Class 2-4 Trucks Landscape in Canada

Final Report

March 2021

Community Energy Association

About This Document

This work is supported by Natural Resources Canada (NRCan) to contribute to a better understanding of Class 2b to Class 4 fleet vehicles in Canada. This report was completed in March 2021 and represents a snapshot in time of available data, information, insights, and perspectives.

The information and recommendations presented in this report, however, are solely those of Community Energy Association (CEA) and NRCan's participation does not imply an endorsement of this report or the views presented herein.

CEA in no way warrants or claims that information in this document is suitable for anything but the intended purpose of informing NRCAN understanding of these vehicles at this time to the degree possible given limits of time and budget. Use of this document for any other purpose is at the risk of the reader.

SECTION 1 – Executive Summary

Vehicle Inventory

Data for the class 2b to class 4 fleet vehicle space in Canada is in varying degrees incomplete or unavailable. Data was obtained from vehicle registration authorities in BC, Alberta, Manitoba, Ontario, and Nova Scotia. Data regarding duty cycles was obtained through interviews with local governments, utilities, construction / maintenance operators, and couriers. In *Chart 1 – Fleet Estimates by Class – Canada*, inventory estimates show that there are 250,000 (+/- 100,000) class 2b to 4 fleet vehicles in Canada. The majority (64%) are class 2b followed by class 3 (23%) and class 4 (12%).

The vast majority of vehicles in this space (passenger and commercial) are produced by Ford, FCA, and GMC with all other manufacturers accounting for just over 10% in class 2b and 3. As can be seen in *Chart 2 – OEM Share by* Class Total Population, other manufacturers account for approximately 20% of the more specialized class 4 vehicles.

The average age of vehicles ranges differs by class;

- 7.75 years for Class 2b,
- 9.2 years for class 3, and
- 11 years for class 4.

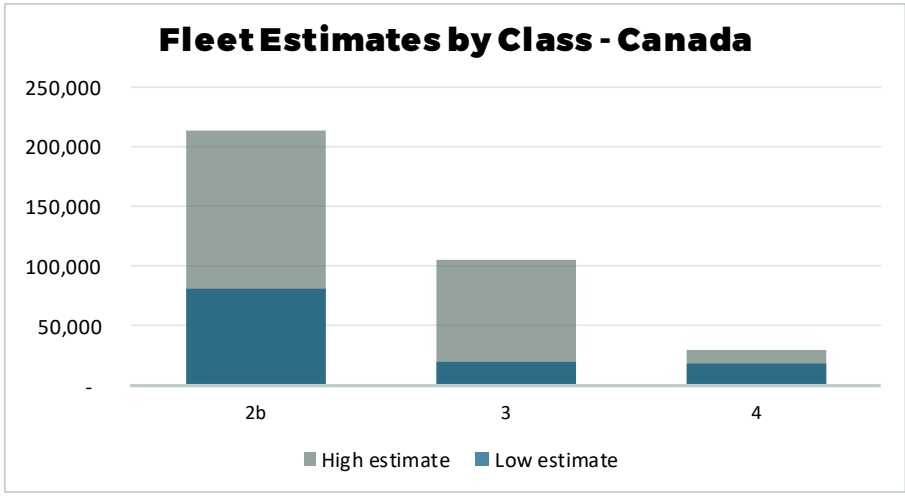


Chart 1 – Fleet Estimates by Class in Canada

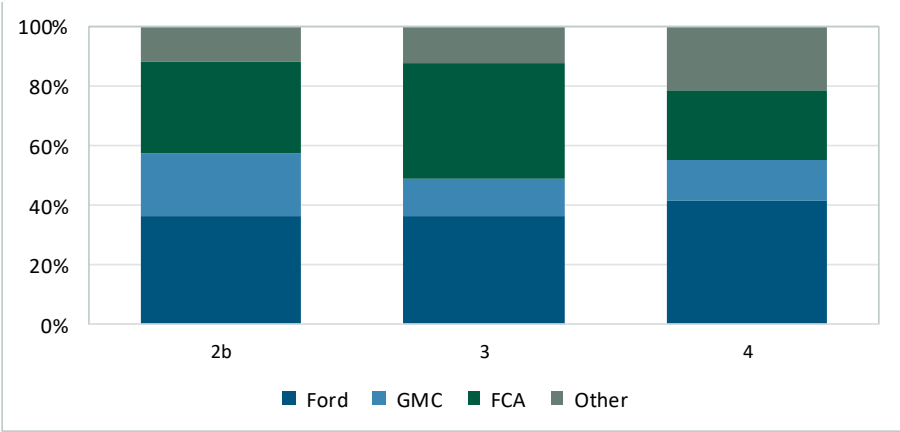


Chart 2 – OEM Share by Class Total Population

There are three broad fleet uses for vehicles in these classes as described in *Table 1 - Duty Cycles*. Each archetypal use has different characteristics which make it more or less likely to adopt emissions reducing technologies. Within each archetypal use, there are multiple types of fleets differentiated by size, type of organization, ownership, and environmental commitments which also determine likelihood to adopt emissions reducing technologies.

