative to the baseline ZEV load. This indicates that these technological and behavioural measures reduce the grid energy required per unit of electrified passenger travel, and therefore lower total ZEV electricity demand even when the pace of electrification differs across scenarios. Over the full simulation period, the efficiency package avoids a cumulative **21.8 TWh** of electricity consumption in the pathway where B.C. maintains its mandate, corresponding to an average reduction of **17%** relative to the case without efficiency. Under the federal pathway, cumulative load savings are **19.4 TWh**, demonstrating that efficiency measures deliver material load savings even under different electrification policy pathways.

We also examined what happens when the same efficiency package is applied to BC Hydro's published light-duty EV electricity load forecast[5] by constructing a reference with efficiency variant that applies the identical technology and eco-driving multipliers. Relative to the BC Hydro baseline, this implies about **18.4 TWh** of cumulative electricity demand that can be avoided. By 2050, the avoided annual load is approximately **1.5 TWh**.

Figures 5 and 6 show the projected load impact of ZEVs under the different scenarios, compared with the B.C. reference load forecast.[6]

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[5] BC Hydro, 2025 Integrated Resource Plan Application (Table A-5, page 14). Accessed 10/03/2025. URL: https://docs.bcuc.com/documents/proceedings/2025/doc_84202_b-1-bch-2025-irp-application.pdf

[6] BC Hydro 2025 Integrated Resource Plan Application. Accessed 14/03/2026. URL: https://docs.bcuc.com/documents/proceedings/2025/doc_84202_b-1-bch-2025-irp-application.pdf

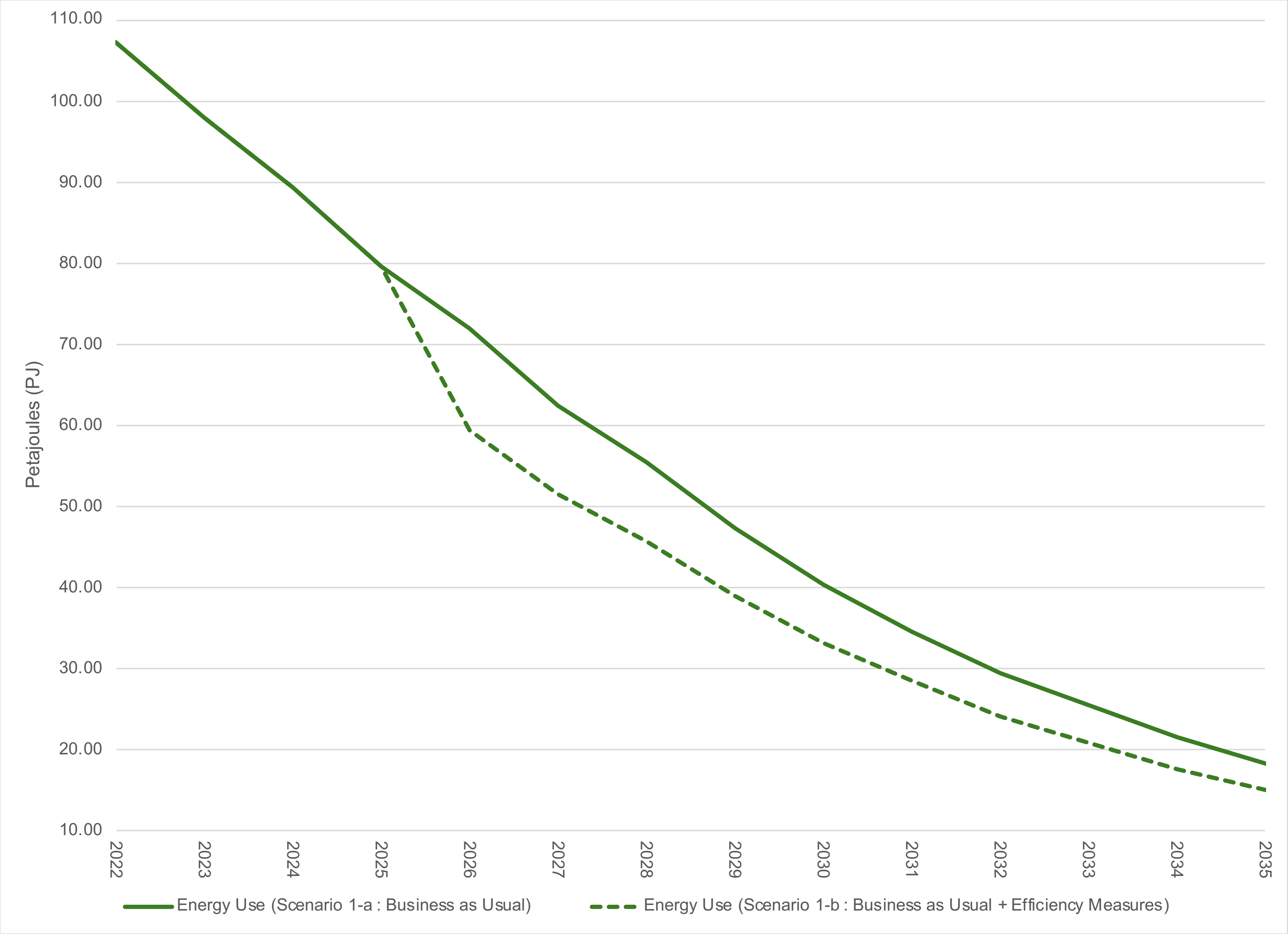

Figure 1: Passenger cars and trucks energy use in the business-as-usual scenarios, with and without efficiency measures (EMC calculations)

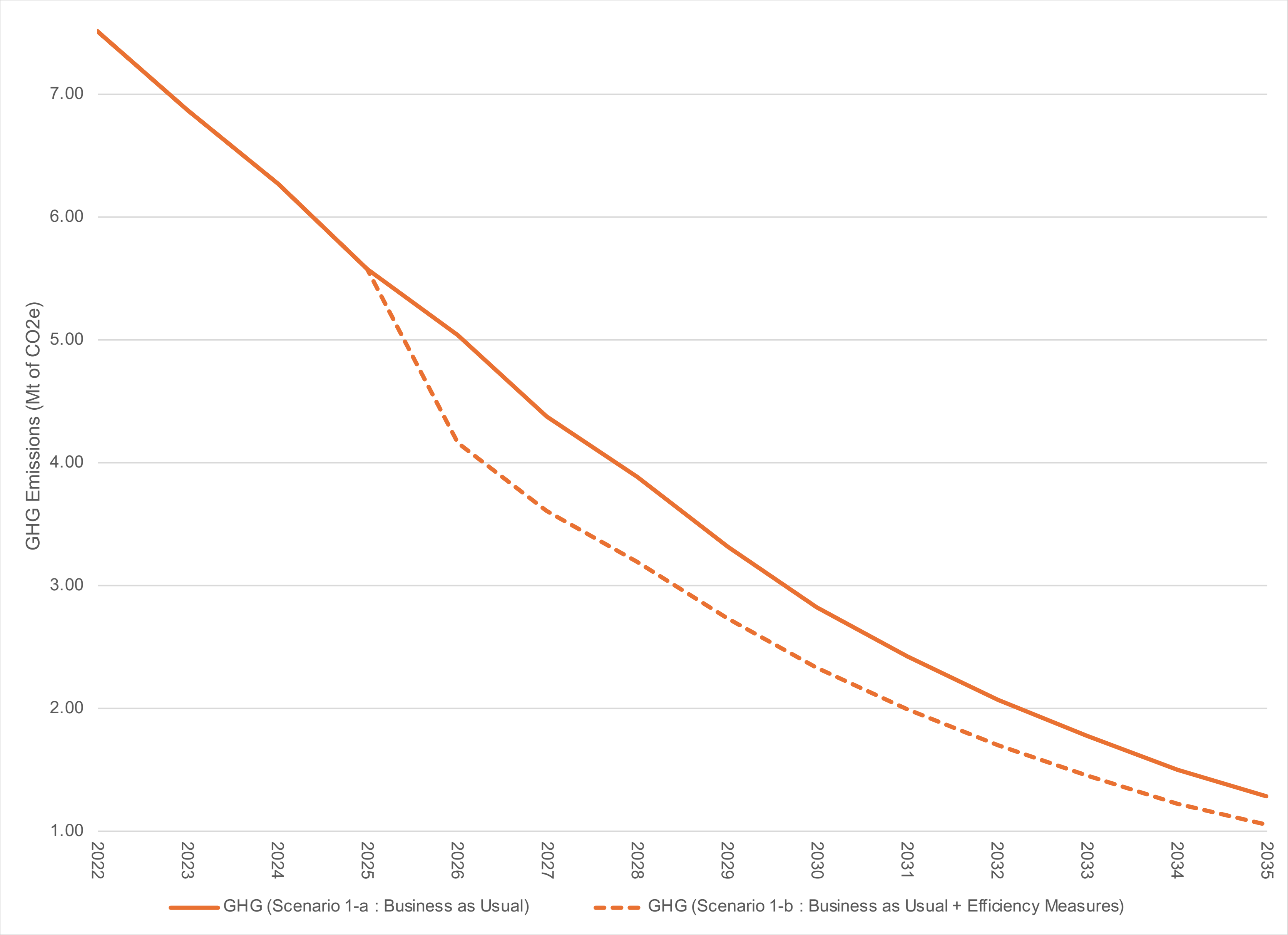

Figure 2: Passenger cars and trucks GHG emissions in the business-as-usual scenarios, with and without efficiency measures (EMC calculations)

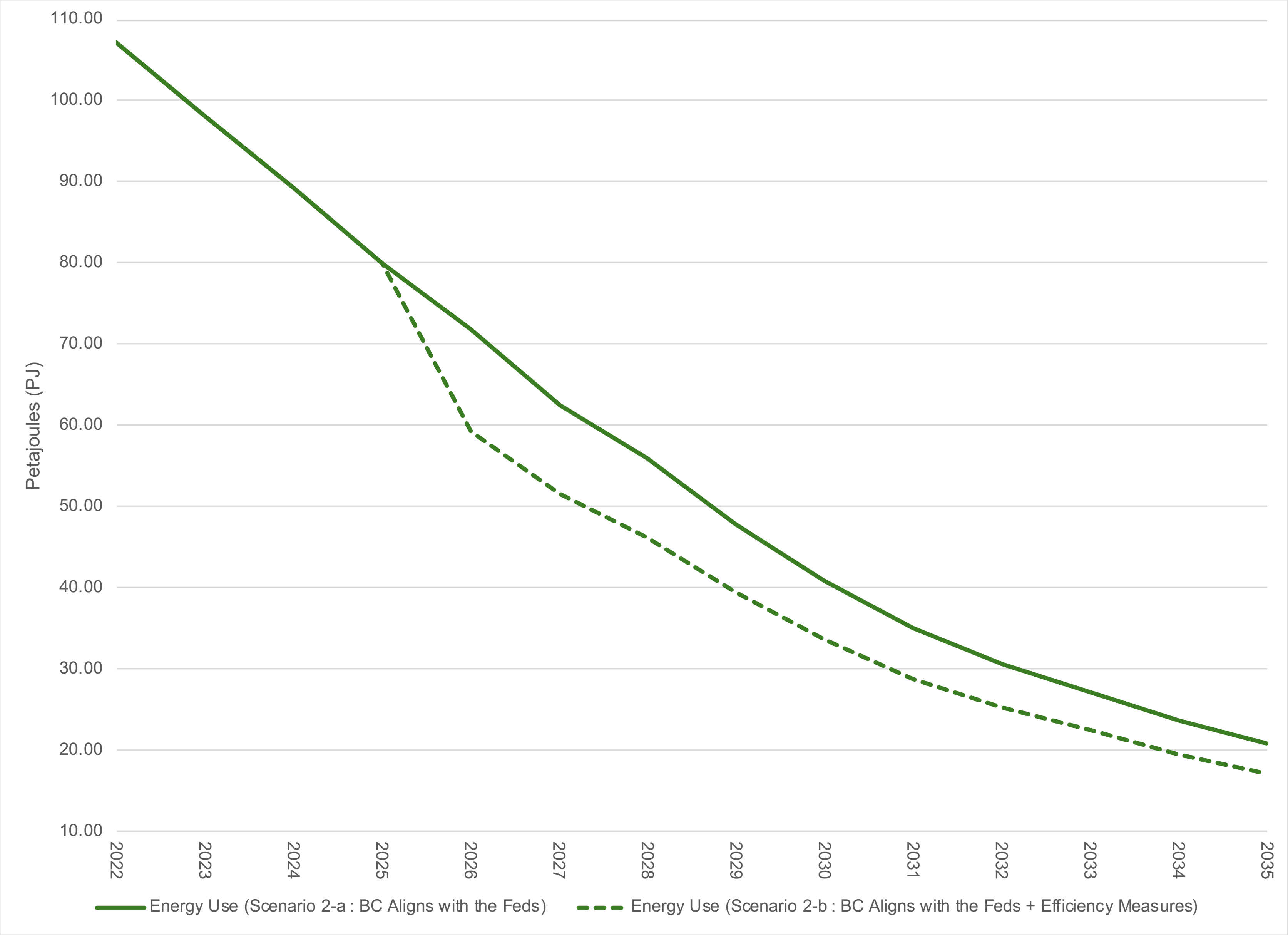

Figure 3: Passenger cars and trucks energy use in the alternative scenarios, with and without efficiency measures (EMC calculations)

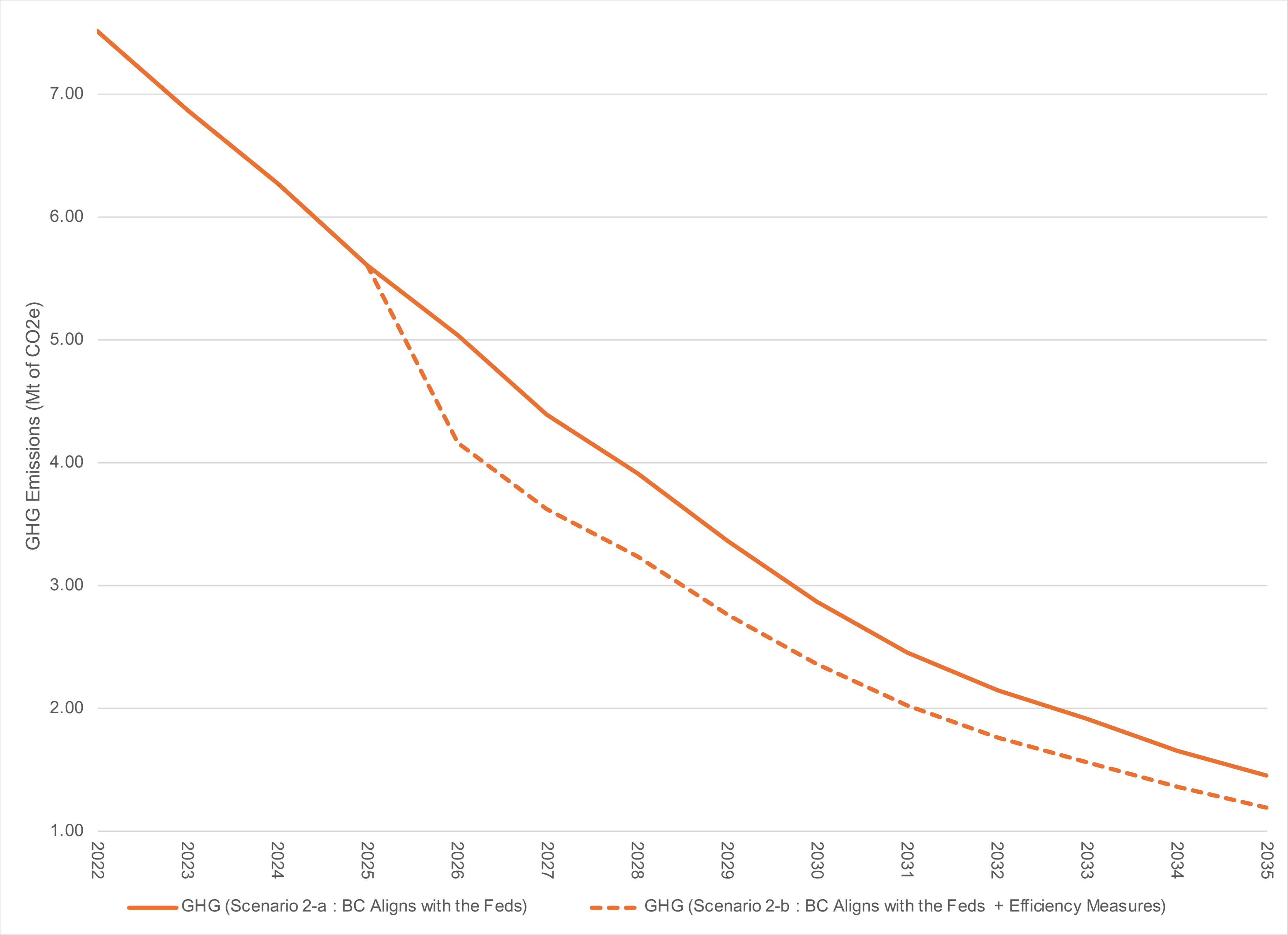

Figure 4: Passenger cars and trucks GHG emissions in the alternative scenarios, with and without efficiency measures (EMC calculations)

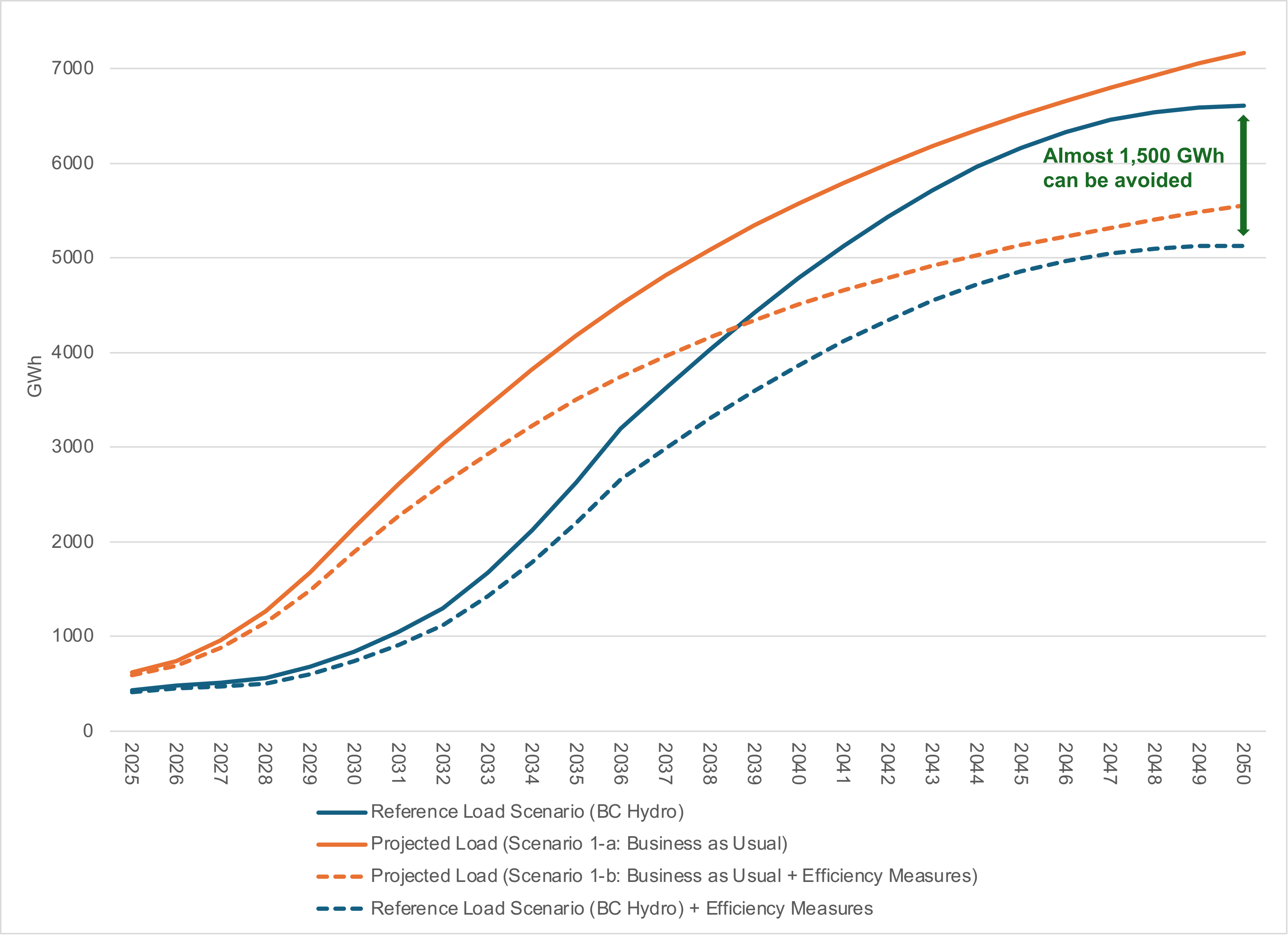

Figure 5: Load of ZEV Passenger cars and trucks, Business as Usual, with and without efficiency measures (EMC calculations)

