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July 28, 2016

Mr. Matt Jones
Director General
Policy Development
Environment and Climate Change Canada
200 Sacre-Coeur Blvd., 14th floor, Office 1477
Gatineau, Quebec K1A 0H3

Subject: Pan-Canadian Framework on Clean Growth and Climate Change – CVMA Detailed Comments

Dear Mr. Jones:

The Canadian Vehicle Manufacturers' Association (CVMA), representing FCA Canada Inc., Ford Motor Company of Canada, Limited, and General Motors of Canada Company, appreciates the opportunity to provide further details to support our submission made to the Climate Change Portal for the Pan-Canadian Climate Change Framework in June of 2016.

The CVMA members recognize and understand that governments across Canada are concerned about the climate and the environment both locally and globally. The automotive industry shares those concerns and provides these comments to shape the direction of the Pan-Canadian Climate Action Plan. The industry has made and continues to make substantial investments in developing lower emission vehicles for both greenhouse gases and criteria pollutants and our record as an industry is unmatched in criteria emissions reductions since the advent of the first emission controls systems in the 1960's. Today's Tier 2 vehicles are over 98.8% cleaner than those in the pre-control era and Tier 3 vehicles will be even cleaner with a further 80% reduction from Tier 2 by 2025 to near zero smog-causing emissions. We are applying the same successful approach to greenhouse gas emissions reduction. These successes have been achieved by aligning regulatory approaches between Canada and the United States. A continued harmonized regulatory approach allows for the leveraging of North American economies of scale which provide Canadians with the greatest access to advanced vehicle technologies and their commensurate environmental benefits (reduction in vehicle GHG emissions as well as criteria emissions). Harmonization also provides regulatory certainty in Canada and allows vehicle manufacturers to focus their efforts on meeting these progressively more stringent vehicle GHG emission regulations on a national and North American level. These actions are consistent with the activities and objectives of the Regulatory Cooperation Council and the June 29, 2016 Leaders' Statement and Action Plan on the North American Climate, Clean Energy, and Environment Partnership.

Our comments, outlined in Appendix A and B, address key issues that are relevant to the automotive industry, the transportation sector more generally, and vehicle consumers. We recognize that the Government of Canada and the provinces all have significant objectives for greenhouse gas (GHG) emissions reductions and there is a desire to develop a national climate change framework. Effective public policy in this area will need to focus on understanding consumers' transportation needs. These policies and programs will need to support and increase consumers' demand on a provincial and national basis for energy saving vehicle technologies across all of their transportation needs.

Automotive technology is advancing at an unprecedented pace and cleaner and more efficient vehicles are being brought to market in an ever increasing array of models and numbers to keep pace with market demands and existing federally mandated regulations.

- New vehicles are very clean from a smog-causing emissions perspective and even more stringent emission controls are being phased-in over the coming years that will further reduce smog-causing emissions to virtually zero by 2025.
- The new light duty and heavy duty vehicle GHG regulations are driving the adoption of significantly lower year over year GHG emission vehicles, across all vehicle sizes and types, resulting in projected 50% lower GHG emissions for the light duty vehicle fleet by 2025.
- Opportunities do exist in all provinces to retire older vehicles and accelerate the adoption of advanced emissions control and GHG technology vehicles for which these actions will significantly lower emissions and improve the environment.
- Increasing vehicle electrification, including plug-in hybrid and battery electric vehicles, is an option that can contribute, over time, GHG and smog-causing emissions reductions. Plug-in electric vehicle technology (PEV) continues to come with a significant cost premium and consumers must be able to make a value judgement based upon their needs to select the most cost effective vehicle choices to meet their transportation needs. Beyond cost, further technology development is required before mass EV consumer acceptance/adoption is possible, such as, increasing battery energy density, expanding limited driving range and minimizing range reduction in cold weather. The current state of EV technology effectively limits model offerings to smaller cars and compact utility vehicles to meet many consumers' transportation needs.
- In many jurisdictions, policies supporting plug-in electric vehicle consumer incentives and measures that make electric vehicle use more convenient and less costly have been found to be helpful at increasing consumer adoption rates.
- Sales of plug-in electric vehicles across Canada have been steadily rising and this growth is expected to continue based on the number of new plug-in vehicle models being brought to market; as technology advances so will the economics supporting further mainstream adoption.