Table 1 – Duty Cycles

Archetype	Description	Typical VKT	Fleet Segment Likely to Move First
Toolbox	Use of the truck to transport tools and crew to worksites such as with buildings construction and maintenance or municipal fleets. Vehicles usually max out cube space before weight.	10,000	Government fleets with an emissions reduction mandate to justify incremental capital cost.
Tool	Another use is vocational or the truck as a tool itself, such as tow-trucks, small bucket trucks, and other specialized uses. These vehicles often have significant loads such as hydraulics when stopped.	Variable	Dependant on vehicle manufacturers delivering vehicles that meet operational needs. This segment is less likely to see significant activity before 2025.
Delivery	Start-stop duty cycle with relatively fixed routes travelling 100-150km/day and returning to base for reloading overnight. Vehicles typical max out cube space before weight.	35,000	Large company-owned / leased fleets followed closely by smaller niche fleets with environmental branding. Then the remaining fleets as local government 'zero emissions delivery zones' emerge in major markets.

Emissions Technology Options

Emissions reduction technologies for these classes of vehicles are primarily related to fuels. Research to date, has not identified non-fuel emissions reduction retrofit options. Of the fuel options, Compressed Natural Gas (CNG) is the most mature retrofit technology. There are primarily three fuel options described in *Table 2 - Alternative Fuels*:

Table 2 – Alternative Fuels

Fuel Option	Maturity	Momentum	Retrofit	Challenges	Benefits
Compressed natural gas	Very Mature	Very low	Yes	Limited infrastructure, loss of cube space for additional CNG tank.	Financial benefits in heavier vehicles in large fleets through low carbon fuel standard trading, Emissions reduction from gasoline to CNG
Hydrogen	Immature	Low	Limited	New technology, cost and longevity of fuel cell stacks, cost of hydrogen price set equivalent to gasoline, limited infrastructure.	Long range, potential for low / no emissions depending on how hydrogen is produced

Electrification	Emerging	High	Limited	Initial capital cost, current lack of availability of vehicles.	Operational cost savings through reduced maintenance, lower driver stress / fatigue, lower fuel cost, lower emissions in all jurisdictions.

Opportunities & Recommendations

Recommended NRCan Program Design Considerations for accelerating emissions reductions in class 2b-4 fleets across Canada.

1. **Numerous Small Fleets**: Research studies have suggested that fleets in this segment tend to be small and numerous, which will require a different approach than engaging with a small number of large fleets.
2. **Electrification Momentum and Pace**: Electrification is the main emissions reduction approach that fleet managers are pursuing in these vehicle classes in the medium term . Electrification is progressing rapidly with several pickup trucks expected to be available in the next 24 months in Canada. Some of these vehicles are already being deployed in the US, such as Amazon's Rivian delivery vans.
3. **Performance Risk**: There is currently little experience with real-world performance in each of the duty cycle categories, creating risk for fleet managers.
4. **Adoption Sequencing**: Not all fleet segments will move at the same speed. We expect:
    a. Large delivery fleets and niche green-branded delivery fleets to be the first adopters starting in 2022 as older vehicles are retired or fleets expand. Experiences with initial vehicles will be critical to adoption at scale.
    b. Government fleets where the capital investment can be justified on leadership and emissions savings, are also likely to begin adoption / testing when they are able to access vehicles—possibly in 2023. This is a large segment and could influence market direction if coordinated strategically.
    c. Remaining delivery fleets will adopt electric vehicles based on business case or local government 'zero emissions delivery zone' regulations, perhaps starting in 2025 or later.
    d. Vocational fleet adoption will likely occur later as vehicles are developed which can support the operational requirements.
    e. Remaining 'truck as a toolbox' fleets, will adopt EV's when their first cost becomes less than comparable fossil fuel vehicles.
    f. Infrastructure for return-to-base vehicles for charging will be a significant investment and, if not undertaken, could delay adoption.

These considerations have emerged through research for this paper and may be referenced if programs are designed at a future date. Refreshing the research is recommended, as there are weekly announcements and changes in vehicle electrification within this space.

There are several significant opportunities for NRCan to accelerate emissions reduction in the Class 2b to 4 space.

1. **Recognize market momentum** of vehicle electrification with program design and incentives while keeping not excluding experimentation with hydrogen and renewable natural gas.
2. **Data products:**
    - **Monitor and report sector progress** through an open-data national transportation inventory. This could be constructed based on data sharing agreements with each province. It could also leverage BC's Community Energy and Emissions Inventory experience. Ultimately this could be a companion to NRCan CAMNET's National Buildings Data Layer.
    - **De-Risk performance** for early adopters through real world data and case studies developed by working with public and private sector fleet partners on early performance measurement, likely with telematics and addressing cold weather performance.
    - **Undertake utility rate structures** research and identify best practices including treatment of demand charges to support commercial fleet EV adoption.
3. **Coordination:**
    - **Coordinate** national public sector procurement through federal departments, provinces and territories, as well as local governments and First Nations, to get early access to EV's in this space and to support development of local maintenance capacity.
    - **Coordinate** knowledge sharing among fleets, potentially linking with data products.
4. **Capital:**
    - **Buy down capital cost** premiums for electric vehicles for fleets, such as British Columbia's SUVI incentive.
    - **Enable infrastructure** including urban charging hubs to pilot and demonstrate zero emissions delivery zone charging technologies and processes, including publication of findings.