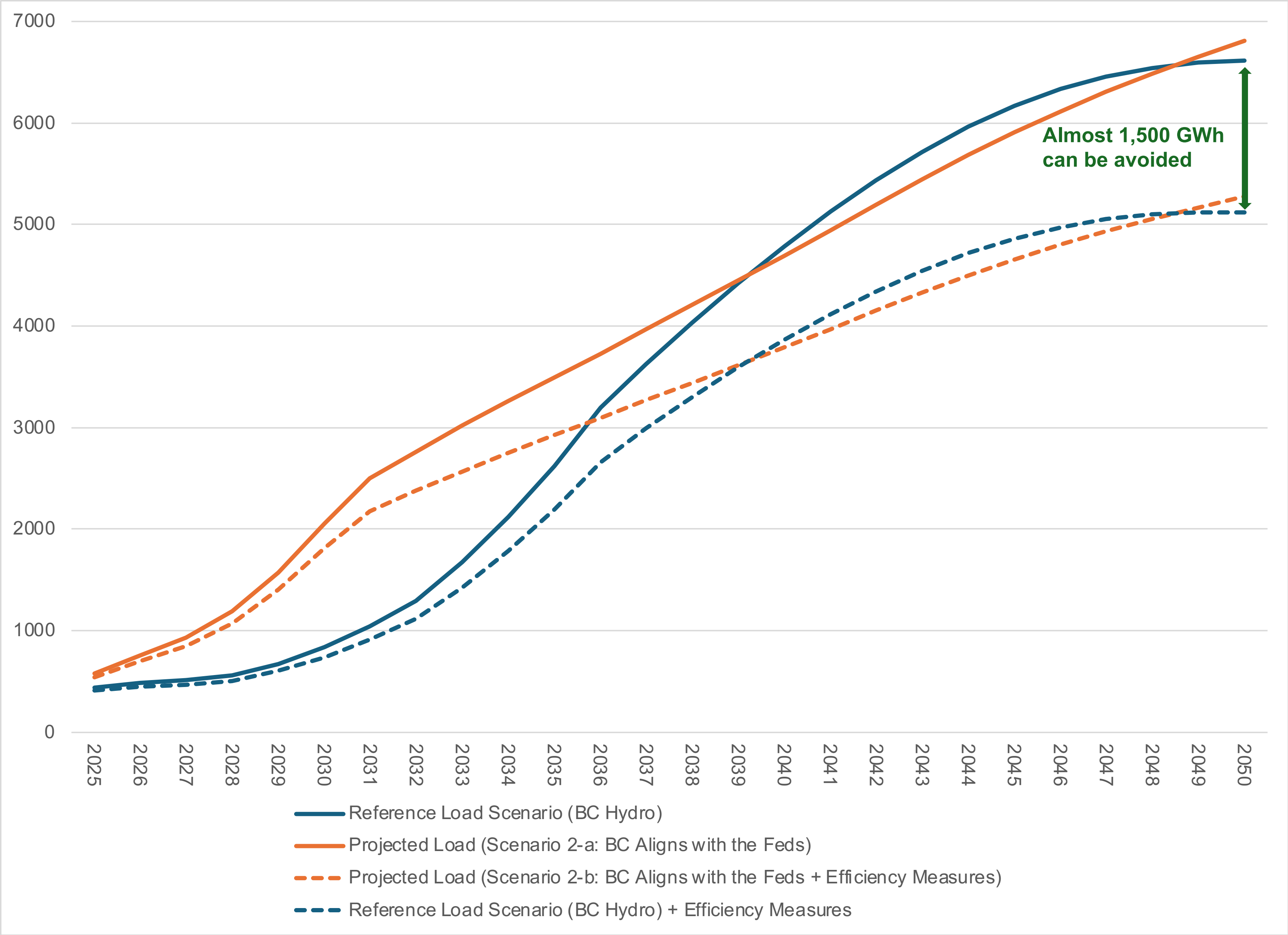

Figure 6: Load of ZEV Passenger cars and trucks, B.C. Aligns with the Feds, with and without efficiency measures (EMC Calculations)

APPENDIX A: Energy efficiency in electrified transportation - Technical concepts and definitions

Energy efficiency refers to delivering mobility services, moving people and goods, using less energy, and creating less stress on the electricity system, particularly during peak hours. Efficiency is therefore treated as a system outcome, not a single technical attribute. A vehicle may be highly efficient in laboratory terms yet impose higher system impacts if it is charged at the wrong time, operated in conditions that amplify auxiliary loads, or used in ways that increase kilometres travelled per person moved.

At its core, electrification introduces a fundamental change in how energy is converted into motion. On average, electric vehicles can convert over 77% of electrical energy from the grid to power at the wheels. In contrast, conventional gasoline vehicles convert only about 12% to 30% of the energy stored in gasoline to power the wheels[7]. This explains why electrification can improve vehicle-side efficiency.

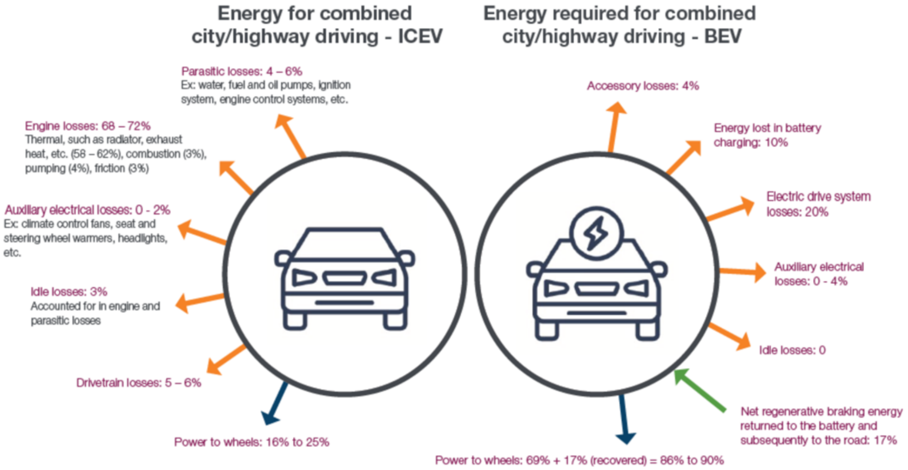

Figure 7: Comparing where energy goes for combined city/highway driving in BEVs and ICEVs[8]

However, this conversion advantage does not automatically translate into the most efficient outcome. For that reason, three interacting dimensions structure the analysis throughout the report. **Vehicle-side efficiency** captures the conversion of energy to motion and the determinants of energy intensity, including thermal loads (heating and cooling), drivetrain losses, rolling resistance, aerodynamics, and regenerative braking. **Charging-side and grid-facing efficiency** captures the losses and constraints between the meter and the battery, as well as the practices that shift charging

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[7] United States Department of Energy. Fuel economy. Accessed 10/02/2026. URL: https://fueleconomy.gov/feg/evtech.shtml

[8] Canada Energy Regulator. 2021. Market Snapshot : Battery electric vehicles are far more fuel efficient than vehicles with internal combustion engines. Accessed 28/02/2026. URL: https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/market-snapshots/2021/market-snapshot-battery-electric-vehicles-are-far-more-fuel-efficient-than-vehicles-with-internal-combustion-engines.html

away from peak hours. **System and behavioural efficiency** capture how travel demand is generated and satisfied, including eco-driving, vehicle occupancy, shared mobility, routing, and scheduling.

Charging is an essential bridge between vehicle-side and grid-side efficiency because electricity delivered to the vehicle is not converted with perfect efficiency. Studies emphasize that battery charging efficiency can vary, but is often 84% to 93%, depending on conditions and equipment.[9] This is particularly important because the electricity system experiences demand at the meter, not only inside the battery. The U.S. EPA's description of EV fuel economy reinforces the same idea from a measurement standpoint. EPA notes that MPGe[10] values include charging losses and are designed to better reflect energy drawn from the outlet, with assumptions that consider Level 2 AC charging and related losses.[11] This framing is directly relevant to grid-facing efficiency because it clarifies that a meaningful efficiency discussion must account for the plug-to-wheel chain rather than only battery-to-wheel.

This system perspective matters because electrification alone does not guarantee an efficient outcome. Electrification reduces tailpipe emissions and lowers energy intensity per kilometre, but a poorly managed transition can increase peak loads, intensify distribution constraints, and limit expected benefits. Efficiency measures are therefore assessed as interventions that reduce kWh per kilometre, mitigate coincident peak load, and reduce the need for upstream investments while maintaining or improving mobility outcomes.

In practical terms, the levers that improve energy intensity are not always the same levers that improve peak outcomes. A vehicle can be efficient per kilometre and still create avoidable peak strain if charging is concentrated into narrow peak windows. Similarly, peak can be managed while leaving avoidable energy use on the table if thermal loads, driving practices, and utilization patterns are not addressed.

In B.C., efficiency is shaped by specific features of the operating environment. Winter heating loads and precipitation can increase energy intensity, particularly for larger vehicles and buses, and can also affect the conditions under which regenerative braking can be fully utilized. Topography influences speed profiles and the frequency and intensity of braking events, affecting the share of kinetic energy that can be recovered through regeneration. Urban congestion affects both energy use and exposure to local air pollution, linking efficiency with health co-benefits. These contextual factors are treated explicitly throughout the report because they determine whether efficiency gains observed in other jurisdictions are likely to transfer to B.C. without adjustment, and which measures offer the most robust benefits in the province.

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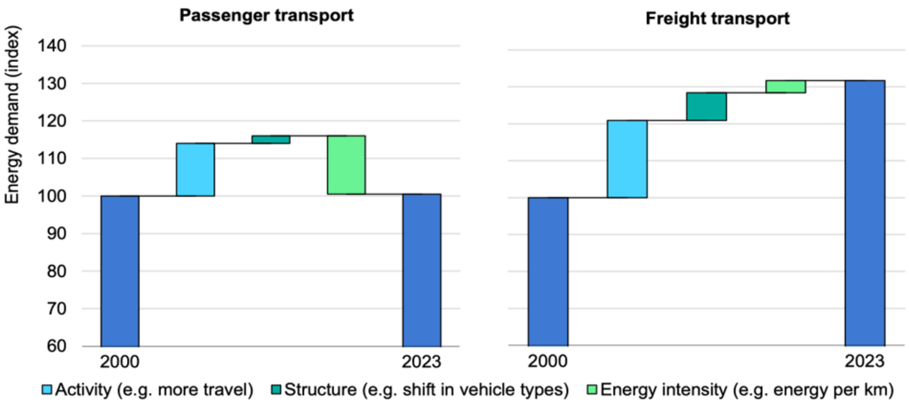
[9] IEEE. Gautam et. al., 2011. An automotive on-board 3.3 kW battery charger for PHEV application. Accessed 10/02/2026. URL: https://ieeexplore.ieee.org/document/6043192

[10] Miles per gallon equivalent.

[11] United States Environmental Protection Agency. Fuel Economy and EV Range Testing. Accessed 10/02/2026. URL: https://www.epa.gov/greenvehicles/fuel-economy-and-ev-range-testing

APPENDIX B - Detailed North American regulatory context

According to the 2025 Energy efficiency report[12] "Passenger transport energy demand in IEA – International Energy Agency countries is around the same level as twenty years ago. Growth in travel lifted demand by about 15% between 2000 and 2023, but efficiency improvements over the same period more than offset this growth, driven by stricter fuel economy standards and the wider adoption of electric vehicles. ***At the same time, there has been a shift towards larger sports utility vehicles, without which car fuel efficiency progress would have been 30% higher***."



IEA. CC BY 4.0.

Figure 8: Transport energy demand decomposition, IEA countries, 2000-2023[13]

The pathway to transportation efficiency in B.C. is shaped by a layered policy environment that operates simultaneously through emissions accounting, vehicle supply rules, GHG standards, and market signals that influence what people buy and how vehicles are used. Policy matters for a specific reason, the same electrification rate can produce very different outcomes for kWh per kilometre and coincident peak depending on whether policy steers technology choices (e.g., range profiles and charging mix), demand-side behaviour (e.g., sharing and occupancy), and grid-facing practices (e.g., charging timing). Identifying efficiency opportunities and policy proposals that reduce grid strain makes the policy environment a central driver rather than just a background context.

A first anchor for the B.C. policy context is the provincial inventory of GHG emissions, which provides the official baseline for province-wide emissions since 1990 and uses national inventory methods with B.C. specific adjustments.[14] The latest update shows that B.C.'s inventory for 2023 was 61.1 Mt CO_2e gross emissions in 2023.[15] This establishes the magnitude of B.C.'s emissions challenge, and the transportation sector breakdown provides the starting point for prioritizing efficiency measures where they can deliver the most meaningful energy and emissions reductions.

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[12] International Energy Agency. Energy Efficiency 2025. Accessed 20/02/2026. URL : https://iea.blob.core.windows.net/assets/23a80bb2-6985-4507-ab99-c1d700f6548b/EnergyEfficiency2025.pdf

[13] Ibid.

[14] Government of BC Provincial Inventory of greenhouse gas emissions. Accessed 19/01/2026. URL: https://www2.gov.bc.ca/gov/content/environment/climate-change/data/provincial-inventory#PI-NIR

[15] 59.2 $MtCO_2e$ net after including sequestration by forest management offset projects not covered in the inventory.

At the national level, the Canadian Environmental Sustainability Indicators (CESI) provide the broader comparison set for emissions trends and sector shares. The 2025 CESI Greenhouse Gas Emissions publication summarizes national trends and provides a consistent framing for the national contribution of the transportation sector. The relevance for this report is not to substitute national averages for B.C., but to situate B.C.'s transport pathway in a national context where federal regulations and supply chains influence the vehicle market, and where transportation remains a major source of air pollution and GHG emissions.[16]

The second anchor is the set of vehicle regulations that shape technology availability. In B.C., the provincial Zero-Emission Vehicles Regulation defines classes of ZEVs (including Classes A, B, and C) and establishes the compliance and reporting framework for suppliers, including the issuance and management of ZEV units and the rules for model-year reporting. This is key because the supply mix, BEVs and PHEVs, and range profiles drive charging behaviour, including the share of charging that occurs at home, at depots, or on public fast chargers, and therefore influences both conversion losses and the existing load. In other words, supply policy indirectly shapes grid impacts by shaping where and how charging sessions are satisfied.[17]

Federal vehicle GHG rules provide a second layer of influence. Canada's Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations are a regulatory instrument establishing fleet-average standards and associated compliance mechanisms (including credit systems). The consolidated regulation contains key provisions on fleet averaging, credits, and components relating to ZEV requirements under that framework. Standards at the fleet level are a durable policy mechanism as they shape manufacturer compliance strategies and can influence the share of efficient technologies entering the market.[18]

A key nuance is that the federal policy approach has evolved relative to the earlier EV Availability Standard (EVAS). In December 2023, ECCC published a backgrounder describing the EVAS as regulated ZEV sales targets ramping from 2026 to 2035, framed as an amendment under existing vehicle GHG regulations.[19] However, in February 2026, the federal government repealed the EVAS and shifted to a package emphasizing renewed consumer incentives and the development of stringent GHG standards.[20] This increases near-term uncertainty regarding the exact compliance mix manufacturers will pursue (BEVs, PHEVs and efficiency improvements in ICE), which in turn affects the likely distribution of efficiency outcomes. In a broad efficiency logic, this strengthens the case for measures that deliver value under multiple technology mixes, such as eco-driving and operational efficiency programs for fleets.

Different instruments can shape markets and compliance behaviour. For example, the ZEV credit system in California is a particularly relevant reference because it illustrates how a credit-based regime can maintain manufacturer compliance and transparency. The California Air Resources Board

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[16] Environment and Climate Change Canada. Greenhouse Gas Emissions – Canadian Environmental Sustainability Indicators. Accessed 19/01/2026. URL: https://www.canada.ca/content/dam/eccc/documents/pdf/cesindicators/ghg-emissions/2025/greenhouse-gas-emissions-en.pdf

[17] Government of BC Zero-Emission Vehicles Regulation. Accessed 19/01/2026. URL: https://www.bclaws.gov.bc.ca/civix/document/id/crbc/crbc/196_2020

[18] Government of Canada. Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations. Accessed 19/01/2026. URL: https://laws-lois.justice.gc.ca/PDF/SOR-2010-201.pdf

[19] Environment and Climate Change Canada. Canada's Electric Vehicle Availability Standard. Accessed 19/01/2026. URL: https://www.canada.ca/en/environment-climate-change/news/2023/12/canadas-electric-vehicle-availability-standard-regulated-targets-for-zero-emission-vehicles.html

[20] Electric Autonomy. Canada repeals EV Availability Standard restores $5,000 vehicle incentive with new automotive policy. Accessed 05/02/2026. URL: https://electricautonomy.ca/policy-regulations/2026-02-05/canada-repeals-ev-availability-standard-restores-5000-vehicle-incentives-with-new-automotive-policy/

(CARB) Annual ZEV Credits Disclosure Dashboard[21] states that, as of model year 2024, all manufacturers remain in compliance with the California ZEV regulation, and it provides a public mechanism for tracking credit balances and obligations.