Vehicle manufacturers have and will continue to work collaboratively with the government to support their objectives in the area of the Climate Action and vehicle GHG emissions reductions.

A partnership approach between the government and industry is the best and most effective way to reduce GHGs, preserve consumer choice and demand, and achieve the government's goal of reducing vehicle fleet GHG emissions. We offer the following recommendations or actions that would form this partnership approach:

I. Joint dealer and consumer education
II. Targeted support for the electrification of vehicle fleets for example taxis, delivery fleets, car sharing, commercial and government fleets
III. Expanded HOV/ EV fast lane access and free charging & parking
IV. Significantly enhance public/city and workplace EV charging infrastructure and fast charging installations along highways; the recharging infrastructure must lead electric vehicle introduction by 2 to3 years
V. Monitor consumer PEV adoption – use Ontario-level incentives to accelerate adoption
VI. Explore Green Tech Opportunity - R&D and testing for batteries, EV components, EV infrastructure (plug-in & hydrogen) and autonomous vehicles
VII. Retirement Program on higher GHG emitting 12 years and older vehicles

The detailed comments in the appendices provide supporting information for the recommended joint industry government approach. This will result in increased consumer demand and reduced GHG emissions from the light duty fleet without risking the strength of the Canadian economy.

Improving vehicle energy efficiency and reducing vehicle GHG emissions is a common interest worldwide. Vehicle manufacturers have been and will be continuing to take significant actions over many years to improve vehicle efficiency and reduce new vehicle emissions to meet the aligned, stringent Canadian and U.S. vehicle GHG performance regulations. Vehicle manufacturers are also competing to introduce new and advanced vehicle technologies to market with energy efficiency, reduced fuel consumption and alternative fuels being important competitive factors driving technology development and innovation.

We trust that the comments provided will be considered and we wish to engage in a further discussion on this planned approach under the pan-Canadian framework on clean growth and climate change**.**

Should you have any questions, please do not hesitate to contact me directly at 416-364-9333.

Yours sincerely,

Mark A. Nantais
President

Attachment

cc: M. Beale, ADM, Environment and Climate Change Canada
S. Lucas, Senior Associate DM, Environment and Climate Change Canada
M. Martin, DM, Environment and Climate Change Canada
Hon. C. McKenna, Minister, Environment and Climate Change Canada
E. Burack, DG, Transport Canada

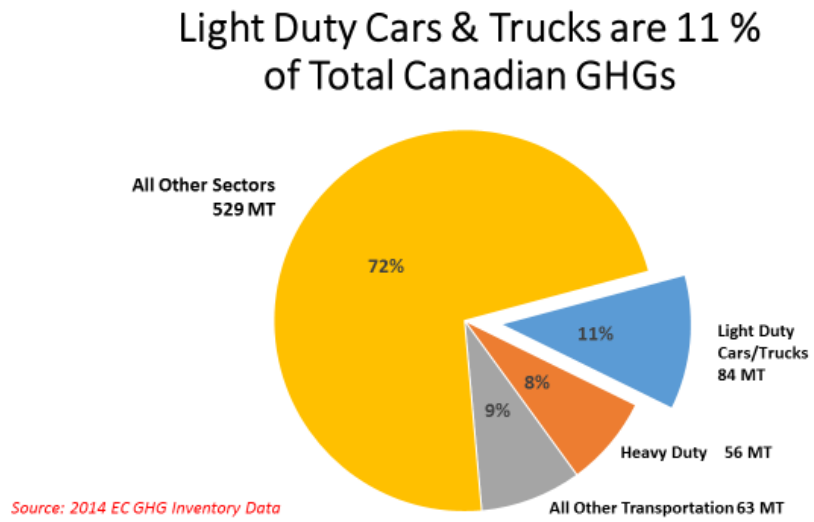
File: 54050YTGS_16
Pan-Canadian Climate Framework

Appendix A

The following is the CVMA submission submitted via the Climate Change Portal in June 2016. Appendix B provides details and supporting information to the information outlined in Appendix A.