SECTION 2 - Introduction

Purpose

The purpose of this report is to provide an overview of class 2-b to class 4 business use vehicles in Canada and emissions reduction technology opportunities. This report addresses the following key questions:

Table 3 – Key Questions Addressed

Vehicle Inventory	Emissions Technology Options

• What is the number of trucks in each category on the road in Canada by make?
• What is the average life span?
• What make/model of truck falls into each category:
  • Type of fleets
  • Main usage
  • Duty cycle and average km traveled (day/year)?
	• What kind of retrofits are available for these classes of trucks?
	• What are the estimated benefits of each retrofit?
	• What alternative fuel versions are available (natural gas, electric, hydrogen)?
	• How are they sold, through O&M, commercially available through
	  • retailer
	  • only via retrofit
	  • engine repower

This report is current as of March 2021. There is significant rapid movement on vehicle electrification and users of this report should consult current analysis.

Vehicles

The vehicles covered in this report are class 2b to class 4 vehicles as outlined in the table below.

Table 4 – Vehicle Classes for Business Use in Canada

class	Weight limit	Examples
1	0–6,000 pounds (0–2,722 kg)	Small and midsize cars, small pickup trucks
2a	6,001–8,500 pounds (2,722–3,856 kg)	Ford F-150, Ram 1500
2b	8,501–10,000 pounds (3,856–4,536 kg)	Ford F-250, Ram 2500
3	10,001–14,000 pounds (4,536–6,350 kg)	Chevrolet Silverado/GMC Sierra 3500, Ford F-350
4	14,001–16,000 pounds (6,351–7,257 kg)	Ford F-450 (chassis cab), Ram 4500
5	16,001–19,500 pounds (7,258–8,845 kg)	Ford F-550, Ram 5500

SECTION 3 - Key Questions

Vehicle Inventory

There is no pre-existing inventory of class 2b to class 4 vehicles in Canada. Each province maintains vehicle registrations, but not all provinces flag vehicles that are used for business. There are multiple groupings of classes for which data is reported by Statistics Canada and third party publications. None of these pre-existing groupings match the scope of this study.

Vehicle registration data was obtained from the provinces of BC, Alberta, Manitoba, Ontario, and Nova Scotia. BC registration data was the most detailed and was a significant outlier in that it indicated a much higher per-capita concentration of vehicles in class 2b-4 in BC than in other provinces.

We estimated the number of vehicles in non-reporting provinces and territories based on an application of per-capita ownership from similar provinces as described in *Table 5*.

Table 5 – Non-Reporting and Provinces with Obtained Registration Data

Non-Reporting Province	Province Per-Capita Used to Estimate
SK	AB
QC	ON
Atlantic	NS
Territories	N/A due to small populations

Total vehicles including both personal and business use as reported and estimated by province, is shown in *Chart 3 – Class 2b-4 Vehicles by Province*. From this data we adjusted BC data for a 'low' case. We then applied the percentage of vehicles by each class used for 'business' to the totals for each province.

Given the unique nature of BC data, an alternative estimate of BC data was also estimated using AB per-capita numbers to provide a range for BC.

Only BC was able to provide flags for vehicles registered for 'business' use or 'fleet' use. The BC numbers for 'business' were roughly twice the BC numbers for 'fleet'. We were unable to find other credible published data on the percentage of vehicles by class in Canada that are used primarily for business. When determining the percentage of vehicles by class that are used for business or fleet, we developed a range based on the BC data.

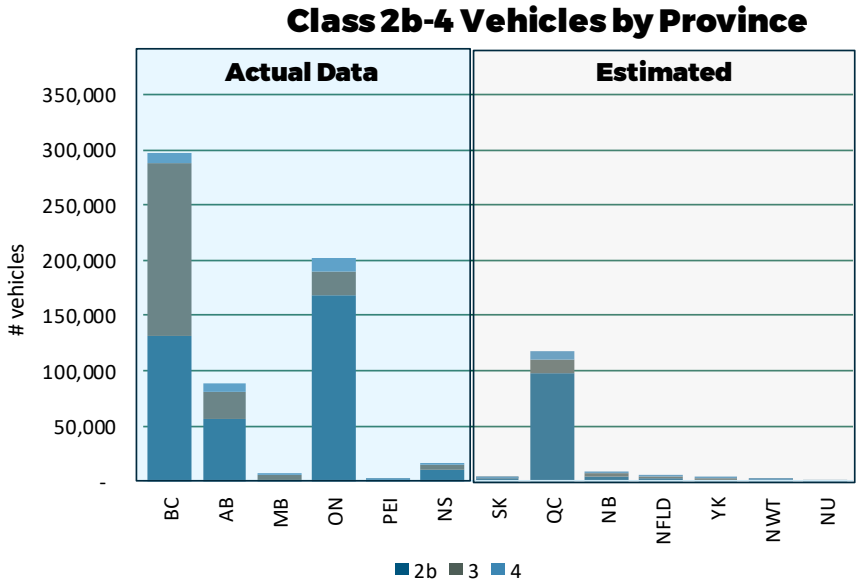


Chart 3 – Class 2b-4 Vehicles by Province

The approach to developing a 'high' estimate and a 'low' estimate for each class of vehicle is described in *Table 6*.

The end result is two estimates providing the likely range of the number of business use vehicles in Canada by each of the three classes.