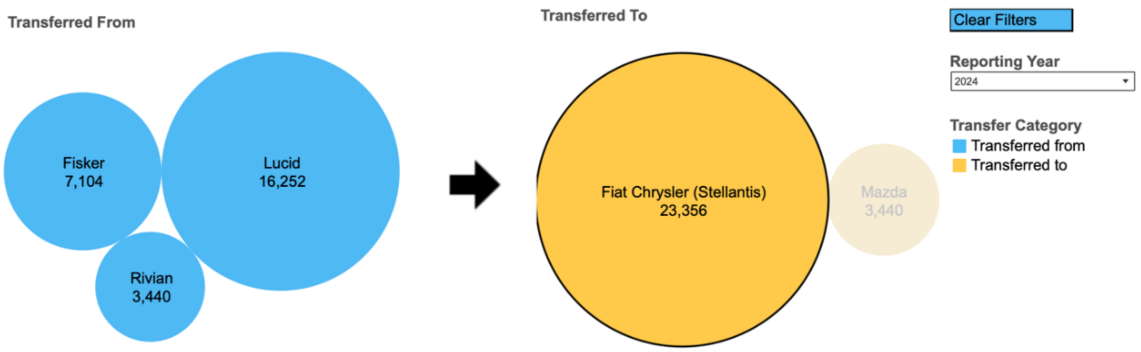
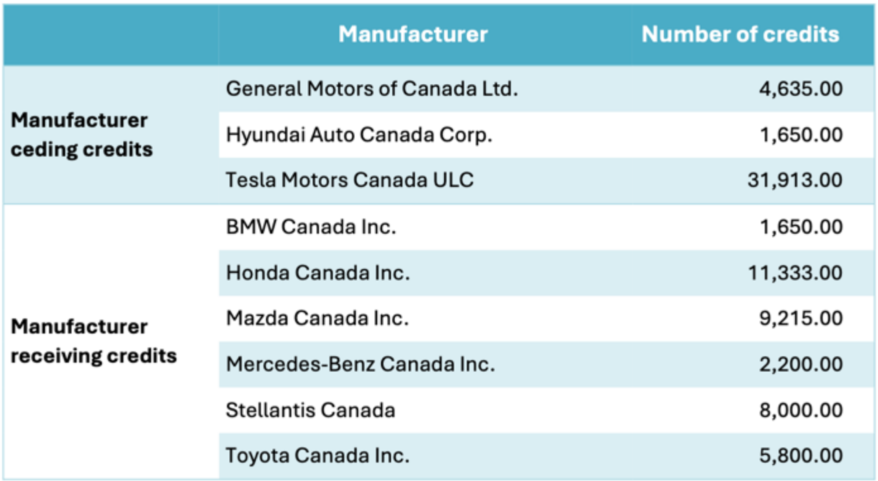


Figure 9: Manufacturer Credit Transfers (California), 2024[22]

This shows that credit markets can produce strong compliance even under ambitious targets, but it also demonstrates the importance of transparent reporting, which supports program evaluation.

Quebec's ZEV Standard provides another comparative case. The Quebec government's ZEV standard description emphasizes the role of credits to stimulate the supply of ZEVs and low-emission vehicles and links the standard to longer-term goals, including electrification targets and its intention to reach 100% ZEV sales by 2035[23], though some updates will be published in the coming months, including adjusting the 2035 ZEV sales target to 90%. Under the current program, only 6 out of 18 carmakers have had to buy credits to meet their ZEV sales requirements in Quebec between 2020 and 2024.[24]



	Manufacturer	Number of credits
Manufacturer ceding credits	General Motors of Canada Ltd.	4,635.00
	Hyundai Auto Canada Corp.	1,650.00
	Tesla Motors Canada ULC	31,913.00
Manufacturer receiving credits	BMW Canada Inc.	1,650.00
	Honda Canada Inc.	11,333.00
	Mazda Canada Inc.	9,215.00
	Mercedes-Benz Canada Inc.	2,200.00
	Stellantis Canada	8,000.00
	Toyota Canada Inc.	5,800.00

Figure 10: Alienation of Credits among manufacturers between September 2, 2020, and September 1, 2024 (Québec)[25]**.**

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[21] California Air Resources Board. Annual ZEV Credits Disclosure Dashboard. Accessed 19/01/2026. URL: https://ww2.arb.ca.gov/applications/annual-zev-credits-disclosure-dashboard

[22] Ibid.

[23] Government of Québec. Norme vehicles zéro émission (VZE). Accessed 19/01/2026. URL: https://www.environnement.gouv.qc.ca/changementsclimatiques/vze/

[24] Government of Québec. Application Report – Evolution of the Zero-Emission Vehicle Standard and Results as of September 1, 2024. Accessed 20/02/2026. URL : https://www.environnement.gouv.qc.ca/changementsclimatiques/vze/rapport-application-norme-vze-en.pdf

[25] Ibid.

In fact, "since the ZEV standard came into force, over 665,000 credits have been accumulated by manufacturers. After the allocation of nearly 265,000 credits for model years 2018 to 2023, over 400,000 surplus credits will remain available. ***This surplus would have been largely sufficient to cover the requirements for the 2024 model year, estimated at approximately 72,000 credits, even if the manufacturers did not sell any EVs for that model year.***"

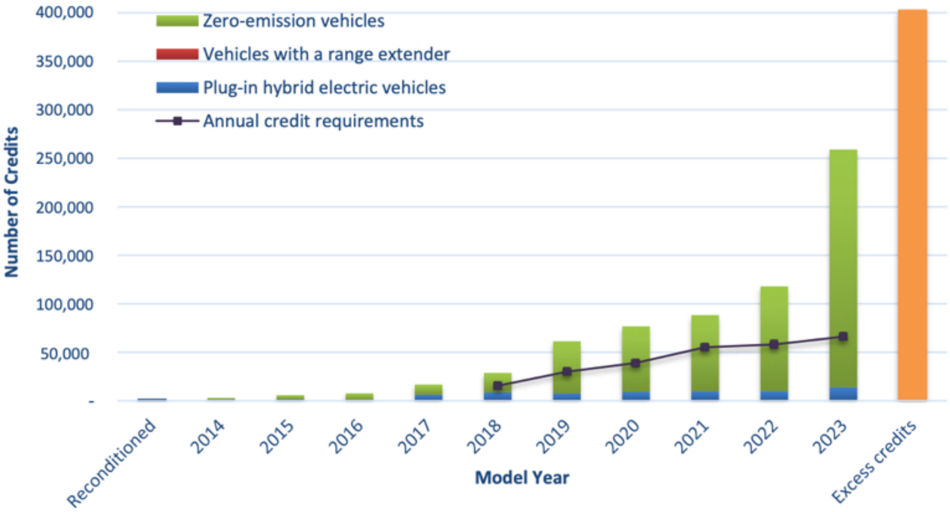

Figure 11: Requirements and credits based on source (Quebec)[26]

This policy model demonstrates how credit systems can influence manufacturer behaviour while managing transition constraints and market readiness.

A third cluster of policy drivers relates to fuel economy standards and market incentives, which shape the baseline efficiency challenge that electrification must address. Canada has historically performed poorly on average vehicle fuel economy relative to peers, and this baseline inefficiency matters for B.C. because electrification of a heavier, higher-power fleet could drive substantial electricity demand and peak loads if efficiency measures are not pursued simultaneously.

The Canada Energy Regulator (CER) issued a market snapshot in 2019 indicating that in 2017 **Canada *ranked dead last in the world*, with an average of 206 g CO_2/km and 8.9 L/100 km**, and links this to vehicle size, power, and a shift toward lights trucks/SUVs.[27] Thus, an efficiency strategy cannot rely on technology substitution alone, it must also address vehicle choice and utilization patterns because larger vehicles inherently require more energy per kilometre and increase the stress on charging infrastructure and the grid.

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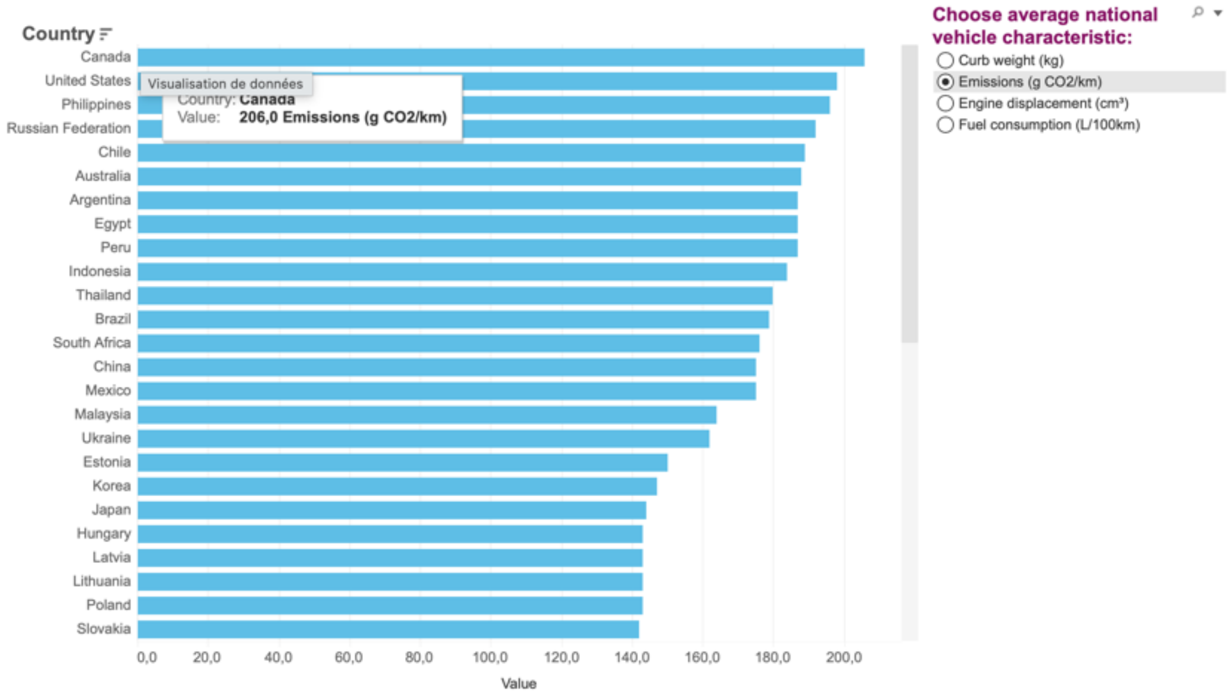
[26] Ibid.

[27] Canada Energy Regulator. Market Snapshot: How does Canada rank in terms of vehicle fuel economy. Accessed 19/01/2026. URL: https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/market-snapshots/2019/market-snapshot-how-does-canada-rank-in-terms-vehicle-fuel-economy.html



Choose average national vehicle characteristic:

○ Curb weight (kg)
● Emissions (g CO2/km)
○ Engine displacement (cm³)
○ Fuel consumption (L/100km)

Figure 12: Average personal vehicle characteristics, by country (2017)[28]

Electrification confers a clear energy conversion advantage, but it does not eliminate sensitivity to operating conditions, especially in cold weather. The CER's 2021 market snapshot explains why BEVs are far more efficient than ICE vehicles in energy conversion terms and discusses regenerative braking as a contributor to that efficiency.[29] It also notes that freezing conditions can increase energy consumption for EVs in winter because energy is required to heat the cabin and battery. This emphasis on winter penalties reinforces that efficiency programs must include both technology and operational measures that address cold-weather energy intensity as well as charging behaviour.

The U.S. policy context is also relevant because of the deeply integrated North American vehicle market. The Corporate Average Fuel Economy (CAFE) program administered by the U.S. Department of Transportation[30] is a cornerstone fuel-economy policy instrument, and changes in U.S. standards can influence manufacturer product planning that also affects Canadian and B.C. availability. The CAFE results underline that fleet-average standards are a proven regulatory mechanism that shapes baseline efficiency independent of electrification, and acknowledges that harmonization, or divergence, can affect vehicle availability and compliance strategies.

Another cluster of drivers relates to transportation system efficiency, the idea that a large share of energy savings is determined by system design, not only by the efficiency of individual vehicles. The U.S. DOE's Alternative Fuels Data Center provides a structured "system efficiency" framing emphasizing that transportation is a multimodal network, and that strategies such as ridesharing, public transportation, active transportation, integrated multimodal travel, and freight/last-mile

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[28] Ibid.
[29] Ibid.
[30] U.S. Department of Transportation, NHTSA. Corporate Average Fuel Economy. Accessed 19/01/2026. URL: https://www.nhtsa.gov/laws-regulations/corporate-average-fuel-economy

optimization can improve system efficiency.[31] This is consistent with the scope of this report, which explicitly includes demand-side measures (eco-driving, carpooling, carsharing) as part of an efficiency pathway. In other words, policy drivers are not limited to vehicle supply, they include programs that change how travel demand is generated and satisfied, which can reduce energy per passenger-kilometre and reduce peak stress by smoothing travel patterns and charging demand. For example. If a government encourages commuters to do more carpooling, the energy efficiency gains will be significant.

International procurement policy provides another useful reference point, especially for fleets. The EU's Clean Vehicles Directive requires public procurement to account for lifetime energy and environmental impacts and sets minimum shares for clean vehicles in public purchasing in support of low-emission mobility.[32] This is relevant because procurement is one of the fastest levers available to influence fleet composition and operational norms, particularly for municipal fleets, transit agencies, and contracted services. For BC Hydro, procurement-driven electrification is also where managed charging and depot design can be institutionalized early, improving grid outcomes.

Taken together, these policy and market drivers imply a clear strategic direction for British Columbia to treat energy efficiency as a cross-cutting objective that must be pursued through multiple instruments. Inventories provide the baseline and accountability logic, supply and emissions regulations shape the vehicle mix and technology pathway, incentives and standards shape adoption and procurement, and system-efficiency programs shape travel behaviour, occupancy, and charging timing. In the near term, the federal policy shift from a sales mandate increases uncertainty in adoption composition, but it does not weaken the rationale for efficiency, if anything, it strengthens the case for measures that are robust regardless of technology mix and that directly address peak impacts and operational efficiency. The subsequent sections of this report focus on levers that can be implemented in B.C. today, such as managed charging, fleet planning, eco-driving programs, and targeted shared mobility and occupancy strategies.

Recent policy shifts and North American regulatory divergence (implications for B.C.)

The efficiency trajectory of vehicles used in British Columbia will be shaped by the most recent EV and GHG policy developments in the region, including Canada's move to stronger fleet GHG standards for model years 2027 to 2032[33], the U.S. federal reversal that removes the main federal basis for vehicle GHG standards and associated compliance mechanisms[34], and also the shift in B.C. from purchase rebates toward charging infrastructure and alignment with federal direction.[35] These changes are important to consider because they create uncertainty and will change the mix of technologies likely to enter the B.C. market, the pace of efficiency improvements in the non EV portion of the fleet, and

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[31] U.S. Department of Energy. Alternative Fuels Data Center. Accessed 19/01/2026. URL: https://afdc.energy.gov/conserve/system-efficiency

[32] European Union. Directive (EU) 2019/1161 of the European Parliament and of the Council of 20 June 2019 amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles. Accessed 19/01/2026. URL: https://eur-lex.europa.eu/eli/dir/2019/1161/oj/eng

[33] Government of Canada. Launch of new strategy to transform Canada's auto industry. Accessed 18/02/2026. URL: https://www.canada.ca/en/employment-social-development/news/2026/02/government-of-canadas-new-auto-strategy.html

[34] U.S. Environmental Protection Agency. President Trump and Administrator Zeldin Deliver Single Largest Deregulatory Action in U.S. History. Accessed 18/02/2026. URL: https://www.epa.gov/newsreleases/president-trump-and-administrator-zeldin-deliver-single-largest-deregulatory-action-us

[35] BIV-Business Intelligence for BC - BC scraps provincial EV rebates permanently amid federal renewal. Accessed 19/02/2026. URL: https://www.biv.com/news/transportation/bc-scraps-provincial-ev-rebates-permanently-amid-federal-renewal-11844186

the overall efficiency outlook, particularly given the high share of SUVs and pickups compared to regular cars, which is key to understanding the energy intensity of vehicles and its grid-facing impacts.

Energy efficiency has already produced measurable reductions in the transportation energy trajectory of B.C. As shown in **Figure 13** the gap between energy use with and without efficiency improvements for cars represents an efficiency wedge of 9,6 PJ in 2022, indicating that efficiency measures materially reduced energy demand relative to a counterfactual baseline. A parallel efficiency wedge is observed for passenger light trucks (**Figure 14**), with 17.8 PJ of savings in 2022. As the fleet electrifies, the efficiency gains will be even more observable, particularly if policy design protects and expands this wedge.

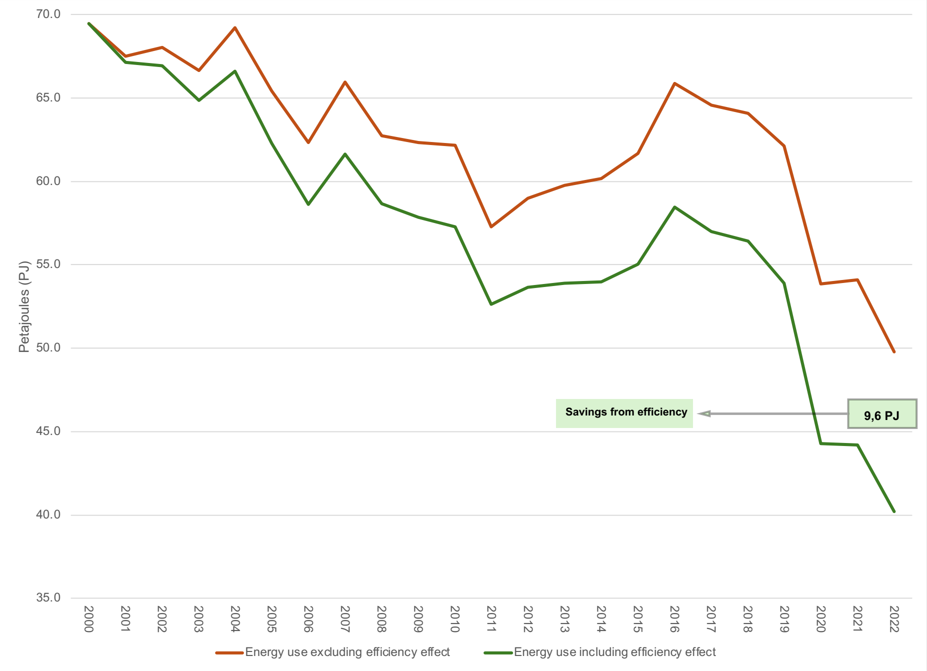

Figure 13: Car energy use with and without energy efficiency effect (NRCan and EMC Calculations), 2000-2022[36]

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[36] Data Source: Natural Resources Canada. National Energy Use Database. Accessed 20/02/2026. URL: https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/data_e/databases.cfm /. Note that the energy use excluding efficiency effect keeps vehicle energy efficiency fixed at its 2000 level and allows travel demand to change, isolating the impact of changes in activity alone.