CANADIAN VEHICLE MANUFACTURERS' ASSOCIATION CIMATE CHANGE PORTAL SUBMISSION
JUNE 1/16

Transportation emissions from the on-road light duty vehicle sector accounts for 11% of GHGs nationally (84 Mt).



The CVMA member companies, FCA Canada Inc., Ford Motor Company of Canada, Limited and General Motors of Canada Company, recognize and understand that governments across Canada are concerned about the climate and the environment both locally and globally. The automotive industry shares those concerns and is taking actions that will help shape the direction and achievement of the objectives of the Pan-Canadian Climate Action Plan.

Our comments address key issues that are relevant to the automotive industry, the transportation sector, and vehicle consumers. Effective public policy in this area will need to comprehend consumer transportation needs, as well as the policies and programs that will support and increase consumer demand on a provincial and national basis for energy saving vehicle technologies across all of their transportation needs.

The industry has made and continues to make substantial investments in developing lower emission vehicles for both greenhouse gases and criteria air pollutants applicable to both light duty and heavy duty vehicles. It is important to first establish exactly what the auto industry is doing and what public policies will be most effective to ensure the transportation sector transitions to a low carbon economy. Automotive technology is advancing at an unprecedented pace and cleaner and more fuel efficient vehicles are being brought to market in an ever increasing array of models and numbers to keep pace with market demands and the announced more stringent federal regulations.

The Government of Canada has revised a number of extremely stringent regulations to address motor vehicle emissions on a national basis including:

- On-Road Vehicle and Engine Emission Regulations – Tier 2 – 2004-2016 model years
- Passenger Car and Light Duty Truck GHG Emission Regulations – 2011–2016 model years
- Heavy Duty Vehicle & Engine GHG Emission Regulations – 2014–2018 model years
- Passenger Car and Light Duty Truck GHG Emission Regulations – 2017–2025 model years
- On-Road Vehicle and Engine Emission Regulations – Tier 3 – 2017-2025 model years
- Heavy Duty Vehicle & Engine GHG Emission Regulations – 2019–2027 model years (in development).

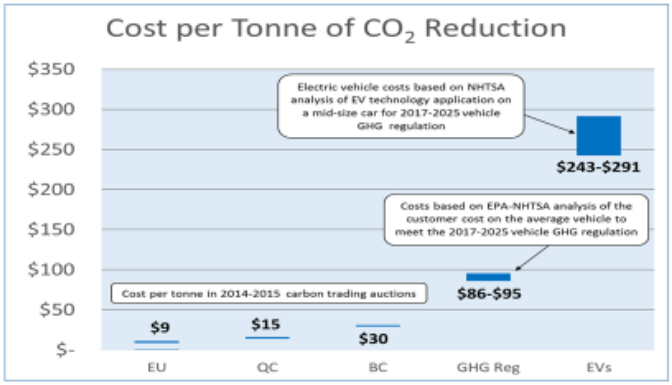
Our record as an industry is unmatched in criteria or smog-causing emissions reductions since the advent of the first emission controls systems in the 1960's. Today's Tier 2 vehicles are over 98.8% cleaner than those in the pre-control era and Tier 3 vehicles will be even cleaner with a further 80% reduction from Tier 2 to virtually zero while being phased in by 2025. We are applying the same successful approach to greenhouse gas emissions reduction.

The unprecedented stringency of the new 2017-2025 MY GHG standards will require manufacturers to spend an estimated $200 billion USD in advance vehicle technology development focused on vehicle GHG reductions. These regulations require manufacturers to adopt a multi-technology and fuels pathway for compliance in which electric vehicles, plug-in hybrid and battery electric, will become increasingly more prominent during this period of rapid technology deployment of new fuel consumption and GHG reducing technologies. Through an unprecedented 3 to 5% year over year improvement requirement, 2025 model year (MY) light duty vehicles are projected to consume 50% less fuel than 2008 MY vehicles. From 2011 MY, this will result in an estimated cumulative reduction of 266 mega-tonnes (Mt) of carbon dioxide equivalent (CO2) GHG emissions from the LDV fleet on a national basis. To put this into perspective the annual year over year improvement prior to this regulation averaged from 1.1% to 1.3% per year.