In *Chart 4 – Fleet Estimates by Class in Canada*, inventory estimates show that there are 250,000 (+/- 100,000) class 2b to 4 fleet vehicles in Canada. The majority (64%) are class 2b followed by class 3 (23%) and class 4 (12%).

The uncertainty about absolute number of vehicles is greatest for the 2b class, which has significantly more vehicles than the other classes. The greatest percentage uncertainty is with class 3 vehicles.

There is little uncertainty with class 4 vehicles given the smaller overall number of vehicles and the very high percentage that are business use.

Table 6 – Estimates for Range of Number of Business Use Vehicles

	2b	3	4
High - BC data	Reported BC data (province of BC)		
Low – BC data	BC data adjusted to reflect Alberta per-capita		
High - estimate BC 'Business' flag %	45%	45%	80%
Low - estimate 'BC Fleet' flag %	20%	20%	50%

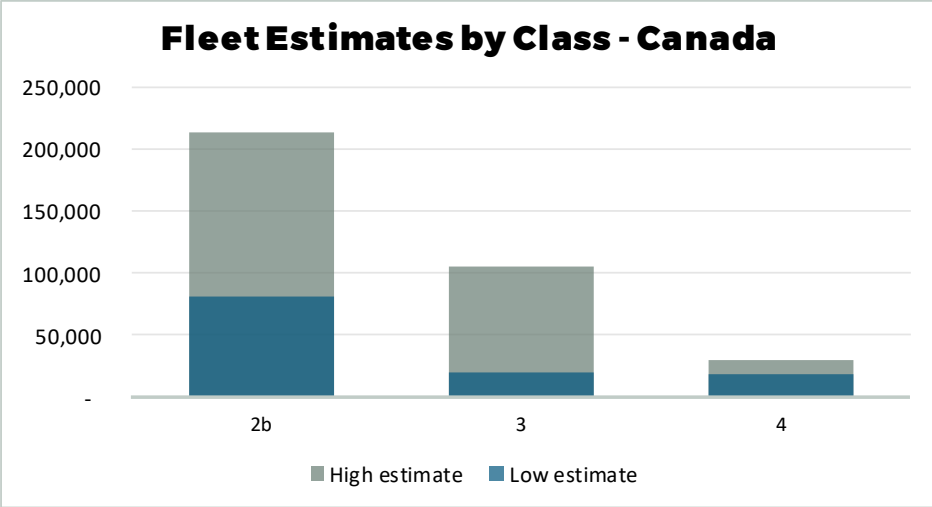


Chart 4 – Fleet Estimates by Class in Canada

OEM Share

As can be seen in *Chart 5 – OEM Share by Class Total Population*, other manufacturers account for approximately 20% of the more specialized class 4 vehicles. The vast majority of vehicles in this space (passenger and commercial) are produced by Ford, FCA, and GMC with all other manufacturers accounting for just over 10% in class 2b and 3.

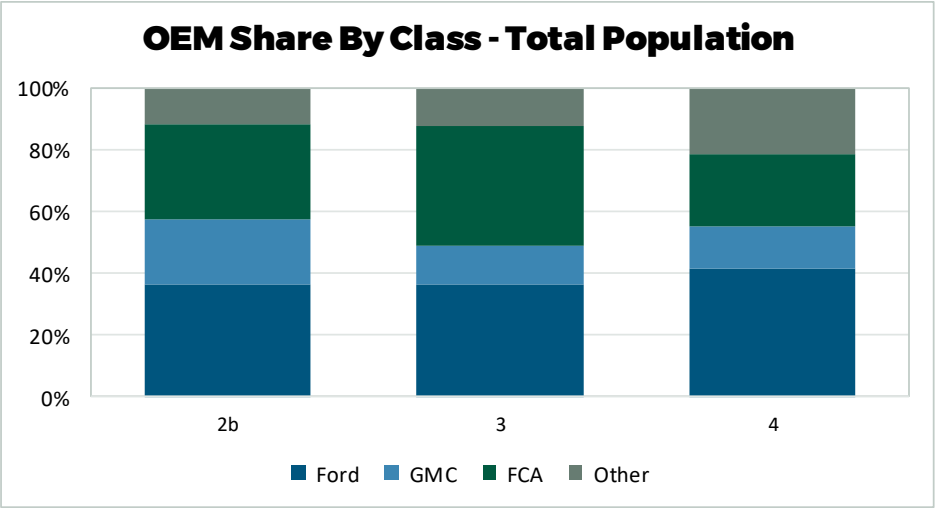


Chart 6 – OEM Share by Class – Total Population

Age

The average age of vehicles is 7.75 years for Class 2b, 9.2 years for class 3, and 11 years for class 4. This implies a 9% to 13% annual replacement rate for these vehicles.

Within each class, there is significant diversity among fleets regarding turnover of vehicles. Advanced fleets replace vehicles based on reliability. Less advanced fleets may set a policy of vehicle replacement based on age of vehicle regardless of reliability. Studies from the US indicate that heavily branded fleets will turnover more quickly as the appearance of the vehicle may degrade more rapidly than reliability.

Data obtained from www.statist.com indicated total (passenger and business) class 3 and class 4 sales are 30% above our calculations from average age and inventory.