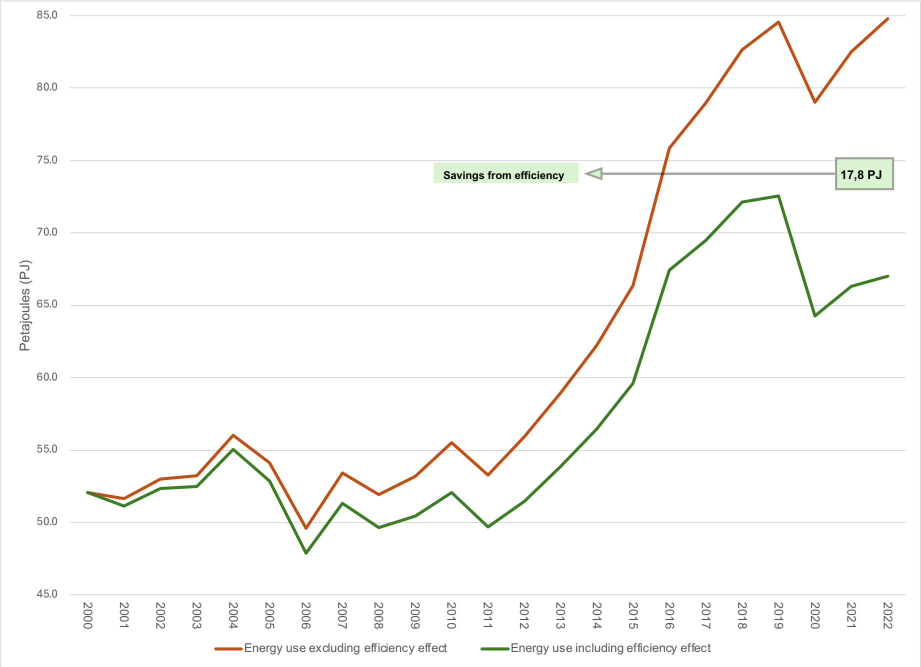

Figure 14: Passenger truck energy use with and without energy efficiency effect (NRCan and EMC Calculations), 2000-2022[37]

The two figures above also show that energy use for cars has a declining trend over the period, while energy use for passenger trucks increased. This pattern is consistent with a longer-run shift in consumer preferences toward larger vehicles. In B.C., that shift is visible in the composition of the vehicles on roads, which has been learning more towards heavier and less efficient vehicles (**Figure 15**). This is even more noticeable in recent years, as shown in **Figure 16**, there is a sustained shift in new registrations away from passenger cars and toward SUVs, with trucks remaining material across the period.

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[37] Ibid.

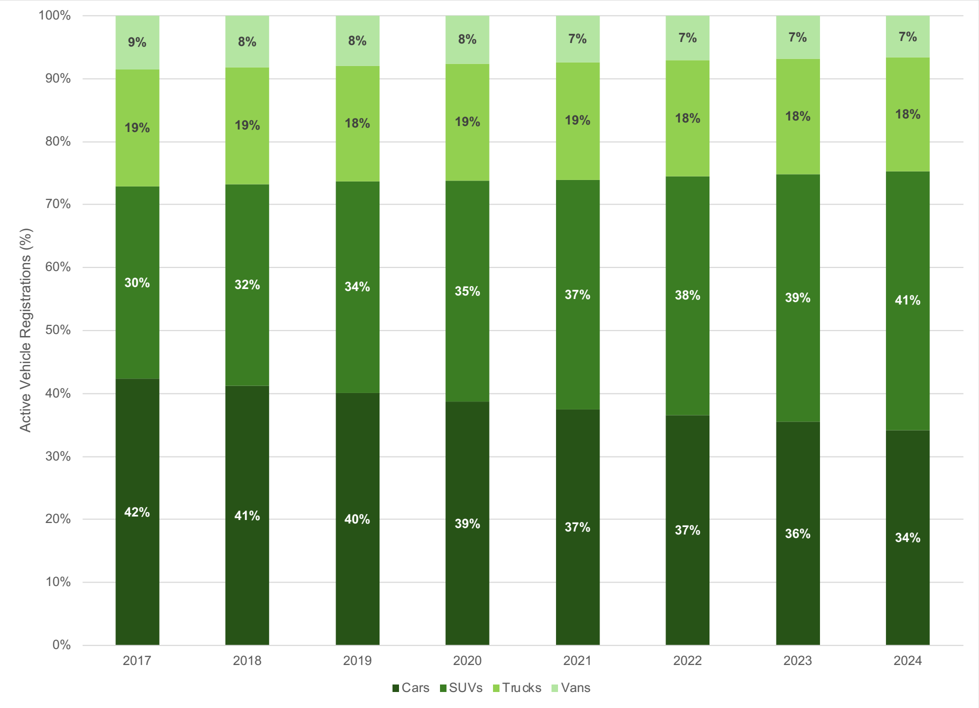
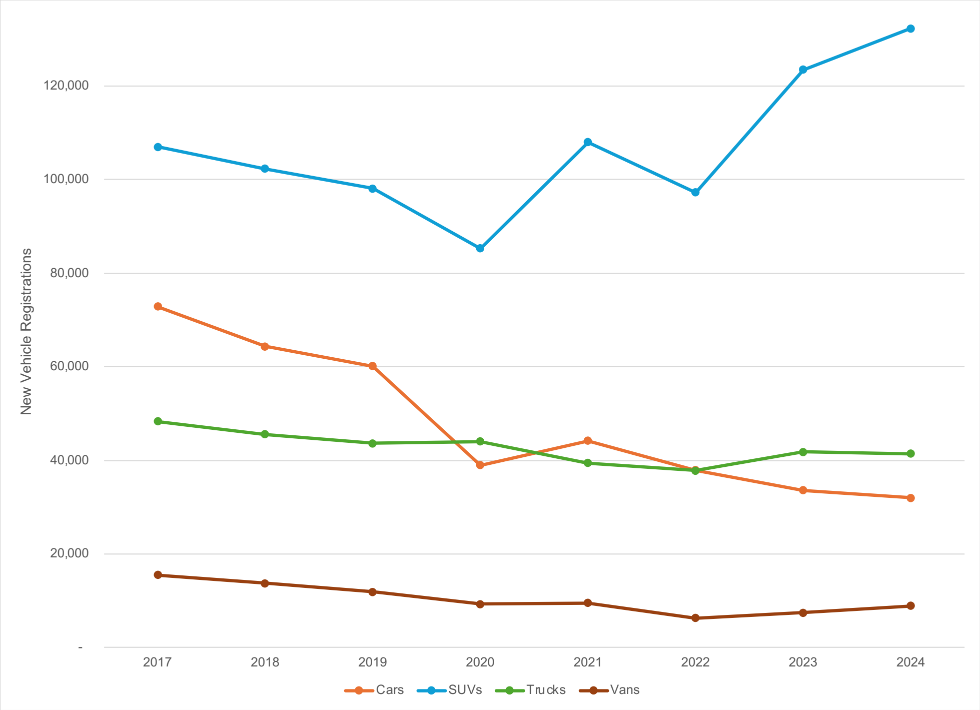


Figure 15: Active registrations by vehicle type in B.C., 2017-2024[38]

Even when per-vehicle efficiency improves, overall energy and grid impacts can worsen if the fleet mix continues to shift toward higher-energy vehicle classes.



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[38] Data Source: Statistics Canada. Vehicle registrations, by type of vehicle and fuel type. Accessed 20/02/2026. URL: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310030801

Figure 16: New registrations by vehicle type in B.C., 2017-2024[39]

Canada's auto strategy: emissions standards replacing a sales mandate

The new federal automotive strategy commits to introducing stronger GHG emission standards for model years 2027 to 2032. It states that these standards will put Canada on a path toward 75% EV sales by 2035 and 90% EV sales by 2040[40]. A shift from a sales mandate framing to an outcomes-based emissions framing in terms of fleet-average creates flexibility in compliance pathways and therefore affects the expected distribution of vehicle-side energy intensity in B.C. during the transition period.

This change is best understood as a compliance logic shift rather than a change in ambition alone. A sales mandate compels a minimum share of ZEV sales while a fleet GHG standard compels a declining average emissions intensity across what manufacturers sell, allowing a range of compliance mixes as well as the use of crediting mechanisms. Manufacturers can increase ZEV sales, expand plug-in hybrid offerings, or improve internal combustion efficiency, the portfolio of supply will depend on compliance costs, technology availability, consumer price sensitivity, and the crediting framework embedded in regulation. The existing Passenger Automobile and Light Truck GHG regulations already operate through fleet averaging and credit systems and were amended in 2023 to embed a ZEV pathway within the same regulatory structure.[41] In practice, this increases the importance of two design questions for the forthcoming standards. How stringent the fleet-average trajectory is, and what flexibility/crediting provisions are permitted, because these determine not only how fast electrification occurs, but also how the efficiency of the non-electric remainder of the fleet evolves during the transition.

U.S. standards trajectory and the deregulation

The North American vehicle market is deeply integrated, and what happens south of the border matters for B.C. and Canada. Platform decisions, technology packages, and model availability are often planned at scale and then distributed across jurisdictions. The long-run U.S. experience with GHG standards shows that fleet efficiency improvements are policy sensitive and can accelerate or reverse depending on standards stringency and market mix. In a transition period where Canada is signalling tighter fleet-average GHG outcomes, the direction of U.S. federal rules becomes an important determinant of whether North American product planning converges on higher efficiency or splits into market-specific offerings. Fleet efficiency does not improve automatically or at a constant rate. The U.S. policy record contains extended periods where regulatory pressure weakened or remained stable, and periods where it tightened, with impacts on both targets and outcomes.[42] The

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[39] Data Source: Statistics Canada. New motor vehicle registrations, quarterly, by geographic level. Accessed 20/02/2026. URL: https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=2010002501

[40] Government of Canada. Launch of new strategy to transform Canada's auto industry. Accessed 18/02/2026. URL: https://www.canada.ca/en/employment-social-development/news/2026/02/government-of-canadas-new-auto-strategy.html

[41] Government of Canada. Regulations Amending the Passenger Automobile and Light Truck Greenhouse Gas Emissions Regulations: SOR/2023-275. Accessed 19/02/2026. URL: https://gazette.gc.ca/rp-pr/p2/2023/2023-12-20/html/sor-dors275-eng.html. Government of Canada. Passenger Automobile and Light Truck Greenhouse Gas Emissions Regulations: SOR/2010-201. Accessed 19/02/2026. URL: https://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-201/FullText.html

[42] U.S. Environmental Protection Agency. Regulations for Greenhouse Gas Emissions from Passenger Cars and Trucks. Accessed 18/02/2026. URL: https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-greenhouse-gas-emissions-passenger-cars-and

efficiency trajectory of vehicles entering the market is shaped by policy stringency and by market composition.

To demonstrate this, one only needs to look at the 20+ years it took for GHG emissions in grams per mile to start declining below the 1987 level due to a lack of regulation from consecutive U.S. administrations. In fact, GHG emissions per km increased ***for 17 years*** before new regulations started making a difference, going from 404.6 g/m in 1987 to 460.6 g/m in 2004[43]. This scenario, under the current U.S. administration, could very well happen again.

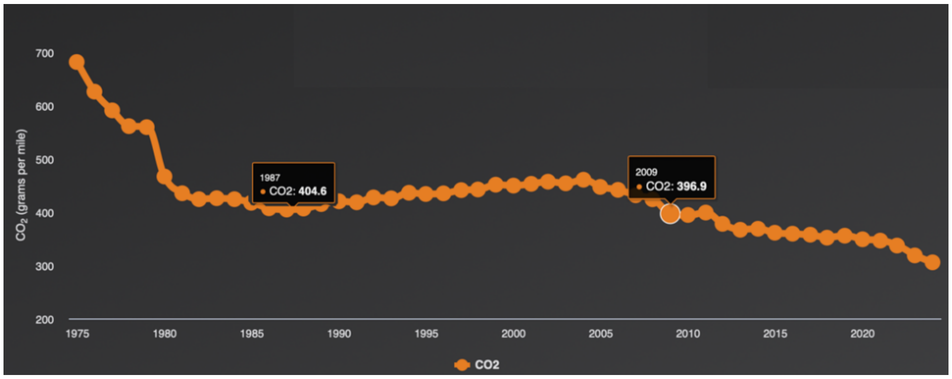

Figure 17: Passenger Cars and Trucks CO$_2$ emissions (U.S), 1975-2025[44]

The revoking of the so-called endangerment finding, a legal recognition that greenhouse gases harm human health, is the largest climate rollback to date. The U.S. EPA announced and finalized a deregulatory action rescinding the 2009 Greenhouse Gas Endangerment Finding and eliminating subsequent federal GHG emission standards for vehicles and engines, framing this as removing the federal legal basis and compliance architecture for vehicle GHG regulation.[45] The same action eliminated all off-cycle credits, including credits associated with the start-stop feature, which had been used within the compliance framework. EPA's companion materials outline which vehicle GHG rulemakings and related provisions are affected and confirm that the change is scoped to GHG standards rather than conventional criteria pollutants.

This makes the case that efficiency outcomes should be treated as contingent rather than assumed. In a divergence situation where Canada is tightening fleet-average outcomes while the U.S. removes federal GHG constraints, manufacturers may either differentiate offerings by market or concentrate compliance engineering where standards remain stringent. Either way, the efficiency characteristics of the vehicles available in B.C. become more sensitive to Canada's regulatory design details and to the province's own market composition, particularly the share of SUVs and pickups, because changes in the share of larger vehicles can materially affect both annual electricity demand and coincident peaks.

As U.S. regulations on average fuel economy, GHG emissions and ZEV sales are being significantly rolled back, we can expect ***new gas and hybrid cars and light trucks offered in Canada to be less***

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[43] U.S. Environmental Protection Agency. 50 Years of EPA's Automotive Trends Report. Accessed 20/02/2026. URL: https://www.epa.gov/greenvehicles/50-years-epas-automotive-trends-report

[44] Ibid.

[45] U.S. Environmental Protection Agency. President Trump and Administrator Zeldin Deliver Single Largest Deregulatory Action in U.S. History. Accessed 18/02/2026. URL: https://www.epa.gov/newsreleases/president-trump-and-administrator-zeldin-deliver-single-largest-deregulatory-action-us

efficient than under Biden EPA's final 2024 rule[46] which targeted a reduction in light-duty vehicle emissions, setting an industry-wide fleet average of 85 grams of per mile (g/mi) by 2032, from the 170 g/mi standard for model year 2027, effectively cutting allowed emissions by nearly 50% from 2026 levels.

In February, Prime Minister Mark Carney spoke to this topic, explaining that ”Right now the standard is set at 172 grams per mile of driving and that would be changed to 74 grams per mile. So, it is a 57 per cent reduction in the emissions as it ramps up for the vehicles in the country.”[47]

B.C. ending rebates and shifting focus to infrastructure

The province has decided to permanently end EV purchase rebates and focus on charging infrastructure, aligning with federal direction.[48] This changes the relative balance between price and infrastructure signals that shape consumer adoption and vehicle choice.

From an energy efficiency perspective, it matters because incentives affect not only how many EVs are adopted, but also which households and which vehicle classes adopt first. A reduction in purchase incentives can shift demand toward hybrids or smaller batteries and can alter the mix of SUV and pickup versus passenger car among electrified purchases. ZEV uptake has been high, but vehicle classes remain skewed toward multipurpose vehicles and pickups.

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[46] U.S. Environmental Protection Agency. Final Rule: Greenhouse Gas Emissions Standards for Heavy-Duty Vehicles – Phase 3. Accessed 20/02/2026. URL: https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-greenhouse-gas-emissions-standards-heavy-duty#rule-summary

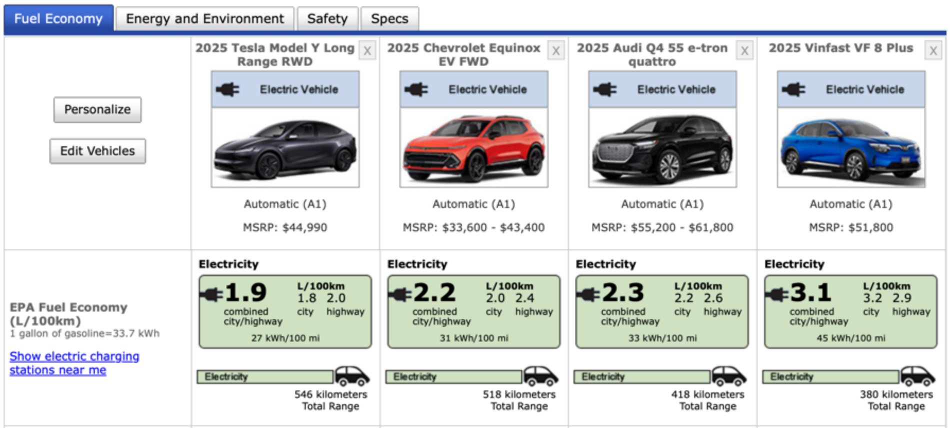
[47] National Observer. Carney Replaces EV Sales Mandate with rebates and regulations. Accessed 20/02-2026. URL: https://www.nationalobserver.com/2026/02/05/news/carney-replaces-ev-sales-mandate-rebates-regulations

[48] BIV-Business Intelligence for BC - BC scraps provincial EV rebates permanently amid federal renewal. Accessed 19/02/2026. URL: https://www.biv.com/news/transportation/bc-scraps-provincial-ev-rebates-permanently-amid-federal-renewal-11844186

APPENDIX C: Technology factors affecting EV efficiency

Vehicle-side efficiency is the starting point for any discussion on efficient electrification, as it determines the amount of electrical energy required to deliver a kilometre of mobility service before considering charging behaviour, grid-facing losses, or system-level travel choices. In electrified transportation, efficiency is not a single parameter, it is the combined outcome of drivetrain conversion, road-load physics (mass, rolling resistance, aerodynamics), accessory loads (especially heating in winter), and the duty cycle the vehicle is asked to perform (speed profile, stop frequency, grade, payload).

While consumers and governments have been looking at energy efficiency for gas vehicles for decades, very little has been communicated when it came to electric vehicles. We believe that the time has come for both to start looking into that as it has a significant impact on electricity demand. The following four compact electric SUVs demonstrate that when it comes to EVs, we can already see a **70% difference** between the most and the least efficient vehicle in the same category, which is very significant[49].



	2025 Tesla Model Y Long Range RWD	2025 Chevrolet Equinox EV FWD	2025 Audi Q4 55 e-tron quattro	2025 Vinfast VF 8 Plus
	Electric Vehicle	Electric Vehicle	Electric Vehicle	Electric Vehicle
	Automatic (A1)	Automatic (A1)	Automatic (A1)	Automatic (A1)
	MSRP: $44,990	MSRP: $33,600 - $43,400	MSRP: $55,200 - $61,800	MSRP: $51,800
EPA Fuel Economy (L/100km) 1 gallon of gasoline=33.7 kWh Show electric charging stations near me	**Electricity** **1.9** combined city/highway L/100km 1.8 city 2.0 highway 27 kWh/100 mi	**Electricity** **2.2** combined city/highway L/100km 2.0 city 2.4 highway 31 kWh/100 mi	**Electricity** **2.3** combined city/highway L/100km 2.2 city 2.6 highway 33 kWh/100 mi	**Electricity** **3.1** combined city/highway L/100km 3.2 city 2.9 highway 45 kWh/100 mi
	Electricity 546 kilometers Total Range	Electricity 518 kilometers Total Range	Electricity 418 kilometers Total Range	Electricity 380 kilometers Total Range

Figure 18: Side-by-side Fuel Economy Comparison[50]

Norway has started to take action to encourage consumers to purchase lighter EVs. Since January 1st, 2026, the VAT exemption for electric vehicles applies only to the first 300,000 NOK of the purchase price. ***Additionally, a weight-based tax ('Vektavgift') of 12.71 NOK per kg applies to the weight exceeding 500 kg.***[51]

A useful baseline is the energy-conversion comparison often used in public technical references. According to the U.S. Department of Energy, all-electric vehicles convert a high share of the electrical

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[49] U.S. Department of Energy. Accessed 20/02/2026. URL : https://fueleconomy.gov/feg/Find.do?action=sbs&id=48771&id=48697&id=48681&id=49087

[50] Ibid.

[51] European Commission, European Alternative Fuels Observatory. Accessed 20/02/2026. URL : https://alternative-fuels-observatory.ec.europa.eu/transport-mode/road/norway/incentives-legislations#:~:text=From%201%20January%202026%2C%20the,the%20weight%20exceeding%20500%20kg

energy from the grid to power at the wheels, whereas conventional gasoline vehicles convert only a smaller fraction of the energy stored in gasoline into motion, with most lost as heat.[52] This conversion gap is the physical reason electrification can reduce energy intensity in transport, but it does not settle the amount of kWh/km that will be required under B.C. operating conditions and the extent to which winter and duty-cycle constraints erode or amplify that advantage.