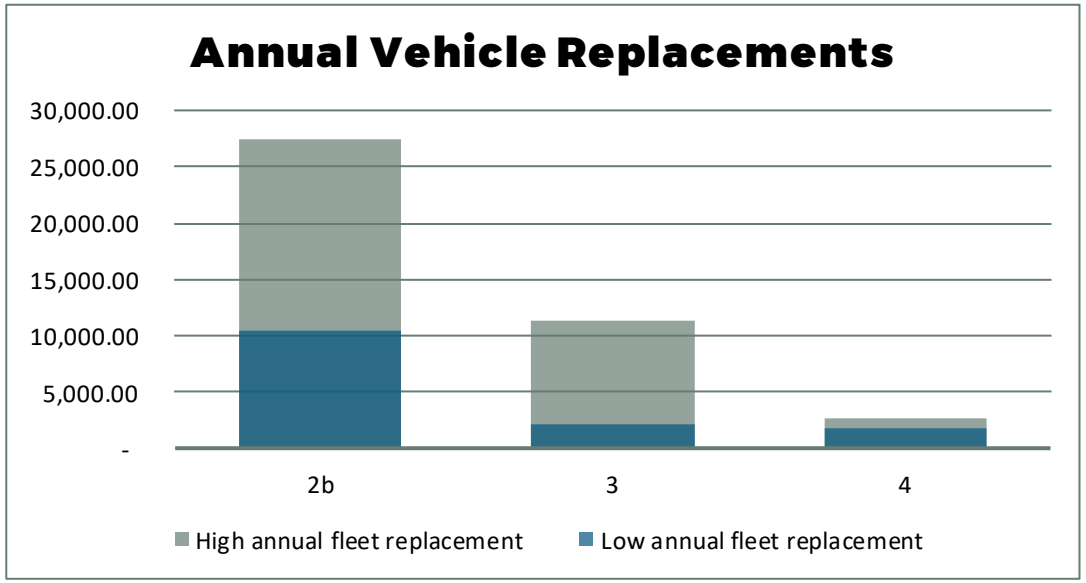
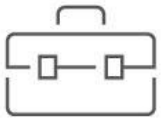


Chart 7 – Annual Vehicle Replacements

Duty Cycles

There are three broad fleet uses for vehicles in these classes as described in *Table 7 - Duty Cycles*.

Table 7 – Duty Cycles

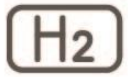
Archetype	Description	Typical Fleets	Class	Typical Kilometers Travelled	Fleet Segment Likely to Move First
Toolbox 	Use of the truck to transport tools and crew to worksites. Vehicles usually max out cube space before weight.	Construction and building maintenance trades, utilities, municipalities	Primarily 2b	6,000-10,000	Government fleets with an emissions reduction mandate to justify incremental capital cost.
Tool 	Another use is vocational or the truck as a tool itself. These vehicles often have significant loads such as hydraulics when stopped.	Tow truck operators, utilities (bucket trucks), emergency vehicles, specialty use vehicles	Primarily 4	variable	Dependant on vehicle manufacturers delivering vehicles that meet operational needs. This segment is less likely to see significant activity before 2025.
Delivery 	Start-stop duty cycle with relatively fixed routes travelling 100-150km/day and returning to base for reloading overnight. Vehicles typical max out cube space before weight.	Large / national couriers, local couriers, grocery / beverage, local logistics	All, 2b for urban delivery	30,000-50,000	Large company-owned / leased fleets followed closely by smaller niche fleets with environmental branding then the remaining fleets as local government 'zero emissions delivery zones' emerge in major markets.

In all archetypes, fleet size ranges from 1-2 trucks to dozens of trucks. This may be a significant factor to consider in designing programs to support emissions reductions in these vehicle classes with programs being either highly flexible or highly targeted.

Emissions Technology Options

Emissions reduction technologies for these classes of vehicles are primarily related to fuels. Research has not identified non-fuel emissions reduction retrofit options. Of the fuel options, Compressed Natural Gas (CNG) is the most mature retrofit technology. There are primarily three fuel options described in *Table 8 – Alternative Fuels*:

Table 8 – Alternative Fuels

	Maturity	Momentum	Retrofit	Challenges	Benefits
Compressed natural gas 	Very Mature	Very low	Yes	Limited infrastructure, loss of cube Space for additional CNG tank	Can be financial benefits in heavier vehicles in large fleets through low carbon fuel standard trading. Emissions reduction from gasoline to CNG.
Hydrogen 	Immature	Low	Limited	New technology, cost and longevity of fuel cell stacks, cost of hydrogen set currently equivalent to gasoline, limited infrastructure	Long range and potential for low / no emissions depending on how hydrogen is produced.
Electrification 	Emerging	High	Limited	Initial capital cost, current lack of availability of vehicles	Operational cost savings through reduced maintenance, lower driver stress / fatigue, lower fuel cost, lower emissions in all jurisdictions.

There appears to be very little powertrain retrofit activity in this space currently. Historically, CNG dual-fuel retrofits were prominent in some niches, however at this time there is little to no CNG dual fuel retrofits occurring in these vehicle classes. Electrification retrofits are possible but not common given the expectation that manufacturers will soon provide electrified vehicle options in this space.

What is more prominent presently is the approach of sending an OEM chassis to a specialized manufacturer to install an electric powertrain and then possible sending that vehicle to another specialized manufacturer to install a custom box. This is viewed as an interim solution until OEM electric vehicle availability increases in this space.

Medium Duty Vehicle Electrification Trajectory

Niche vehicle makers, large OEM's, and specialized equipment manufacturers who put electric powertrains into OEM chassis, are all active in the class 2b to 4 space.

Table 9 – Vehicle Availability is an inventory of when vehicles are expected to be available by class, year, and manufacturer.

We expect that announced class 2a vehicles may claim some of the 2b class space depending on the specifications of these vehicles. These vehicles often max out on cube space rather than weight and the class 2a vehicles may be generally available earlier than many in the 2b class.

This is a very dynamic time for vehicle electrification. This table is a snapshot in time as of March 2021.

While there are few vehicles available in these classes in early 2020, we expect to see many new options become available over the next 2 years.

Table 9 – Vehicle Availability

Make	Class			Vehicles & notes
	2b	3	4	
Bollinger		2022		B1, B2
CityFreighter		2022		CF1
Dana Nordresa			New	T4, T4+, W4, W4+
Girardin Blue Bird			New	G5e
GM		2021		BrightDrop 600
GreenPower			New	EV Star
Hummer	2022			EV[3X] (Class unknown)
Lightning eMotors		New + Retrofit		Transit 350HD, E-450
Lordstown	2021			Endurance (Class unknown)
MAN		New		*EU Only
Micro Bird			New	G5, D Series
Motiv			New + Retrofit	EPIC E-450
Nikola	Unknown	Unknown		Badger
Phoenix Motorcars			New	ZEUS 400, ZEUS 500
SEA Electric	New			E4B, E4V, Refuse EV
SEA Electric Ford	New + Retrofit			E-Transit, Transit 350HD
SEA Electric Hino		New		195 EV
SEA Electric Isuzu			New + Retrofit	NLR EV, NNR EV, NPR EV, NQR EV
Tesla	2021			CyberTruck
Workhorse		2021		C650, C1000
Wrightspeed		Retrofit		Route 250 - NG Hybrid

Legend	Availability in Canada
New	Now as New Vehicle
New + Retrofit	Now as New or Retrofit
Retrofit	Now as Retrofit
2021	Late 2021
2022	2022
Unknown	Unknown availability

SECTION 4 – Implications and Recommendations

Characteristics Influencing Program Design

The following characteristics of the class 2b to 4 fleets and vehicles are likely to be important program design considerations if NRCAN develops a program to support emissions reductions for these fleets and vehicles.

1. **Fleet Diversity**: Research studies have suggested that fleets in this segment tend to be small and numerous. This is balanced by a small number of large fleets (utilities, some couriers). We expect different fleet segments to adopt emissions reduction technologies at different paces due to the differences in vehicle use and the differences in fleet priorities and processes. Successfully supporting the fleets that want to move at the right time may be important to program success.
2. **Electrification Momentum and Pace**: Electrification is the main emissions reduction approach that fleet managers are pursuing in these vehicle classes in the medium term . Electrification is progressing rapidly with several pickup trucks expected to be available in the next 24 months in Canada. Some of these vehicles are already being deployed in the US, such as Amazon's Rivian delivery vans. On March 5th, FEDEX announced that all its delivery fleet would be electric by 2040. There is no discernable momentum for natural gas dual-fuel conversions or hydrogen vehicles in this class of vehicle.
3. **Risk**: There is currently little experience with real-world performance in each of the archetypal uses. This lack of information creates risk for fleet managers considering electrifying class 2b to 4 vehicles. This lack of data also negatively impacts the ability of fleet managers to confidently make the business case for electrification which further delays adoption. A regularly updated vehicle inventory does not exist in Canada which poses a risk for program measurement, evaluation and evolution.
4. **Adoption Sequencing**: Not all fleet segments will move at the same speed. We expect:
    a. Large delivery fleets and niche green-branded delivery fleets to be the first adopters starting in 2022 as older vehicles are retired or fleets expand. Experiences with initial vehicles will be critical to adoption at scale.
    b. Government fleets where the capital investment can be justified on leadership and emissions savings, are also likely to begin adoption / testing when they are able to access vehicles—possibly in 2023. This is a large segment and could influence market direction if coordinated strategically.
    c. Remaining delivery fleets will adopt electric vehicles based on business case or local government 'zero emissions delivery zone' regulations, perhaps starting in 2025 or later.
    d. Vocational fleet adoption will likely occur later as vehicles are developed which can support the operational requirements.
    e. Remaining 'truck as a toolbox' fleets, will adopt EV's when their first cost becomes less than comparable fossil fuel vehicles.
    f. Infrastructure for return-to-base vehicles for charging will be a significant investment and, if not undertaken, could delay adoption.
5. **Capital Cost**: Higher first cost is a barrier for many fleets, particularly those with relatively low annual kilometers traveled.

There are several significant opportunities for NRCan to accelerate emissions reduction in the Class 2b to 4 space.