For light-duty vehicles, the evidence base compiled shows that driving style remains a meaningful efficiency lever even in EVs. In *The eco-driving effect of electric vehicles compared to conventional gasoline vehicles* (AIMS Energy),[53] the authors evaluate eco-driving under controlled conditions using a chassis dynamometer (eco-driving test mode) derived from real-world driving datasets. They report CO_2 reduction rates of about 10.9% to 12.6% for conventional and hybrid vehicles and 11.7% to 18.4% for two EV types, concluding that conventional eco-driving practices (steady speed, gentle acceleration, anticipatory deceleration) also apply to EVs and can be particularly beneficial for EVs that maintain high conversion efficiency at low load.

The policy implication is not merely to encourage eco-driving, but to recognize that eco-driving is one of the few vehicle-side measures that is deployable quickly and at scale through training, in-vehicle feedback, and fleet telematics, producing benefits without new infrastructure. It also interacts positively with other efficiency measures such as route planning and managed charging because it reduces speed variability and unnecessary peak power demands, and it increases the share of deceleration that can be executed smoothly, reinforcing regenerative braking benefits where they are available.

Traffic intensity and speed variability provide a second vehicle-side insight. Even if EVs can perform relatively well in stop-and-go conditions due to regenerative braking and efficient part-load operation, empirical evidence indicates congestion still imposes a measurable penalty on energy consumption. In *Quantifying the Impact of Traffic on Electric Vehicle Efficiency* (World Electric Vehicle Journal), Jonas et al. report a field study with 30 drivers using a 2017 Volkswagen e-Golf, comparing a higher-traffic morning commute scenario with a lower-traffic mid-day scenario.[54] They find additional consumption of approximately 4 to 5% in the high-traffic scenario and estimate that avoiding high traffic could yield up to seven miles of additional range for that vehicle on that route. This is valuable as an "order of magnitude" indicator for what route and time-of-day choices can do to EV efficiency under real conditions. The practical implication is that congestion management, time of day, and route optimization remain relevant for EV efficiency, though the magnitude of energy savings from congestion reduction may differ from ICE vehicles. This also reinforces the complementarity between vehicle-side and system-side measures, eco-driving can partially mitigate stop-and-go penalties, while scheduling and routing can avoid the most energy-intensive congestion windows when operationally feasible.

Winter operation is one of the most important determinants of vehicle-side efficiency in Canada and is especially relevant to B.C., given the contrast between a milder coastal climate and colder interior regions. The Canada Energy Regulator’s 2021 market snapshot makes this mechanism explicit and notes that fuel economy can fall under cold testing conditions (down to roughly −7°C), with larger per

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[52] U.S. Department of Energy. Fuel economy. Accessed 10/02/2026. URL: https://fueleconomy.gov/feg/evtech.shtml

[53] AIMS Energy. The eco-driving effect of electric vehicles compared to conventional gasoline vehicles. Accessed 09/12/2025. URL: https://www.aimspress.com/article/id/1020

[54] World Electric Vehicle Journal. Jonas et al. Quantifying the Impact of Traffic on Electric Vehicle Efficiency. Accessed 10/02/2026. URL: https://www.mdpi.com/2032-6653/13/1/15

centage impacts for electrified powertrains because heating loads are additive, while still emphasizing that BEVs remain more efficient than comparable ICE vehicles even under substantial cold-weather degradation.[55] The U.S. Environmental Protection Agency (EPA) estimates that a drop in temperature from 24°C to 7°C can increase fuel consumption in urban commutes by 12 to 28%[56].

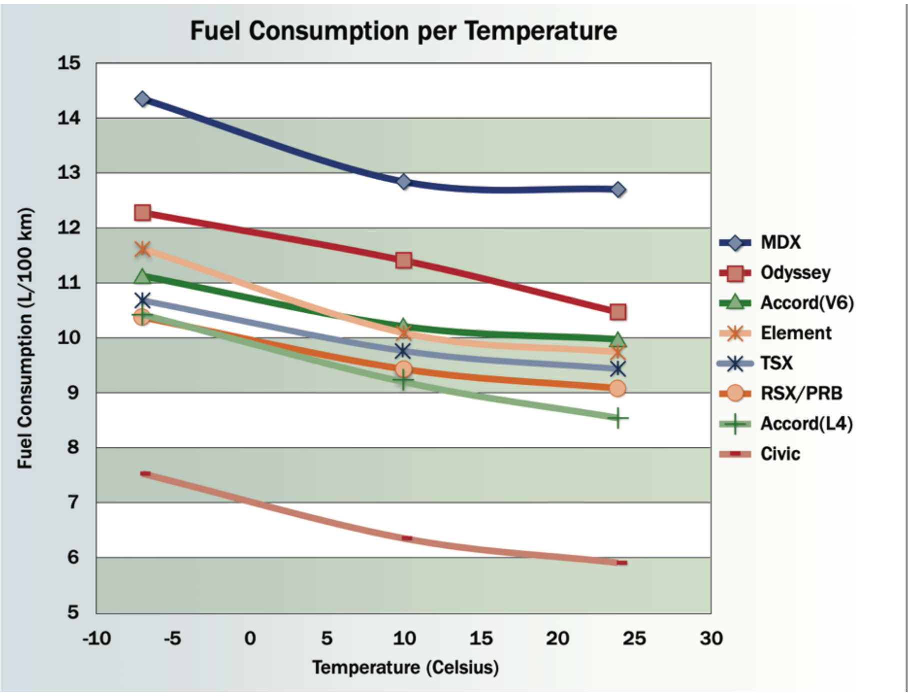

Figure 19: Fuel consumption data for eight different vehicles tested at three different operating temperatures for a shorter city-like commute[57]

Winter penalties must be treated as a planning variable, not an anomaly, particularly for fleets operating in colder regions or on routes with long dwell times and frequent stops. This matters not only for cost and reliability, but also for grid planning because winter is when electricity systems can already be under stress due to heating demand. In that sense, winter vehicle-side efficiency and winter grid adequacy become coupled. Measures that reduce winter kWh/km (through thermal management choices and operational protocols) also reduce winter charging demand and peak risks.

Medium- and heavy-duty vehicles, including buses, are where the duty cycle becomes the defining variable for vehicle-side efficiency. Payload, stop frequency, average speed, grade, and dwell time determine not only traction energy but also the relative importance of auxiliary loads. In *Assessment of energy efficiency of battery electric buses in cold regions* (Transportation Research), the authors analyze operational data from 40 New Flyer XE40 battery-electric buses in the transit network of Montréal across 56 routes between June 2022 and October 2023.[58] The article indicates that average energy consumption in winter is 26% higher than in summer (1.7 kWh/km vs 1.4 kWh/km), attributing

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[55] Canada Energy Regulator. Market Snapshot: Battery electric vehicles are far more fuel efficient than vehicles with internal combustion engines. Accessed 19/01/2026. URL: https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/market-snapshots/2021/market-snapshot-battery-electric-vehicles-are-far-more-fuel-efficient-than-vehicles-with-internal-combustion-engines.html

[56] Natural Resources Canada. Learn the facts: Cold weather effects on fuel efficiency. Accessed 20/02/2026. URL : https://natural-resources.canada.ca/sites/www.nrcan.gc.ca/files/oee/pdf/transportation/fuel-efficient-technologies/autosmart_factsheet_3_e.pdf

[57] Ibid.

[58] Science Direct. Transportation Research. Tian et al. Assessment of energy efficiency of battery electric buses in cold regions. Accessed 09/12/2025. URL: https://www.sciencedirect.com/science/article/pii/S136192092500344X

the increase primarily to auxiliary heating and winter operating conditions. It also reports that regenerative braking is most effective in a mid-speed band (about 30-50 km/h), with an average recovery rate around 45.8%, peaking at 53% in summer and dropping to 32% in winter. The magnitude of seasonal penalties and the operating regime influence regenerative braking and the benefit this technology yields. The same study identifies peak consumption periods under heavy traffic and low-speed stop-and-go operation, which implies that bus efficiency is shaped jointly by temperature and corridor operations. It also shows that despite winter penalties, electric buses can maintain substantially lower daily operating costs than diesel (typically 40 to 60% below diesel), strengthening the case for pairing electrification with targeted efficiency measures that reduce winter kWh/km and improve reliability.

Translating the evidence to B.C. requires treating mechanisms as transferable while calibrating magnitudes. Coastal B.C. will generally experience smaller average winter penalties than Montréal or interior Canada, but interior B.C. can face winter constraints of a similar kind, especially for fleets with early morning starts and high heating needs. B.C.'s topography also changes the computations for regenerative braking and road-load energy. Grades increase traction energy uphill but can increase regeneration opportunities downhill, subject to battery limits and winter stability constraints. The study indicates that regenerative braking performs best at mid-speeds and declines in winter, therefore suggesting that realized regen benefits will depend not only on grades but on speed regime and winter operating constraints.

The conclusion is that vehicle-side efficiency in electrified transport should be treated as a portfolio of levers that can be embedded into procurement and fleet transition planning. Eco-driving is scalable and fast, and there is evidence for expecting material savings under controlled conditions, while also indicating the need for context calibration. Winter penalties are not an excuse to slow electrification, but a reason to include thermal performance and cold-weather operation protocols as explicit procurement criteria and operational planning variables. Finally, duty-cycle sensitivity implies that B.C. should prioritize telemetry and measurement to build B.C.-specific efficiency parameters by vehicle class and route type rather than relying on a single average kWh/km across fleets.

This section sets up the following. Once vehicle-side energy intensity rises in winter and varies strongly by duty cycle, the grid-facing consequence is straightforward. The same electrified fleet can create very different system impacts depending on how, where, and when vehicles are charged, and whether charging is coordinated with operational schedules. For that reason, the next chapter turns from "how much energy the vehicle needs" to "how that energy is delivered", focusing on charging-side losses and on practices that reduce coincident peak demand, especially in fleet depots, where duty-cycle constraints and winter penalties can otherwise compound system strain.

APPENDIX D: Charging system efficiency and grid interface

Charging-side and grid-facing efficiency determines how much electricity must be delivered (at the meter) to achieve a given amount of mobility (at the wheels), and it determines whether electrification produces manageable load growth or concentrated peaks that strain local distribution infrastructure. In practical terms, two different mechanisms matter. The first is energy loss in the charging chain (conversion and thermal losses), which increases kWh drawn from the grid per kilometre driven. The second is load coincidence, meaning when and where charging happens relative to existing peaks. This drives feeder constraints and upgrades even when annual energy demand is modest.

A useful way to anchor charging-side efficiency is to distinguish battery-to-wheel efficiency from plug-to-wheel performance. The charging efficiency varies, and not all energy drawn from the grid ends up stored in the battery, which is why a system view must account for charging losses rather than focusing only on in-vehicle consumption. From a measurement standpoint, the U.S. Environmental Protection Agency notes that MPGe includes charging losses and assumes Level 2 AC charging while accounting for losses from the charging cable and the onboard charger.[59] For grid planning, this clarifies why the relevant demand metric is electricity drawn at the outlet and why programs that reduce conversion losses and avoid high-loss charging practices have real system value.

Where charging occurs is the next determinant because it shapes both losses and peaks. It is well-known that most charging typically occurs at home (and often at work), with public charging used for top-ups and longer-distance travel.[60] The Québec government overview of charging locations notes that home charging can account for over 80% of annual charging needs and frames home charging as the most common and economical solution.[61]

BC Hydro makes a similar point, stating that the bulk of charging needs are met at home and at work, with public charging serving more occasional needs.[62] Since most charging is home or workplace based, efficiency and peak outcomes depend heavily on whether that charging is aligned with off-peak windows or coincides with residential peaks. Even when most charging happens at home, unmanaged plug-in behaviour can cluster charging into the late afternoon/evening window. For fleets, a similar clustering risk occurs when vehicles return to base and charging starts simultaneously. The implication is that electrification can increase peaks faster than annual energy growth would suggest unless managed charging practices are treated as a core efficiency measure rather than an optional add-on.

Rate structures and program design are grid-facing tools that reduce coincident peak demand and improve utilization of existing assets. In B.C., public charging prices vary by operator, but BC Hydro

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[59] United States Environmental Protection Agency. Fuel Economy and EV Range Testing. Accessed 10/02/2026. URL: https://www.epa.gov/greenvehicles/fuel-economy-and-ev-range-testing

[60] Electric Mobility Canada. Powering Up – A national and sub-national outlook on electric vehicle adoption, barriers, and impacts on the grid. Accessed 12/10/2025. URL: https://emc-mec.ca/our-work/ev-dashboard/

[61] Government of Québec. Electric vehicle charging locations and estimated costs. Accessed 10/02/2026. URL: https://www.quebec.ca/en/transports/electric-transportation/charging/locations-costs

[62] BC Hydro. Old habits drive hard: How British Columbians' fueling habits are driving misconceptions about EV charging. Accessed 10/02/2026. URL: https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/news-and-features/bc-hydro-ev-home-charging-report.pdf

provides a clear example of how tariff design can shape system efficiency. BC Hydro's public network uses energy-based (per kWh) pricing. Effective April 1, 2025, Level 2 costs $0.2972/kWh (no idle fee) and fast charging (≥25 kW) costs $0.3609/kWh, with an idle fee of $0.40/min applied after a five-minute grace period once a vehicle stops taking energy.[63] These price structures can steer users toward behaviours that improve asset utilization and reduce peak coincidence. The idle fee discourages lingering after charging completion, improving turnover and utilization. And BC Hydro complements public pricing with explicitly time-differentiated, grid-facing tools at home. Its voluntary time-of-day pricing applies a 5¢/kWh overnight discount (11 p.m. to 7 a.m.) and a 5¢/kWh on-peak surcharge (4 to 9 p.m.), encouraging EV charging to shift away from the evening peak. Finally, Peak Saver adds a demand-response lever by rewarding customers who enroll in eligible smart EV chargers, offering a $250 one-time credit plus $50 per season while enrolled, in exchange for allowing remote adjustments during high demand periods.[64]

Public charging utilization is a separate but connected issue because it determines infrastructure economics and where demand will concentrate. A study led by NREL analyzed utilization across public Level 2 and DC fast charging stations in the U.S..[65] The authors conclude that local EV adoption is a strong indicator of utilization and that Level 2 utilization decreases as the local charging network becomes larger. DC fast charging is less affected since the increased charging power has a greater effect on utilization for DC fast chargers than for Level 2 stations. This indicates that utilization is not fixed but evolves with local adoption and network buildout. In terms of planning, it has implications because it influences where local distribution constraints are likely to emerge first and where managed charging programs may yield the greatest marginal benefit.

Fleet and depot charging deserves separate emphasis because it is the most likely source of heavy new loads. The advantage of depot electrification is that charging location and schedules are predictable, which makes it possible to stagger charging across vehicles and smooth the load profile. But that advantage is only realized if managed charging protocols are implemented, otherwise, depot charging can concentrate demand at the end of shifts and create sharp peaks. The practical takeaway is that depot electrification programs should be paired with basic load management requirements and measurement, including telemetry and interval metering.

Winter amplifies the importance of charging-side management because winter increases vehicle energy intensity at exactly the time electricity systems can already be winter-peaking. The CER market snapshot on BEVs vs ICE vehicles explains the mechanism. EVs draw additional energy for cabin and battery heating, so their efficiency drops proportionally more in freezing conditions, even though they remain more efficient than ICE vehicles overall.[66] When higher winter energy demand coincides with unmanaged evening home charging or end-of-shift depot charging, peak impacts are compounded. This is why efficiency should be treated as a joint technology-behaviour question and explicitly links efficiency measures to reduced grid strain.

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[63] BC Hydro. Charging rates and roaming. Accessed 10/02/2026. URL: https://www.bchydro.com/powersmart/electric-vehicles/public-charging/charging-rates-roaming.html

[64] BC Hydro. Peak Saver enrollment bonus for EV chargers. Accessed 10/02/2026. URL: https://www.bchydro.com/powersmart/electric-vehicles/rebates-incentives/rebates-home-chargers/peak-saver-enrollment-bonus.html

[65] NREL. Pritchard et al. Evaluating Electric Vehicle Public Charging Utilization in the United States using the EV WATTS Dataset. Accessed 11/02/2026. URL: https://docs.nrel.gov/docs/fy24osti/85902.pdf

[66] Canada Energy Regulator. Market Snapshot: Battery electric vehicles are far more fuel efficient than vehicles with internal combustion engines. Accessed 11/02/2026. URL: https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/market-snapshots/2021/market-snapshot-battery-electric-vehicles-are-far-more-fuel-efficient-than-vehicles-with-internal-combustion-engines.html

Vehicle-to-grid and broader vehicle-grid integration (V2G/V2X) can be treated as an additional layer of grid-facing efficiency, but it is best positioned here as a staged option rather than a foundation for near-term planning, because the practical sequence for scaling flexibility starts with smart charging solutions, while bidirectional will come later as technology advances. A recent technical paper describes V2G as a controlled bidirectional energy exchange that can support peak reduction and ancillary services, while also emphasizing key constraints for deployment at scale, including battery degradation considerations, charger architecture and grid code compliance, interoperability, standards, and cybersecurity requirements.[67] The near-term implication is that first-order grid-facing efficiency gains are likely to come from managed charging and load coordination, supported by existing tools such as time-of-day pricing that rewards overnight charging and penalizes evening peak use, and demand-response style programs that can modulate enrolled smart devices. V2G can be considered selectively where fleet duty cycles, centralized depots, and standards make it operationally feasible.

Once charging losses and peak coincidence are recognized as major determinants of system impact, the next question becomes how fleets and drivers can be supported to charge at the right time and place, and how broader behavioural programs influence both energy intensity and charging load profiles. The key consideration is that charging-side efficiency is not only a technical question, but also a program design question that sits at the intersection of infrastructure deployment, pricing, customer incentives, and fleet operational planning.

IMPORTANT*: As industry moves to ever more powerful chargers, the discussion will also revolve around efficiency of charging station locations. As square footage is very expensive in downtown areas around the world and in Vancouver in particular, it will make more and more sense to install fewer chargers per site but more powerful ones. The image below was taken on February 27 in Shanghai where BYD showed our team their new ultrafast 2 MW charger equipped with a battery to help manage peak demand.

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[67] Science Direct. Energy Research & Social Science. Letcher and Britton. The role of electric vehicle-to-X in net zero energy systems: A comprehensive review. Accessed 11/02/2026. URL: https://www.sciencedirect.com/science/article/pii/S2214629625001021

Land costs are now a defining constraint for public charging deployment in Canada's major urban centres, and the effect is **most pronounced in Vancouver**, where commercial parcels can reach $**69** to $80 per square foot and industrial land exceeds $110 per square foot. By comparison, land suitable for similar fast-charging configurations is materially cheaper in Toronto, where industrial proxies fall near $57 per square foot, and dramatically lower in Calgary and Halifax, where industrial and business-park parcels range from $17 to $20 per square foot and $6.50 to $6.75 per square foot, respectively. Because a typical urban fast-charging site may require 15,000 to 25,000 square **feet**, these cost differentials translate into order-of-magnitude land expenses from **$1.4 to $1.6 million** in Vancouver, compared with **$340,000 to $400,000** in Calgary and **$130,000 to $135,000** in Halifax[68].

The implication for high-cost markets is structural: maximizing power delivery per square foot becomes more economically rational than maximizing stall count. In practice, this means fewer chargers per site but with significantly higher power ratings, especially when paired with behind-the-meter buffering batteries that mitigate peak loads. As downtown land prices continue to escalate, particularly in Vancouver's constrained commercial core, ultrafast systems such as the 2 MW battery-equipped hardware demonstrated in Shanghai represent a viable strategy to increase throughput, reduce required land area, and improve overall system efficiency in dense locations.

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[68] Data sources for land costs calculated for this paragraph:
-Business in Vancouver. "Vancouver land prices top all cities in Canada: Colliers." Accessed 27/02/2026. URL: https://www.biv.com/news/real-estate/vancouver-land-prices-top-all-cities-canada-colliers-8272014 ;
-Lee & Associates Calgary. Calgary Industrial Market Review, Q4 2024. Accessed 27/02/2026. URL: https://leecalgary.com/wp-content/uploads/2025/05/LeeIndustrialReportQ42024.pdf
-JLL (Calgary Industrial Group). Balzac, Alberta – 5.9 Acres (listing). Accessed 27/02/2026. URL: https://www.calgaryindustrialgroup.com/properties/balzac-alberta-17-4-acres/
-Halifax Regional Municipality. Business Parks: Price Sheet and Availability. Accessed 27/02/2026. URL: https://www.halifax.ca/business/business-parks/price-sheet-availability
-RENX – Real Estate News Exchange. "Choice sells Montreal development site to Place Dorée." Jan 24, 2025. Accessed 27/02/2026. URL: https://renx.ca/place-doree-buy-montreal-property-multifamily-development
-Canadian Apartment Properties REIT (CAPREIT). News release: "CAPREIT Extracts Development Value from Land Disposition in Montréal." Mar 6, 2023. Accessed 27/02/2026. URL: https://ir.capreit.ca/news/news-details/2023/CAPREIT-Extracts-Development-Value-From-Land-Disposition-in-Montral/default.aspx

APPENDIX E: Behavioural efficiency measures and evidence Base (eco-driving, carsharing, ridesharing)

Operational and behavioural levers are often the fastest efficiency gains available because they can be deployed through programs, incentives, training, and operational rules without waiting for full vehicle turnover or new infrastructure. While vehicle technology determines the baseline kWh/km, operations and behaviour determine how close real-world performance comes to that baseline and whether charging demand becomes concentrated during peak hours.

Eco-driving is the most direct behavioural lever because it targets the driver's decisions that impact energy intensity, particularly speed variability, hard acceleration, late braking, and idling. In their study, Hideki Kato et al use real-world driving datasets to design an "eco-driving test mode" and evaluate vehicles on a chassis dynamometer.[69] They find a near-linear relationship between eco-driving achievement and energy consumption for all powertrains, 10.9% to 12.6% for conventional as well as hybrid vehicles and 11.7%-18.4% for the two EVs tested. These results support a defensible claim that eco-driving remains relevant in EVs and may even offer larger gains for some EV architectures in low-load operation. The operational implication is that eco-driving is not simply a consumer education message, but a program that can be structured and measured. The study points to specific behaviours, such as maintaining steady speed, moderating acceleration, and anticipating deceleration. These are teachable driver rules that can yield substantial energy savings. In fleet settings, these behaviours can be reinforced through feedback loops and incentives. The same operational program that reduces kWh/km can also reduce the variability of charging demand by improving the predictability of energy use on routes.

A second behavioural lever closely connected to eco-driving is time-of-day and route choice. Even when the vehicle and driver are unchanged, driving in heavier congestion tends to increase energy use because it raises acceleration variability and reduces speed stability. Jonas et al. provide field evidence using a 2017 Volkswagen e-Golf with 30 drivers. They observe approximately 4 to 5% additional energy consumption in the higher-traffic scenario compared to a lower-traffic scenario on the same route, and estimate a meaningful range benefit from avoiding the congestion window for that vehicle.[70] This provides evidence that operational choices such as departure time, route selection, and dispatching rules can yield measurable savings even for EVs, and those savings scale when applied to fleets. For program design, the practical question is not "should we promote eco-driving", but "what is the delivery mechanism and what will be measured". A credible approach is to define eco-driving in operational terms (speed variance targets, harsh event thresholds), implement driver feedback and coaching, and set KPIs that can be reported and improved over time. In transport electrification, eco-driving also has a second-order effect. Smoother driving generally reduces the magnitude of battery and cabin heating demand spikes in winter by reducing high-power draw events,

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[69] AIMS Energy. Kato et al. The eco-driving effect of electric vehicles compared to conventional gasoline vehicles. Accessed 09/12/2025. URL: https://www.aimspress.com/article/id/1020

[70] World Electric Vehicle Journal. Jonas et al. Quantifying the Impact of Traffic on Electric Vehicle Efficiency. Accessed 10/02/2026. URL: https://www.mdpi.com/2032-6653/13/1/15

which is one of the ways a behavioural program can complement the winter penalty issues discussed in the previous chapter.

Carsharing and ridesharing target a different pathway to efficiency. They reduce energy per unit of mobility service by changing utilization and occupancy. The point is that electrification alone can still lead to inefficient system outcomes if it is paired with growth in single-occupancy vehicle travel and low vehicle utilization. In contrast, shared mobility can reduce the number of vehicles needed to provide a given level of access, reduce vehicle-kilometres travelled (VKT) for participants, and shift some trips to transit, walking, and cycling that are especially plausible in dense urban contexts. Ridesharing and carsharing can meaningfully impact transportation system efficiency, and for that to work, multimodal integration is a key deployment strategy.[71]

Carsharing in all its types[72] changes ownership and driving behaviour among participants. The Victoria Transport Policy Institute shows that car-sharing can reduce vehicle use among members, often reported in the 40% to 60% range in the studies it reviewed and argues that shifting from high fixed costs of ownership to variable per-use costs changes trip-making behaviour.[73] Car-sharing can reduce discretionary driving and therefore reduce both energy use and congestion externalities when implemented in proper contexts.

Another empirical study focusing on the urban region of Montréal confirms a significant reduction in private vehicle ownership among carsharing members after adoption, and highlights enabling conditions such as density and transit reliability.[74] Importantly, carsharing has limitations in suburban and rural contexts. For policy design, the key question becomes: where can these mechanisms plausibly deliver net efficiency gains? The evidence base suggests shared mobility works best where density is sufficient to sustain high utilization and where public transport provides substitutes. In Metro Vancouver, these conditions are present, but for rural and lower-density areas, carsharing may still be relevant but is more likely to behave as a niche service unless paired with targeted institutional use cases (e.g., municipal fleets, campus fleets, employer-based pools).

Ride-sharing and carpooling operate through an occupancy mechanism. Energy and emissions per passenger-kilometre fall when more passengers share a trip that would otherwise be driven as separate single-occupancy trips. The key risk is that net impacts depend on the counterfactual, ridesharing can deliver less benefit, or even a negative benefit, if it substitutes for transit or induces new travel. A study frames carpooling effectiveness in terms of an occupancy threshold (preferred estimate of 0.6 passengers per trip) and shows how price signals affect carpooling supply, demand, and occupancy.[75] Carpooling is not automatically efficient, it is efficient when it increases occupancy relative to what would have happened otherwise.

From a policy program angle, the practical question is how to move occupancy upward and ensure substitution away from single-occupancy driving rather than away from transit. A behavioural

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[71] U.S. Department of Energy. Transportation System Efficiency. Accessed 11/02/2026. URL: https://afdc.energy.gov/conserve/system-efficiency
[72] Innovation, Science and Economic Development Canada. Car sharing. Accessed 22/01/2026. URL: https://ised-isde.canada.ca/site/office-consumer-affairs/en/buying-and-leasing-big-ticket-items/car-sharing
[73] Victoria Transport Policy Institute. Evaluating carsharing benefits. Accessed 22/01/2026. URL: https://www.vtpi.org/carshare.pdf
[74] Science Direct. Transpiration Research. Nong et al. Material efficiency for transport decarbonization: a case study of carsharing in Montreal. Accessed 10/02/2026. URL: https://www.sciencedirect.com/science/article/pii/S136192092500447X
[75] HAL Open Science. Olave-Cruz et al. Does Carpooling Reduce Carbon Emissions? The Effect of Environmental Policies in France. Accessed 11/02/2026. URL: https://hal.science/hal-04961832/document

incentive intervention can serve the purpose. For example, the "Five Free Rides" program in the Bay Area was designed to encourage carpool use through a limited free ride offer.[76] That kind of short-term incentive can attract new users into shared travel habits, especially when paired with digital matching platforms. For B.C., the operational implication is that ride-sharing and carpooling programs should be designed with measurable objectives, improved average occupancy on targeted corridors and reduced peak-period single-occupancy trips. Fewer vehicles making the same commute means fewer EVs needing to charge for that travel, and potentially less evening home-charging coincidence. The point is that carpooling is a demand-side efficiency measure that can influence the charging load shape at scale under the right design conditions.

Taken together, the evidence supports a balanced B.C. strategy for operations and behaviour. Eco-driving is a high-confidence lever with direct vehicle-side effects and clear implementation pathways in fleets and consumer programs, supported by controlled experimental evidence and field congestion sensitivity evidence. Carsharing is best treated as a targeted demand-side lever that works where enabling conditions exist, supported by evidence that member vehicle use can fall and that car ownership can be reduced, but with explicit limits on generalizability outside dense contexts. Ride-sharing and carpooling should be framed as an occupancy policy whose net benefits depend on a credible design; therefore, they require careful targeting and measurement rather than broad claims.

According to the 2024 Vancouver Transportation Fall Survey published in September 2025[77], “about four out of ten Vancouver workers who commute to work at least some of the time do so by automobile (37% as drivers and 2% as passengers). One-third (33%) commute by transit, about 14% by bike, and 13% walk.”

This means that the majority of cars only have one person on board for an average of approximately 1.1 person per vehicle. If policies to encourage carpooling were to be adopted to reach 1.4 person per vehicle on average, this would mean that the number of cars on the road could decrease to **550,000 compared to 775,000 right now.** This would represent a very important gain in terms of energy efficiency per person as well as a significant reduction in traffic congestion and air pollution.

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[76] Metropolitan Transportation Commission. ‘Five Free Rides’ Incentive Program Launches on February 1, 2019. URL: https://mtc.ca.gov/news/five-free-rides-incentive-program-launches-february-1-2019

[77] 2024 Vancouver Transportation Fall Survey. Final Report – September 2025. URL : https://vancouver.ca/files/cov/2024-transportation-survey-report.pdf

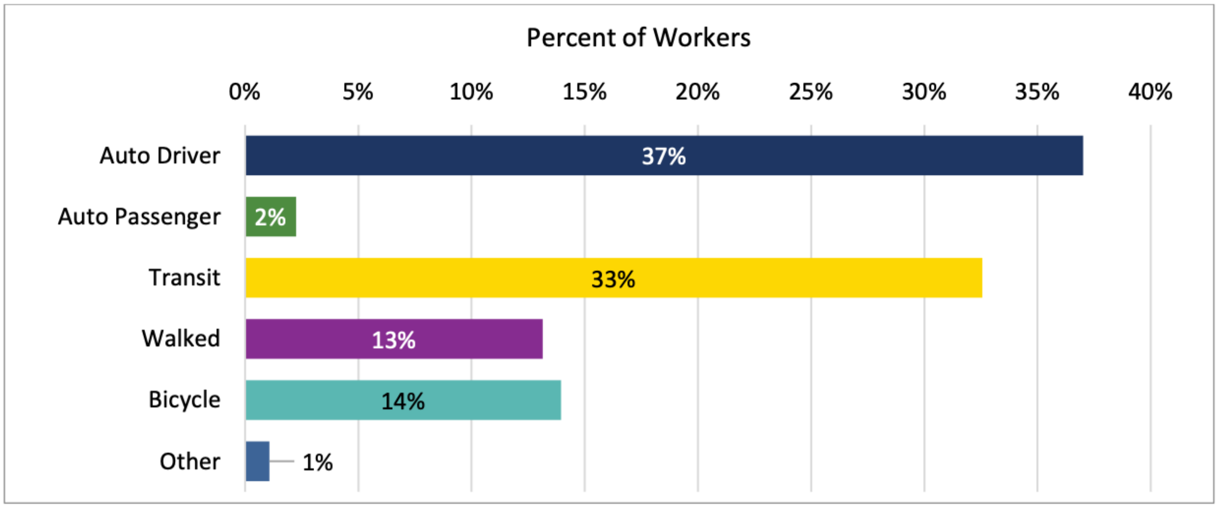

Figure 20: Usual Mode of Travel for Commute (2024 Vancouver Transportation Fall Survey)

Recent analysis of Québec travel patterns reinforces the importance of occupancy as an efficiency lever. According to a review of origin destination survey data, drivers in major urban areas travel with approximately **25 million empty seats each weekday**, including nearly **15 million in the Montréal region alone**[78]. Average vehicle occupancy during the morning peak is about 1.2 persons per vehicle, which indicates that congestion is driven less by road capacity limits than by a structural underutilization of available seating. Evidence from the same analysis shows that increasing peak period occupancy from 1.2 to 1.4 could reduce the number of vehicles on the road by about 14 per cent, equivalent to roughly 180 000 fewer cars in circulation. These findings support the efficiency logic in this chapter. Higher occupancy can deliver immediate reductions in both energy use and congestion intensity when supported by appropriate incentives and regulatory frameworks.

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[78] Congestion routière – 25 millions de sieges vides à combler. 20 juin 2018. Jérôme Laviolette, Chercheur invite en Transports et Changements climatiques à la Fondation David Suziki et trois autres signataires. Accessed 27/02/2026. URL: https://plus.lapresse.ca/screens/137061c1-190c-4359-aa1a-d77f13d8918d__7C___0.html

APPENDIX F: Congestion and health co-benefits

Congestion remains a material policy issue in transportation because it affects how efficiently vehicles convert energy into mobility service under real-world driving conditions, and how people are exposed to traffic-related air pollution (TRAP) and associated health burdens. Congestion should not be treated only as a mobility problem, it is also a driver of system inefficiency because it increases energy use through speed variability and delay, and contributes to air pollution exposure and health impacts, co-benefits that strengthen the case for efficiency measures that smooth traffic flow and reduce peak-period travel.

A key nuance is that the energy consequences of congestion differ by powertrain. A study examined energy consumption across more than 100 driving cycles for battery electric vehicles (BEVs) and internal combustion engine vehicles (ICEVs) and found that BEVs can show minimum consumption at lower-speed urban traffic, consistent with regenerative braking and part-load efficiency, whereas ICEVs are most efficient at higher speeds typical of rural and suburban driving.[79] It demonstrates that congestion mitigation yields average energy consumption gains, with larger gains for gasoline and diesel vehicles than for BEVs in the higher-speed range. Another study shows that solving traffic congestion would have a much greater effect on improving fuel efficiency in a shorter period than technological improvements.[80]

The relationship between congestion and energy is also influenced by behavioural response. In *their study*, Hoffmann and Thommes analyze telematics from a large logistics fleet and find that reduced private traffic can enable more fuel-efficient driving and reduce overall CO_2 emissions for heavy goods vehicles, but the effect can be non-linear because very low congestion can induce speeding and reduce fuel efficiency.[81] This cautions against simplistic assumptions that less congestion always equals higher efficiency, it can be directionally correct, but still requires complementary speed management and operational controls to avoid rebound effects. From an energy efficiency planning lens, a practical takeaway is that congestion mitigation should be interpreted broadly as a package of interventions that reduce stop-and-go variability and reduce time spent in inefficient operating regimes, not simply as policies that increase average speeds. ERIA’s report on transport energy efficiency through traffic improvement frames congestion as a structural energy problem because worsening traffic conditions degrade fuel efficiency and generate energy losses, and it emphasizes that effective public transport and proactive traffic policy are central to preventing a self-reinforcing cycle of congestion and economic loss.[82]

Health co-benefits are a second, independent rationale for addressing congestion even in an electrified future. A large share of the public health burden from transportation comes from exposure

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[79] Science Direct. Transportation Research. Mamarikas et al. Traffic impacts on energy consumption of electric and conventional vehicles. Accessed 09/12/2025. URL: https://www.sciencedirect.com/science/article/abs/pii/S136192092200061X

[80] Economic Research Institute for ASEAN and East Asia. Theory of Traffic Policy Development in Relation to Energy Efficiency. Accessed 22/01/2026. URL: https://www.eria.org/RPR_FY2015_No.10_Chapter_2.pdf

[81] Science Direct. Journal of Cleaner Production. Hoffmann and Thommes. Clear Roads and Dirty Air? Indirect effects of reduced private traffic congestion on emissions from heavy traffic. Accessed 23/01/2026. URL: https://www.sciencedirect.com/science/article/pii/S0959652622046261

[82] Economic Research Institute for ASEAN and East Asia. Theory of Traffic Policy Development in Relation to Energy Efficiency. Accessed 22/01/2026. URL: https://www.eria.org/RPR_FY2015_No.10_Chapter_2.pdf

to pollutants emitted by vehicle traffic, including particulate matter and nitrogen oxides that contribute to smog and fine particle exposure. The U.S. EPA's overview of smog, soot, and other air pollution from transportation explains that transportation contributes to emissions of NOx, VOCs, and particulate matter that drive ozone and particle pollution, and that mobile sources also emit air toxics, with health impacts especially affecting people who live near busy roads.[83]

The congestion-health mechanism becomes clearer when considering near-road exposure and delay. Zhang and Batterman's study explicitly connects congestion to emissions and exposure by modelling on-road and near-road NO_2 concentrations and associated health risks under freeway and arterial scenarios.[84] The paper emphasizes that risks and exposures are not proportional to traffic volume and that incremental risks can be non-linear, depending on road type and traffic conditions, highlighting why congestion conditions and the extra travel time they impose are an important part of exposure and risk assessment rather than a simple mobility inconvenience. This is relevant to B.C. because the province's highest exposure zones are often near major corridors and bottlenecks, meaning congestion policies can deliver health co-benefits by reducing both emissions and time-weighted exposure, even as tailpipe emissions decline with electrification.

Health Canada describes a modelling framework that links emissions, ambient concentrations (including $PM_{2.5}$ and NO_2), and health outcomes, and quantifies the population health burden and socio-economic costs of traffic-related air pollution attributable to on-road vehicle emissions in Canada.[85] It shows that TRAP from on-road vehicles is associated with 1,200 premature deaths nationally in 2015 and 2.7 million acute respiratory symptom days and 210,000 asthma symptom days annually. That is a monetized health burden of about $9.5 billion (2015 CAD). The provincial breakdown of premature deaths indicates that B.C. is ranked third with 170 cases after Ontario (500) and Quebec (410).

A second strand of evidence addresses long-term exposure to traffic-related pollution and broader health endpoints. Boogaard et al. provide a systematic review and meta-analysis on long-term exposure to traffic-related air pollution and selected health outcomes, reinforcing the conclusion that TRAP remains a significant public health concern and that policy-relevant health outcomes extend beyond short-term respiratory irritation.[86] This type of evidence supports the co-benefits narrative, measures that reduce traffic emissions and exposure can deliver public health benefits, and these benefits are policy-relevant even when the primary program goal is energy efficiency or grid management.