Opportunity	Characteristics Addressed				
	Diversity	Momentum	Cost	Risk	Sequencing
1. **Recognize market momentum** of vehicle electrification with program design and incentives while keeping not excluding experimentation with hydrogen and renewable natural gas.		■			■
Data products					
2. **Monitor and report sector progress** through an open-data national transportation inventory. This could be constructed based on data sharing agreements with each province. It could also leverage BC's Community Energy and Emissions Inventory experience. Ultimately this could be a companion to NRCan CAMNET's National Buildings Data Layer.				■	■
3. **De-Risk performance** for early adopters through real world data and case studies developed by working with public and private sector fleet partners on early performance measurement, likely with telematics and addressing cold weather performance.	■	■		■	■
4. **Undertake utility rate structures** research and identify best practices including treatment of demand charges to support commercial fleet EV adoption.		■		■	
Coordination					
5. **Coordinate** national public sector procurement through federal departments, provinces and territories, as well as local governments and First Nations, to get early access to EV's in this space and to support development of local maintenance capacity.		■			■
6. **Coordinate** knowledge sharing among fleets, potentially linking with data products	■	■	■	■	■
Capital					
7. **Buy down capital cost** premiums for electric vehicles for fleets, such as British Columbia's SUVI incentive.	■		■		■
8. **Enable infrastructure** including urban charging hubs to pilot and demonstrate zero emissions delivery zone charging technologies and processes, including publication of findings		■	■	■	

APPENDICES

APPENDIX 1 Approach and Process Overview

The purpose of this report is to provide an overview of class 2-b to class 4 business use vehicles in Canada and emissions reduction technology opportunities. This report addresses the following key questions:

Table 10 – Key Questions Addressed

Vehicle Inventory	Emissions Technology Options

Inventory
• What is the number of trucks in each category on the road in Canada by make?
• What is the average life span?
Usage
• What make/model of truck falls into each category:
  • Type of fleets
  • Main usage
  • Duty cycle and average km traveled (day/year)?
	• What kind of retrofits are available for these classes of trucks?
	• What are the estimated benefits of each retrofit?
	• What alternative fuel versions are available (natural gas, electric, hydrogen)?
	• How are they sold, through O&M, commercially available through
	  • retailer
	  • only via retrofit
	  • engine repower

This report is current as of March 2021. There is significant rapid movement on vehicle electrification and users of this report should consult current analysis.

The project team conducted the following research:

- **Vehicle Inventory - Inventory**: The team reviewed publicly available data from government and private sources listed in the resources appendix. The team contacted the vehicle registration data entity in each province to request the current number of vehicles by class (selected by one of the following: class, gvwr, make/model), age, and make/model. Data was received from BC, AB, MB, ON, and NS. Other jurisdictions were not able to provide data during the timespan of the project. The team also sought data from IHS Markit, however there was not sufficient budget to acquire that data. The team analyzed the data received from each of the provinces and projected data for similar provinces based on that data. Two approaches were taken to BC data which was a significant outlier with five times the per-capita class 3 vehicles as AB. The 'high' estimate takes BC data as-is and the 'low' estimate uses AB per-capita data to estimate BC data. The team also compared provincial vehicle inventories to those that Statistics Canada produces to determine any further outliers. Estimated annual vehicle sales were calculated based on the implied turnover rate based on vehicle age and this was compared to published sales data by class nationally. These two approaches were within 30% of

each other, leading to a reasonable level of confidence in inventory estimates. The difference may be accounted for by the used / resale market.

- **Vehicle Inventory – Usage**: CEA contacted each of the organizations / individuals listed in the 'contacts' appendix. Of particular use were interviews with City of Vancouver, Metro Vancouver, the national fleet manager for an international courier, multiple divisions of FortisBC and ICCT. These sources and others agreed on the three broad use cases for these classes of vehicles and the duty cycle characteristics. Data does not exist to calculate the number of vehicles in each of the three duty cycle archetypes. Through interviews, a consensus emerged that the duty cycle archetype with the most vehicles is likely the 'toolbox' an the archetype with the least is likely the 'tool' with 'delivery' falling in the middle.
- **Vehicle Emissions Technology Options**: CEA interviewed the contacts noted above and in the 'contacts' appendix to understand which emissions reduction technologies were being deployed, how they are expected to be deployed in the future, as well as the benefits and challenges associated with each. CEA also reviewed recent announcement by automakers and fleets as well as other published projections of vehicle availability. Announcements on new electric vehicle commitments occurred on a weekly basis during the project. CEA also relied on data from previous projects, publications, research, and networks.
- **Management**: Monthly progress check-in calls were held with NRCAN to review progress and insights to date.

APPENDIX 2 Contacts

The project team contacted the following organizations for the following purposes in researching this report.