The pollution inventory context is also relevant to the co-benefits case because it clarifies which pollutants are tracked and why they matter. Environment and Climate Change Canada publishes Canada's Air Pollutant Emissions Inventory, which reports anthropogenic emissions from 1990 to 2023 for pollutants that contribute to smog, acid rain, and diminished air quality, including $PM_{2.5}$, NOx,

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[83] U.S. Environmental Protection Agency. Smog, Soot, and Other Air Pollution from Transportation. Accessed 23/01/2026. URL: https://www.epa.gov/transportation-air-pollution-and-climate-change/smog-soot-and-other-air-pollution-transportation

[84] National Library of Medicine. Air pollution and health risks due to vehicle traffic. Accessed 23/01/2026. URL: https://pmc.ncbi.nlm.nih.gov/articles/PMC4243514/

[85] Health Canada. Health impacts of traffic-related air pollution in Canada. Accessed 12/02/2026. URL: https://www.canada.ca/en/health-canada/services/publications/healthy-living/health-impacts-traffic-related-air-pollution.html

[86] Science Direct. Environment International. Boogaard et al. Long-term exposure to traffic-related air pollution and selected health outcomes: A systematic review and meta-analysis. Accessed 12/02/2026. URL: https://openaccess.sgul.ac.uk/id/eprint/114399/1/1-s2.0-S016041202200188X-main.pdf

VOCs, CO, and NH_3.[87] These categories align with the pollutants that congestion influences through vehicle operations and that electrification can reduce, particularly tailpipe-related components. Even while recognizing that some non-tailpipe emissions remain.

Finally, the economic value of health co-benefits provides additional policy motivation for B.C. The United Nations Environment Program summarizes that air pollution imposes very high economic costs globally, including health and productivity impacts, reinforcing that policies that reduce pollution generate benefits that extend beyond environmental indicators.[88] The figures provide a credible framing for why air quality improvements are economically consequential.

For B.C. policy design, the practical implication is that congestion and TRAP co-benefits strengthen the case for a subset of efficiency measures that are robust under electrification. Measures that smooth traffic flow, reduce stop-and-go variability, reduce peak-period and single-occupancy travel can lower energy use, especially for ICE vehicles still on the road during the transition, can reduce exposure time and near-road pollutant concentrations, and can improve reliability. At the same time, the evidence cautions against assuming monotonic benefits from decongestion if it leads to rebound effects such as speeding, particularly for heavy vehicles. Therefore, policy packages that improve flow should be paired with speed management and operational strategies.

Some interventions can be justified on energy efficiency grounds alone, but many become substantially more compelling when framed as multi-objective measures that also deliver congestion relief and health co-benefits. The next section prioritizes measures that deliver stacked benefits, reduced kWh/km, reduced peak coincidence through better travel patterns and charging timing, improved reliability, and reduced exposure to traffic-related air pollution, while being explicit about the conditions under which benefits are expected and the safeguards needed to avoid rebound.

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[87] Environment and Climate Change Canada. Canada's Air Pollutant Emissions Inventory Report 2025. Accessed 12/02/2026. URL: https://www.canada.ca/en/environment-climate-change/services/air-pollution/publications/emissions-inventory-report-2025.html

[88] UN Environment Programme. Why dirty air costs us trillions every year. Accessed 12/02/2026. URL: https://www.unep.org/news-and-stories/video/why-dirty-air-costs-us-trillions-every-year

APPENDIX G – Modelling methodology

Data baseline and scope

This scenario analysis focuses on passenger cars and passenger light trucks. Baseline values for 2022 (energy use, passenger-kilometres travelled, energy intensity, and GHG intensity) are taken from the Comprehensive Energy Use Database (CEUD).[89]

This dataset combines British Columbia and the Territories. However, Statistics Canada Vehicle Registrations dataset indicates that the share of passenger cars and light trucks attributed to British Columbia is approximately 99% and over 95%, respectively.[90] Therefore, energy use and GHG emissions in the Territories are considered negligible relative to British Columbia.

Outputs are produced for four cases:

Scenario 1-a: represents B.C. ZEV pathway (baseline) under its ZEV sales trajectory to 100% ZEV new sales by 2035, accelerating turnover of passenger travel toward ZEVs. A post-2026 US "efficiency drag" term reduces the rate of efficiency improvement in the remaining ICE fleet. Vehicle mix drift toward larger vehicles is assumed to be moderate relative to recent history due to greater ZEV availability in smaller classes.

Scenario 2-a: B.C. follows a slower ZEV sales trajectory toward 75% ZEV new sales by 2035, in line with the federal announcements, while the U.S. drag term again reduces the rate of ICE efficiency improvement after 2026. Vehicle mix is assumed to continue the recent drift toward SUVs/pickups a bit more strongly than Scenario 1-a.

Scenario 1-b: Same as Scenario 1-a, with eco-driving and carsharing applied as additional reductions to per-km energy use and total travel, implemented using empirical parameters from the literature.

Scenario 2-b: Same as Scenario 2-a, with eco-driving and carsharing added to illustrate the value of behavioural efficiency under slower electrification.

Energy and emissions simulation

Annual passenger road energy use is computed from passenger travel activity and intensity:

$$E_t \text{ (PJ)} = \frac{PKM_t \text{ (million)} \cdot EI_t \text{ (MJ/pkm)}}{1000}$$

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[89] Natural Resources Canada. Comprehensive Energy Use Database. Accessed 20/02/2026. URL: https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/trends/comprehensive_tables/list.cfm

[90] Statistics Canada. Vehicle registrations, by type of vehicle and fuel type. Accessed 20/02/2026. URL: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310030801

Annual GHG emissions are computed using the GHG intensity factor consistent with the CEUD dataset:

$$GHG_t \text{ (Mt)} = \frac{E_t \text{ (PJ)} \cdot GHGint_t \text{ (tonne/TJ)}}{1000}$$

The CEUD series used in this workbook reports GHG excluding electricity production.

Passenger travel activity projection

Passenger-km (PKM) for cars and passenger light trucks are projected by scaling the 2022 baseline by the ratio of the forecasted population from Statistics Canada M1 scenario[91] in year t to the population in 2022:

$$PKM_t^{car} = PKM_{2022}^{car} \cdot \frac{Pop_t}{Pop_{2022}} \qquad PKM_t^{truck} = PKM_{2022}^{truck} \cdot \frac{Pop_t}{Pop_{2022}}$$

This gives us a proportional scaling from the 2022 baseline.

ZEV adoption

Depending on the policy pathway, we define two paths (see table below).

Table 1: ZEV Share of new vehicle sales

Year	Scenario 1	Scenario 2
2022	15%	17%
2023	17%	21%
2024	20%	21%
2025	22%	16%
2026	26%	34%
2027	43%	37%
2028	59%	51%
2029	75%	71%
2030	91%	90%
2031	93%	91%
2032	95%	70%
2033	97%	72%
2034	99%	74%
2035	100%	75%

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[91] Statistics Canada, Projected population, by projection scenario, age, and gender. Accessed 25/02/2026. URL: https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1710005701

Scenario 1-a (B.C. pathway): the ZEV sales follow the trajectory set by the current Zero-Emission Vehicles Act, reaching 100% by 2035.[92]

Scenario 2-a (federal alignment): observed ZEV sales shares are used where available. For 2026 to 2031, projections apply a growth path derived from the historical year-over-year changes in ZEV sales shares observed following the introduction of federal purchase incentives in 2019.[93] The resulting annual growth factors from 2019 to 2024 are sequentially applied to the projection period between 2026 and 2031. This effectively replicates the post-incentive growth trajectory we have seen before when purchase incentives were introduced. For 2032 to 2034, values are adjusted using interpolation to align with the 75% ZEV sales target in 2035.

ZEV travel share

To reflect the fact that changes in vehicle sales do not immediately translate into changes in how vehicles are used, the analysis converts the ZEV share of new sales in each scenario into a gradually evolving ZEV share of passenger travel using a turnover rate of $\rho = 0.10$ (approximately the average vehicle retirement rate). For each scenario:

$$z_{t,S} = (1 - \rho)\, z_{t-1,S} + \rho\, s_{t,S}, \qquad \rho = 0.10$$

Where

$s_{t,S}$ is the ZEV share of new vehicle sales in year t for scenario S

$z_{t,S}$ is the ZEV share of passenger travel used in the energy calculations for year t for scenario S

This formulation ensures that the share of travel adjusts progressively over time as older vehicles are retired and replaced.

Passenger-kilometres are then allocated as:

$$PKM_{t,S}^{ZEV} = z_{t,S} \cdot PKM_t \qquad\qquad PKM_{t,S}^{ICE} = (1 - z_{t,S}) \cdot PKM_t$$

ICE and ZEV energy intensities in 2022

We first compute a weighted average energy intensity for 2022 using CEUD data for passenger cars and light trucks. This weighted value serves as the anchor for separating ICE and ZEV energy intensities.

ZEVs are assumed to be 73% less energy intensive than gasoline vehicles on a tank-to-wheel basis.[94] That is, ZEV energy intensity is 27% of ICE intensity. Let $k = 0.27$. Then $EI_{2022}^{ZEV} = k \cdot EI_{2022}^{ICE}$

Given the observed weighted average in 2022:

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[92] Zero-Emission Vehicles Act. Accessed 20/02/2026. URL: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/19029 -section16

[93] Statistics Canada. New motor vehicle registrations, quarterly, by geographic level. Accessed 20/02/2026. URL: https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=2010002501

[94] United States Department of Energy. Fuel economy. Accessed 10/02/2026. URL: https://fueleconomy.gov/feg/evtech.shtml

$$EI_{2022}^{weighted} = z_{2022} \cdot EI_{2022}^{ZEV} + (1 - z_{2022}) \cdot EI_{2022}^{ICE}$$

Where z_{2022} is the ZEV share of travel in 2022.
Substituting the ZEV to ICE intensity relationship and solving for ICE intensity:

$$EI_{2022}^{ICE} = \frac{EI_{2022}^{weighted}}{z_{2022} \cdot k + (1 - z_{2022})}$$

ZEV intensity is then obtained using:

$$EI_{2022}^{ZEV} = k \cdot EI_{2022}^{ICE}$$

This logic ensures consistency between the observed weighted average intensity and the assumed relative efficiency of ZEVs and ICE vehicles.

Energy intensity trends

From 2023 onward, passenger vehicle energy intensities (MJ/pkm) evolve annually based on three components:

- **Technological improvement**, calibrated from average intensity reductions observed over 2008-2022 and specified separately for cars and light trucks (Figure 13 **and** Figure 14)
- **US drag term**, applied only to ICE vehicles, reflecting historically weaker fuel economy progress during periods of deregulation.
- **Upsizing effect** of +1% per year, applied multiplicatively to both ICE and ZEV intensities.

Technological improvement

Constant annual improvement rates are assumed equal to the historical averages over 2008-2022: $\boldsymbol{r_{car} = 0.06}$, and $\boldsymbol{r_{truck} = 0.15}$. Each year, these are combined into a single improvement factor using current passenger-kilometre shares:

$$r_t^{tech} = w_t^{car} \cdot r_{car} + w_t^{truck} \cdot r_{truck}$$

where:

$$w_t^{car} = \frac{PKM_t^{car}}{PKM_t^{car} + PKM_t^{truck}}, \qquad w_t^{truck} = \frac{PKM_t^{truck}}{PKM_t^{car} + PKM_t^{truck}}$$

Thus, overall technological progress reflects the evolving composition of car versus truck travel.

U.S. drag term

To capture periods of weaker fuel economy improvement under U.S. regulatory rollback conditions, a year-specific term δ_t^{US} is added to the ICE update.

This term is derived from historical year-over-year changes in U.S. fuel economy (MPG) and may be null or negative, reflecting stagnation or deterioration between 1987 and 2009 (Figure 17).[95]

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[95] U.S. Environmental Protection Agency. 50 Years of EPA's Automotive Trends Report. Accessed 20/02/2026. URL: https://www.epa.gov/greenvehicles/50-years-epas-automotive-trends-report

The effective ICE improvement rate becomes: $r_t^{ICE} = r_t^{tech} + \delta_t^{US}$

Upsizing effect

To reflect the long-run shift toward larger vehicle classes (SUVs and pickups), a constant multiplicative penalty of: $(1 + \delta_t^{mix})$, with $\delta_t^{mix} = 0.01$, is applied annually to both ICE and ZEV intensities.

The resulting equations become:

- $EI_t^{ZEV} = EI_{t-1}^{ZEV} \cdot (1 - r_t^{tech}) \cdot (1 + \delta_t^{mix})$, for ZEVs
- $EI_t^{ICE} = EI_{t-1}^{ICE} \cdot (1 - (r_t^{tech} + \delta_t^{US})) \cdot (1 + \delta_t^{mix})$, for ICE

Total passenger intensity and energy by scenario

For each scenario $s \in \{S1, S2\}$, total intensity is computed as a travel-weighted average:

$$EI_{t,s}^{Total} = \frac{EI_t^{ZEV} . PKM_{t,s}^{ZEV} + EI_t^{ICE} . PKM_{t,s}^{ICE}}{PKM_{t,s}}, \text{with } PKM_{t,s} = PKM_{t,s}^{ZEV} + PKM_{t,s}^{ICE}$$

Energy and emissions then follow directly from the previous identities:

$$E_{t,S} = \frac{PKM_t \cdot EI_{t,S}}{1000} \qquad GHG_{t,S} = \frac{E_{t,S} \cdot GHGint_{2022}^{weighted}}{1000}$$

Efficiency measures

The "efficiency package" variants of the two scenarios apply two multiplicative adjustments.

Carsharing

Carsharing is implemented as a reduction in passenger travel activity.

- Member travel reduction midpoint of 50% (from the 40-60% range reported in the literature)[96]
- The car-sharing membership base in British Columbia is assumed to be approximately 300,000 members across major providers (Evo and Modo). For modelling purposes, this is treated as equivalent to 300,000 privately owned vehicles displaced, representing roughly 13% of the provincial light-duty vehicle fleet in 2024. This share is assumed to remain constant over the projection period.[97]
- Effective travel reduction:

$$\delta^{cs} = 0.13 \cdot 0.50 = 0.065$$

Then adjusted activity:

$$PKM_t^{eff} = PKM_t \cdot (1 - \delta^{cs})$$

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[96] Victoria Transport Policy Institute. Evaluating carsharing benefits. Accessed 22/01/2026. URL: https://www.vtpi.org/carshare.pdf

[97] British Columbia Automobile Association. Happy 10th Birthday, Evo Car Share! Accessed 23/02/2026. URL: https://www.bcaa.com/media-centre/2025/evo-car-share-10th-birthday. Daily Hive. Modo carshare fleet size reaches 1,000 vehicles. Accessed 23/02/2026. URL: https://dailyhive.com/vancouver/modo-carshare-fleet-size

Eco-driving

Eco-driving is applied as an intensity multiplier with separate parameters for ICE and ZEVs, using experimental estimates from Kato et al (2016)[98]:

$EI_t^{ICE,eco} = EI_t^{ICE} \cdot (1 - \delta_{ICE}^{eco})$ and $EI_t^{ZEV,eco} = EI_t^{ZEV} \cdot (1 - \delta_{ZEV}^{eco})$, where: $\delta_{ICE}^{eco} = 0.12$ and $\delta_{ZEV}^{eco} = 0.15$

Total intensity for the efficiency package variants becomes:

$$EI_{t,S}^{(eff)} = \frac{PKM_{t,S}^{ICE} \cdot EI_t^{ICE,eco} + PKM_t^{ZEV} \cdot EI_t^{ZEV,eco}}{PKM_t}$$

The resulting formulas for energy and emissions:

$$E_t^{(eff)} = \frac{PKM_t^{eff} \cdot EI_t^{(eff)}}{1000} \text{ and } GHG_t^{(eff)} = \frac{E_t^{(eff)} \cdot GHGint_{2022}^{weighted}}{1000}$$

Load from light-duty ZEVs

Annual grid electricity demand (GWh) required to power the ZEV portion of passenger cars and light trucks is estimated under the four scenarios. The simulation horizon is extended to 2050 to align with the BC Hydro reference load outlook[99] and allow for comparisons.

In scenarios 1-a and 1-b, where B.C. is assumed to maintain its ZEV sales regulation, the new ZEV sales share increases to 100% by 2035 and then plateaus at 100% through 2050. In the other two cases where B.C. is expected to align its targets with the federal path (scenarios 2-a and 2-b), ZEV new sales share follows a slower path. We implement a linear interpolation to reach 90% by 2040, then continue to 100% and plateau thereafter.

We denote these sales by: $s_{t,S} \in [0,1]$, where S denotes the scenario. Thus, we consider only the passenger travel activity $PKM_{t,S}^{ZEV}$ attributed to ZEVs as explained **above**.

ZEV energy intensity trajectory

As described **above**, the base year energy intensity of the ZEV fleet is assumed to be 73% lower than the weighted average of LDVs. For long-term projections, a 2050 efficiency improvement is derived from the Energy Transitions Commission, which estimates that electric vehicle efficiency could approximately double between 2024 and 2050.[100] This corresponds to a reduction in passenger EV energy consumption from about 0.2 kWh/km to 0.1 kWh/km.

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[98] AIMS Energy. The eco-driving effect of electric vehicles compared to conventional gasoline vehicles. Accessed 09/12/2025. URL: https://www.aimspress.com/article/id/1020

[99] BC Hydro, 2025 Integrated Resource Plan Application (Table A-5, page 14). Accessed 10/03/2026. URL: https://docs.bcuc.com/documents/proceedings/2025/doc_84202_b-1-bch-2025-irp-application.pdf

[100] Energy Transitions Commission. Accessed 12/03/2026. URL: https://www.energy-transitions.org/wp-content/uploads/2025/12/ETC-Road-Productivity-Report_web-file_vf-1.pdf

For modelling purposes, a midpoint value of 0.15 kWh/km is adopted as a representative 2050 consumption level. This value is converted to energy intensity in MJ/pkm, assuming an occupancy of 1.5 passengers per vehicle, which yields a projected ZEV energy intensity of 0.36 MJ/pkm in 2050.[101]

Between 2022 and 2050, ZEV energy intensity is interpolated using a non-linear function that allows for faster improvements in the early years and more gradual gains over time:

$$EI_t^{ZEV} = EI_{2022}^{ZEV} - (EI_{2022}^{ZEV} - EI_{2050}^{ZEV})\left(\frac{t-2022}{2050-2022}\right)^{0.05}$$

This functional form is chosen to reflect diminishing marginal improvements in technology over time, where early gains are more significant and incremental improvements become smaller as the technology matures. The choice of a low exponent is consistent with this assumption.

Electricity demand

ZEV electricity demand is calculated by combining energy intensity (MJ/pkm) with total ZEV travel (million pkm), and then converting the result into grid electricity demand. Multiplying energy intensity by passenger travel gives total energy use in megajoules. This is converted to kWh by dividing by 3.6, and since travel is expressed in millions of passenger-kilometres, the result is directly expressed in GWh.

To reflect real-world charging losses, a constant charging efficiency of 90% is applied, meaning that grid electricity demand is higher than the energy delivered to the vehicle.

Formally:

$$E_{t,S}^{ZEV,grid} = \frac{EI_t^{ZEV} \cdot PKM_{t,S}^{ZEV}}{3.6 \,.\, \eta_{chg}} \quad \text{with } \eta_{chg} = 0.90$$

This ensures that electricity demand reflects both vehicle energy use and losses incurred during charging.

Efficiency measures applied to ZEV intensity

Additional efficiency gains for ZEVs are modelled by applying two multiplicative adjustments to energy intensity, reflecting technological improvements and eco-driving behaviour. These measures affect vehicle energy intensity directly and do not alter travel demand.

Adoption of both measures increases over time following an exponential uptake function:

$$A(t) = A_{\max}\left(1 - e^{-k(t-2022)}\right)$$

Separate adoption rates are assumed for technology and eco-driving.

$$A_{\max,tech} = 1,\ k_{tech} = 0.08$$

$$A_{\max,eco} = 1,\ k_{eco} = 0.05$$

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[101] Converting to megajoules: $0.15\ \mathrm{kWh/km} \times 3.6 = 0.54\ \mathrm{MJ/km}$, then adjusting for occupancy: $0.15\ \mathrm{kWh}/1.5 = 0.36\ \mathrm{MJ/pkm}$

Technological improvements capture gains from heat pump systems, regenerative braking, and drivetrain optimization. These are combined into a single multiplier:

$$M_{tech}(t) = (1 - \varepsilon_{HP} A_{tech}(t))\big(1 - \varepsilon_{regen} A_{tech}(t)\big)(1 - \varepsilon_{drv} A_{tech}(t))$$

The elasticity parameters ($\varepsilon_{HP}, \varepsilon_{regen}, \varepsilon_{drv}$) are based on the typical efficiency impact ranges reported in **Section 3** (Key measures and policy levers). For each measure, the midpoint of the reported range is used to represent a balanced estimate of its effect on energy intensity.

Eco-driving improvements are modelled as a function of adoption, participation, and adherence:

$$M_{eco}(t) = 1 - \varepsilon_{eco}\, p\, a\, A_{eco}(t)$$

The eco-driving parameter ε_{eco} is similarly based on the typical efficiency impact range, with the midpoint selected as a central estimate. The overall effect is further adjusted by participation ($p = 0.7$) and adherence ($a = 0.75$) rates, reflecting the share of drivers adopting eco-driving practices and the extent to which these practices are consistently maintained over time.

Adjusted ZEV intensity and load

ZEV energy intensity is adjusted as: $EI_t^{ZEV,eff} = EI_t^{ZEV} \cdot M_{tech}(t) \cdot M_{eco}(t)$

Then, the electricity demand is recalculated using this adjusted intensity:

$$E_{t,S}^{ZEV,grid,eff} = \frac{EI_t^{ZEV,eff} \cdot PKM_{t,S}^{ZEV}}{3.6 \cdot \eta_{chg}}$$

This produces the ZEV load series when efficiency measures are implemented as described.

Comparison with BC Hydro's reference load

The modelled ZEV electricity demand is compared to the BC Hydro reference load for light-duty EVs as a way to apply the same framework to the established planning outlook.[102]

To show the magnitude of the efficiency package, the same combined efficiency multiplier used in the scenarios is applied to the reference trajectory:

$$E_t^{ref,eff} = E_t^{ref} \cdot M_{tech}(t) \cdot M_{eco}(t)$$

This produces a reference with efficiency case, which can be interpreted as a counterfactual where the BC Hydro load projection incorporates the same improvements in vehicle technology and driving behaviour. By comparing the original reference trajectory with this adjusted case, the analysis highlights the extent to which efficiency measures alone can reduce electricity demand, independent of differences in travel activity or ZEV adoption pathways.

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[102] BC Hydro 2025 Integrated Resource Plan Application. Accessed 14/03/2026. URL: https://docs.bcuc.com/documents/proceedings/2025/doc_84202_b-1-bch-2025-irp-application.pdf

APPENDIX H: Gas and diesel import costs for B.C.

Talking about energy efficiency also means talking about financial efficiency. To reflect this broader perspective, this appendix provides an overview of the financial impact associated with importing gasoline and diesel into B.C. The purpose is to clarify how replacing fossil fuel imports with locally generated electricity can retain more economic value within the province and support local employment.

According to the Canada Energy Regulator[103],

- In 2023, British Columbia (B.C.) produced 113.3 thousand barrels per day (Mb/d) of crude oil (including condensate and pentanes plus). See **Figure 21.** This represented 3.7% of total Canadian production.
- All production is conventional light oil, condensate, and pentanes plus and is from the northeast portion of the province.
- B.C.'s remaining resource of crude oil was estimated to be 524 million barrels as of December 2021.

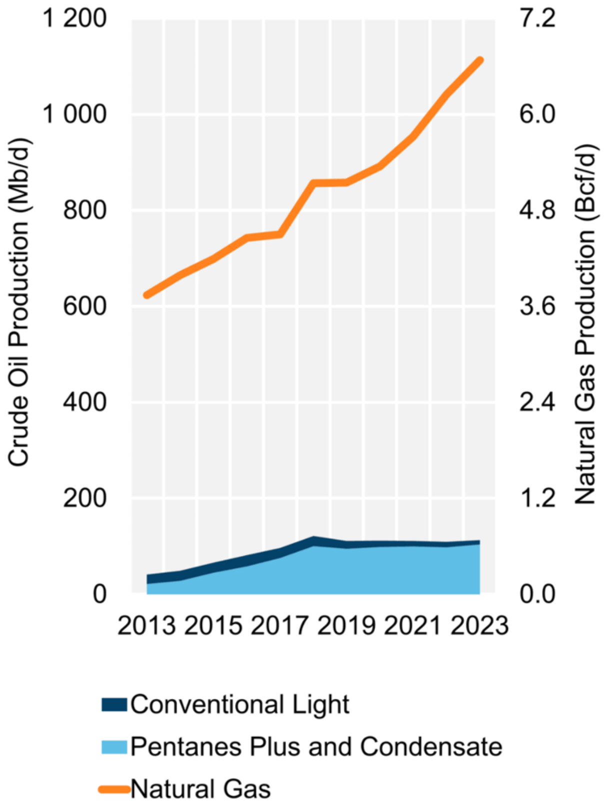

Figure 21: Hydrocarbon Production in B.C. from 2013 to 2023[104]

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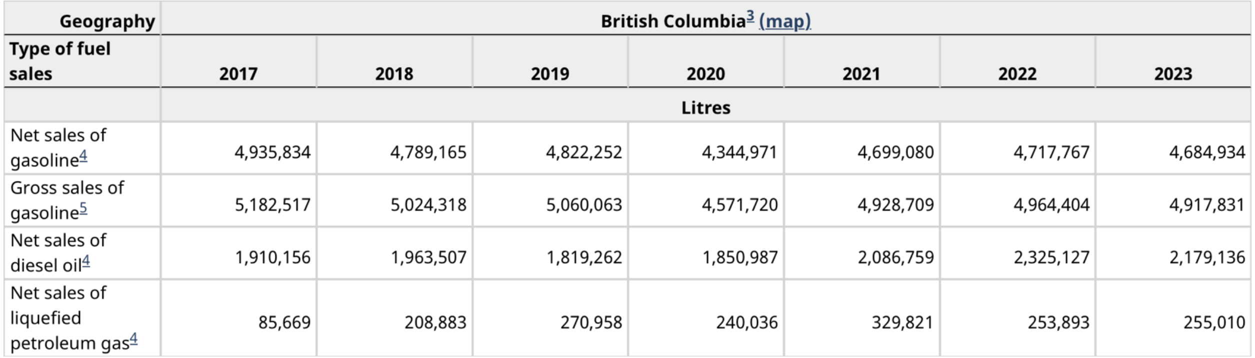
[103] Canada Energy Regulator. British Columbia Energy Profile. Accessed 28/02/2026. URL: https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-british-columbia.html

[104] Ibid.

According to Statistics Canada[105], net sales of gasoline had decreased by 5% in 2023 compared to 2017, while net sales of diesel oil had increased by more than 14% during the same period.



Geography	British Columbia[3] (map)						
Type of fuel sales	2017	2018	2019	2020	2021	2022	2023
	Litres						
Net sales of gasoline[4]	4,935,834	4,789,165	4,822,252	4,344,971	4,699,080	4,717,767	4,684,934
Gross sales of gasoline[5]	5,182,517	5,024,318	5,060,063	4,571,720	4,928,709	4,964,404	4,917,831
Net sales of diesel oil[4]	1,910,156	1,963,507	1,819,262	1,850,987	2,086,759	2,325,127	2,179,136
Net sales of liquefied petroleum gas[4]	85,669	208,883	270,958	240,036	329,821	253,893	255,010

Figure 22: Sales of fuel used for road motor vehicles (x 1,000), 2017 to 2023[106]

According to the U.S. Energy Information Administration[107], Petroleum refineries in the United States produce about 19 to 20 gallons of motor gasoline and 11 to 12 gallons of ultra-low sulfur distillate fuel oil (most of which is sold as diesel fuel and in several states as heating oil) from one 42-gallon barrel of crude oil.

- One U.S. gallon = 3,8 liter. A single barrel of oil therefore produces approximately 74 liters of gasoline and 43 liters of diesel.
- Using these ratios, B.C.'s 113,298 barrels per day of production translate into an estimated 8,384,052 liters of gasoline and 4,871,814 liters of diesel per day.
- Annualized, this corresponds to 3,060,178,980 liters of gasoline and 1,778,212,110 liters of diesel.

When these production-derived volumes are compared to provincial consumption, this indicates:
- Approximately 1,624,755,020 liters of gasoline were imported in 2023.
- Approximately 400,923,890 liters of diesel were imported in 2023.

These figures highlight the scale of petroleum product imports and provide the basis for estimating associated financial outflows.

Cost for B.C. to import gasoline

According to the B.C. government[108], the motor fuel tax rate per liter on gasoline ranges between 14.50 and 27 cents now that the carbon tax has been abolished.

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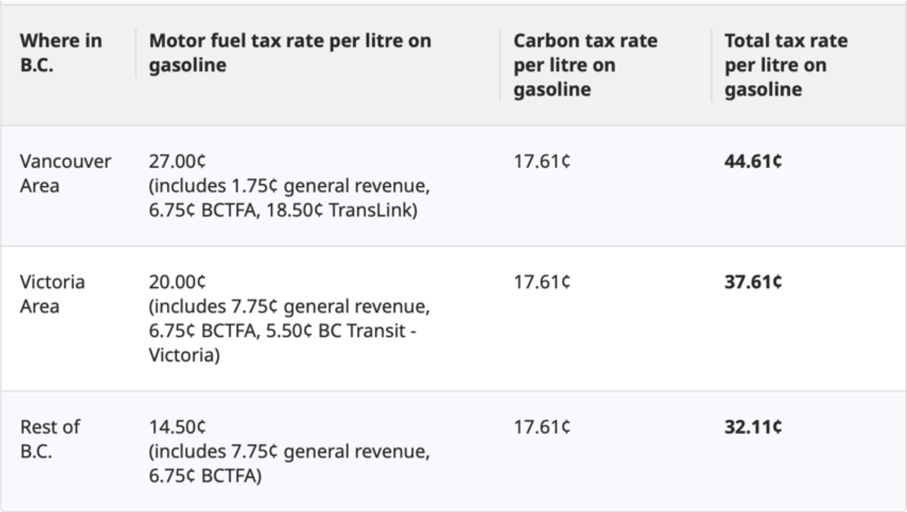
[105] Statistics Canada. Sales of fuel used for road motor vehicles, annual (x 1,000). Accessed 28/02/2026. URL: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310006601&pickMembers%5B0%5D=1.11&cubeTimeFrame.startYear=2017&cubeTimeFrame.endYear=2023&referencePeriods=20170101%2C20230101

[106] Ibid.

[107] U.S. Energy Information Administration. 2023. How many gallons of gasoline and diesel fuel are made from one barrel of oil? Accessed 28/02/2026. URL : https://www.eia.gov/tools/faqs/faq.php?id=327&t=9

[108] BC Government. 2025. Motor fuel tax and carbon tax rates on fuels and substances. Accessed 28/02/2026. URL: https://www2.gov.bc.ca/gov/content/taxes/sales-taxes/motor-fuel-carbon-tax/publications/motor-fuel-tax-and-carbon-tax-rates



Where in B.C.	Motor fuel tax rate per litre on gasoline	Carbon tax rate per litre on gasoline	Total tax rate per litre on gasoline
Vancouver Area	27.00¢ (includes 1.75¢ general revenue, 6.75¢ BCTFA, 18.50¢ TransLink)	17.61¢	**44.61¢**
Victoria Area	20.00¢ (includes 7.75¢ general revenue, 6.75¢ BCTFA, 5.50¢ BC Transit - Victoria)	17.61¢	**37.61¢**
Rest of B.C.	14.50¢ (includes 7.75¢ general revenue, 6.75¢ BCTFA)	17.61¢	**32.11¢**

Figure 23: B.C. Motor fuel and carbon tax rates on clear gasoline.[109]

Using an average tax rate of 20 cents per liter and subtracting this from the average retail gasoline price in B.C.[110] as of April 20, 2025, as of April 20, 2025, the estimated pre-tax price is about $1.15 per liter.

Top Ten Lowest Gas Prices in Vancouver

Price	Station	Address	City	Time
139.9	**Costco**	20499 64 Ave	Langley	Apr 21, 12:35 AM
140.9	**Super Save Gas**	20966 56 Ave	Langley	Apr 20, 11:06 PM
140.9	**Super Save Gas**	19415 Langley Bypass	Surrey	Apr 20, 9:52 PM
140.9	**CENTEX**	2426 200 St	Langley	Apr 20, 9:19 PM
140.9	**Super Save Gas**	4061 200 St	Langley	Apr 20, 8:32 PM
141.9	**Wesco**	6191 King George Blvd	Surrey	Apr 21, 1:47 AM
142.9	**Esso**	6036 Glover Rd	Langley	Apr 20, 11:06 PM
142.9	**Chevron**	6295 200 St	Langley	Apr 20, 11:03 PM
142.9	**Chevron**	19811 Fraser Hwy	Langley	Apr 20, 9:52 PM
142.9	**Esso**	19712 Fraser Hwy	Langley	Apr 20, 9:52 PM

Top Ten Lowest Gas Prices in B.C.

Price	Station	Address	City	Time
129.8	**Husky**	200 BC-3	Fernie	Apr 20, 1:59 PM
129.9	**Petro-Canada**	1261 BC-3	Fernie	Apr 20, 6:53 PM
129.9	**Super Save Gas**	914 Front St	Quesnel	Apr 20, 6:01 PM
129.9	**Sparwood Heights Foods**	105 - 1290 Ponderosa Dr	Sparwood	Apr 20, 8:07 AM
129.9	**Canco Gas**	2100 Middletown Place Unit 2	Sparwood	Apr 20, 7:34 AM
129.9	**Husky**	121 Aspen Dr	Sparwood	Apr 20, 7:34 AM
130.3	**Fas Gas Plus**	601 BC-3	Fernie	Apr 20, 1:58 PM
131.9	**Costco**	2555 Range Rd	Prince George	Apr 20, 11:42 PM
131.9	**Esso**	1009 Main St	Okanagan Falls	Apr 20, 8:40 PM
131.9	**Petro-Canada**	525 Cranbrook St N	Cranbrook	Apr 20, 8:24 PM

Figure 24: Gas Prices in B.C.[111]

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[109] Ibid.

[110] CBC British Columbia. Gas Prices in BC Accessed 28/02/2026. URL : https://www.cbc.ca/bc/gasprices/

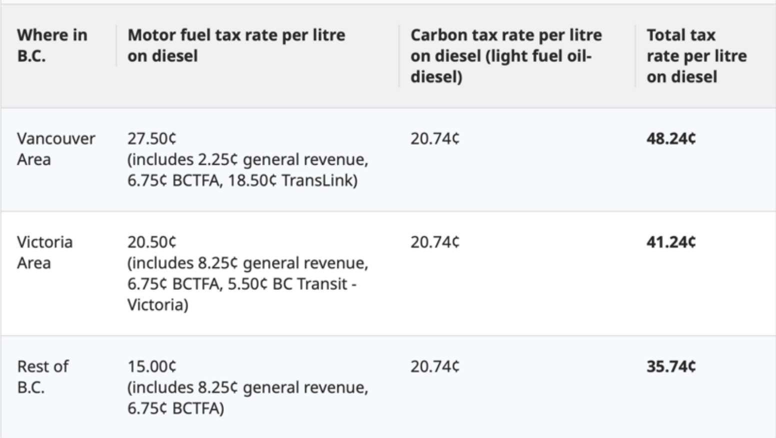
[111] Ibid.

Multiplying the pre-tax price by the volume of imported gasoline:

- 1,624,755,020 liters multiplied by $1.15 per liter = **1,868,468,273 dollars per year** to import gasoline.

Cost for B.C. to import diesel

According to the B.C. government[112], the motor fuel tax rate per liter on diesel ranges between 15 and 27.50 cents now that the carbon tax has been abolished.



Where in B.C.	Motor fuel tax rate per litre on diesel	Carbon tax rate per litre on diesel (light fuel oil-diesel)	Total tax rate per litre on diesel
Vancouver Area	27.50¢ (includes 2.25¢ general revenue, 6.75¢ BCTFA, 18.50¢ TransLink)	20.74¢	**48.24¢**
Victoria Area	20.50¢ (includes 8.25¢ general revenue, 6.75¢ BCTFA, 5.50¢ BC Transit - Victoria)	20.74¢	**41.24¢**
Rest of B.C.	15.00¢ (includes 8.25¢ general revenue, 6.75¢ BCTFA)	20.74¢	**35.74¢**

Figure 25: B.C. Motor fuel and carbon tax rates on clear diesel.[113]

Using the same 20-cent average and subtracting it from the diesel price in B.C.[114] as of April 20, 2025, the resulting pre-tax price is approximately $1.35 per liter.

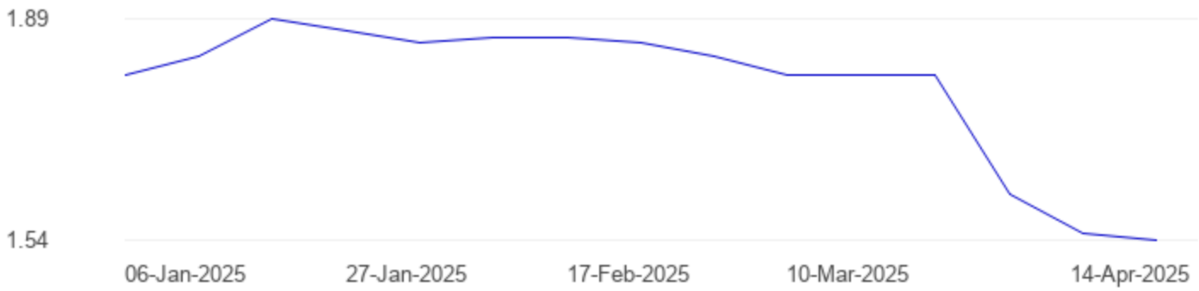


Figure 26: B.C. Diesel prices, liter, Canadian Dollar.[115]

Multiplying the pre-tax price by the volume of imported diesel:

- 400,923,890 liters multiplied by 1.35 dollars per liter = **541,247,251 dollars per year** to import diesel.

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[112] BC Government. 2025. Motor fuel tax and carbon tax rates on fuels and substances. Accessed 28/02/2026. URL: https://www2.gov.bc.ca/gov/content/taxes/sales-taxes/motor-fuel-carbon-tax/publications/motor-fuel-tax-and-carbon-tax-rates

[113] Ibid.

[114] Global Petrol Prices.com. British Columbia Diesel prices, liter. Accessed 28/02/2026. URL: https://www.globalpetrolprices.com/Canada/British_Columbia/diesel_prices/

[115] Ibid.

Total financial outflow

Together, these figures indicate that B.C. consumers spend approximately **$2,409,715,525** a year on pre-tax gasoline and diesel imports. This is equivalent to more than $**200 million per month** flowing out of the province to purchase fossil fuels.

The implication for energy policy is clear: electrification not only reduces emissions and improves efficiency, but it also retains more economic value within B.C.'s borders, supporting local jobs in electricity generation, infrastructure deployment, and clean technology services.