Organization	Type	Purpose
Alberta Registratry Agents	Registration Entity	Vehicle Data
Alberta Registratry Agents	Registration Entity	Vehicle Data
Government of Alberta	Provincial Government	Vehicle Data
Manitoba Public Insurance	Registration Entity	Vehicle Data
Manitoba Public Insurance	Registration Entity	Vehicle Data
Manitoba Public Insurance	Registration Entity	Vehicle Data
Service New Brunswick	Provincial Government	Vehicle Data
Service New Brunswick	Provincial Government	Vehicle Data
Digital Government and Service NL	Provincial Government	Vehicle Data
Access Nova Scotia and Internal Services	Provincial Government	Vehicle Data
Service Nova Scotia	Provincial Government	Vehicle Data
Government of Ontario, Ministry of Transportation	Provincial Government	Vehivle Data
Service Ontario	Provincial Government	Vehicle Data
Service Ontario	Provincial Government	Vehicle Data
Ontario Freedom of Information Office	Provincial Government	Vehicle Data
Access PEI	Provincial Government	Vehicle Data
Access PEI	Provincial Government	Vehicle Data
Government of PEI	Provincial Government	Vehicle Data
Société de l'assurance automobile du Québec	Registration Entity	Vehicle Data
Saskatchewan Government Insurance	Registration Entity	Vehicle Data
Alberta Motor Transport Association	Provincial Trucking Association	Vehicle Data
Atlantic Provinces Trucking Association	Provincial Trucking Association	Vehicle Data
Atlantic Provinces Trucking Association	Provincial Trucking Association	Vehicle Data
Atlantic Provinces Trucking Association	Provincial Trucking Association	Vehicle Data
Manitoba Trucking Association	Provincial Trucking Association	Vehicle Data
Ontario Trucking Association	Provincial Trucking Association	Vehicle Data
Ontario Trucking Association	Provincial Trucking Association	Vehicle Data
Ontario Trucking Association	Provincial Trucking Association	Vehicle Data
Ontario Trucking Association	Provincial Trucking Association	Vehicle Data
Ontario Trucking Association	Provincial Trucking Association	Vehicle Data
Ontario Trucking Association	Provincial Trucking Association	Vehicle Data

Ontario Trucking Association	Provincial Trucking Association	Vehicle Data
Quebec Trucking Association	Provincial Trucking Association	Vehicle Data
Saskatchewan Trucking Association	Provincial Trucking Association	Vehicle Data
Saskatchewan Trucking Association	Provincial Trucking Association	Vehicle Data
UPS	Delivery Fleet Managers	Interviews - Fleet Management
UPS	Delivery Fleet Managers	Interviews - Fleet Management
Purolator Inc.	Delivery Fleet Managers	Interviews - Fleet Management
Purolator Inc.	Delivery Fleet Managers	Interviews - Fleet Management
Canada Post	Delivery Fleet Managers	Interviews - Fleet Management
Canada Post	Delivery Fleet Managers	Interviews - Fleet Management
Canada Post	Delivery Fleet Managers	Interviews - Fleet Management
Canada Post	Delivery Fleet Managers	Interviews - Fleet Management
Canada Post	Delivery Fleet Managers	Interviews - Fleet Management
Canada Post	Delivery Fleet Managers	Interviews - Fleet Management
Canada Post	Delivery Fleet Managers	Interviews - Fleet Management
Loomis Express	Delivery Fleet Managers	Interviews - Fleet Management
FedEx	Delivery Fleet Managers	Interviews - Fleet Management
Dana Nordresa	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
Girardin Blue Bird	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
GreenPower	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
Phoenix Motorcars	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
SEA Electric Ford	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
Lightning eMotors	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
MAN	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
SEA Electric	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
SEA Electric Hino	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
Motiv	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
Wrightspeed	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
Bollinger	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
Nikola	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
Workhorse	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
Tesla	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
GM	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
Hummer	Vehicle Fleet Manufacturer	Vehicle Sales & Availability
Lordstown	Vehicle Fleet Manufacturer	Vehicle Sales & Availability

ICLEI Canada	Provincial Municipal Association	Local Government Fleets
Association of Manitoba Municipalities	Provincial Municipal Association	Local Government Fleets
Union of the Municipalities of New Brunswick	Provincial Municipal Association	Local Government Fleets
Municipalities Newfoundland and Labrador	Provincial Municipal Association	Local Government Fleets
Northwest Territories Association of Communities	Provincial Municipal Association	Local Government Fleets
Nova Socia Federation of Municipalities	Provincial Municipal Association	Local Government Fleets
Nunavut Association of Municipality	Provincial Municipal Association	Local Government Fleets
Association of Municipalities of Ontario	Provincial Municipal Association	Local Government Fleets
Federation of PEI Munciipalities	Provincial Municipal Association	Local Government Fleets
Quebec Federation of Municipalities	Provincial Municipal Association	Local Government Fleets
Saskatchewan Association of Rural Municipalities	Provincial Municipal Association	Local Government Fleets
Association of Yukon Communities	Provincial Municipal Association	Local Government Fleets

APPENDIX 3 Resources

The research team found the following resources to be useful in informing our work:

Publication	Date	Author
Race to Zero	October 2020	**ICCT** Ben Sharpe and Clair Buysse et al
Medium Truck Duty Cycle Data from Real-World Driving Environments: Project Final Report	November 2012	**Oak Ridge National Laboratory** Mary Beth Lascurian et al
Speciality-Use Vehicle Incentive Program Eligible Vehicles List	December 2020	**Province of BC**
Electrification Beyond Light Duty: Class 2b-3 Commercial Vehicles	December 2017	**Oak Ridge National Laboratory** Mary Alicia Birky et al
Steep Climb Ahead: How fleet managers can prepare for the coming wave of electrified vehicles	2021	**Rocky Mountain Institute** Lynn Daniels et al
Guidance Report: Medium-Duty Electric Trucks Cost of Ownership	2018	**North American Council for Freight Efficiency**
California HVIP – Vehicles and Eligible Technologies	October 2019	**California Air Resources Board**
2020 Fact Book	2020	**Canadian Automotive Fleet Magazine**