In addition, opportunities do exist to retire older vehicles and accelerate the adoption of advanced emissions control and GHG reducing technology vehicles which will significantly lower emissions and improve the environment.

Increasing vehicle electrification, including plug-in hybrid and battery electric vehicles, is an option that can provide reductions in GHG emissions reductions. Plug-in electric vehicle technology (PEV) continues to come with a significant cost premium and consumers must be able to make a value judgement based upon their needs to select the most cost effective vehicle choices.

Electric Vehicle Cost GHG/Tonne Reduced



Cost for GHG reduction is an order of magnitude higher than typical cost per tonne of $25 to $30 for other sectors

Beyond cost, electric vehicle technology also has significant technical challenges with range and vehicle size that needs further development before mass consumer acceptance and adoption of these technologies is possible; it will require a transition period which is a function of consumer demand for these products. Consumer financial incentives that support new technology are helpful while policies which increase new vehicle prices will slow new vehicle sales and GHG reductions.

In many jurisdictions, policies supporting plug-in electric vehicle consumer incentives and measures that make electric vehicle use more convenient and less costly have been found to be more helpful than regulation at increasing consumer adoption rates. Sales of plug-in electric vehicles across Canada have been steadily rising year-over-year and this growth is expected to continue based on the number of new plug-in vehicle models being brought to market; there are now 21 models available to consumers and growing.

Vehicle manufacturers have and will continue to work collaboratively with the government to support their objectives in the area of the Climate Action and vehicle GHG emissions reductions. A partnership approach between the government and industry is the best and most effective way to reduce GHGs, preserve consumer choice and demand, and achieve the government's goal of reducing vehicle fleet GHG emissions. This will result in increased consumer demand and reduced GHG emissions from the light duty fleet without risking the strength of the Canadian economy or constraining consumer choice.

We offer the following recommendations for industry and government collaborative action that would form this partnership approach:

I. Joint dealer and consumer education

II. Targeted support for the electrification of city fleets for example taxis, delivery fleets, car sharing, commercial and government fleets

III. Expanded HOV/ EV fast lane access and free charging & parking

IV. Enhance city and workplace EV charging infrastructure and fast charging installations along highways

V. Monitor consumer PEV adoption – use Ontario-level incentives to accelerate adoption

VI. Explore Green Tech Opportunity - R&D and testing for batteries, EV components, EV infrastructure (plug-in & hydrogen) and autonomous vehicles

VII. Retirement Program of higher GHG emitting 12 years and older vehicles

Improving vehicle energy efficiency and reducing vehicle GHG emissions is a common interest worldwide. Vehicle manufacturers have been and will be continuing to take significant actions over many years to improve vehicle efficiency and reduce vehicle emissions to meet nationally mandated GHG performance regulations. Vehicle manufacturers are also competing to introduce new and advanced vehicle technologies to market with energy efficiency, reduced fuel consumption and alternative fuels being important competitive factors driving technology development and innovation.

Our industry looks forward to engaging in further discussion of the approach and actions under the Pan-Canadian Climate Action Plan.

Appendix B

Following are the CVMA's detailed comments relative to the Pan-Canadian Climate Change Framework.

SUMMARY

Significant progress has been made in reducing the GHG and criteria emissions from the light and heavy duty on-road vehicle fleets and progress will continue with the actions that have been and will be taken over the coming years by the automobile industry. The Government of Canada has mandated and revised a number of extremely stringent regulations which are aligned with the U.S. (recognizing the highly integrated market) to address motor vehicle emissions on a national basis including:

- On-Road Vehicle and Engine Emission Regulations – Tier 2 – 2004-2016 model years
- Passenger Car and Light Duty Truck GHG Emission Regulations – 2011–2016 model years
- Heavy Duty Vehicle & Engine GHG Emission Regulations – 2014–2018 model years
- Passenger Car and Light Duty Truck GHG Emission Regulations – 2017–2025 model years
- On-Road Vehicle and Engine Emission Regulations – Tier 3 – 2017-2025 model years
- Heavy Duty Vehicle & Engine GHG Emission Regulations – 2019–2027 model years (in development)

While at the same time also meeting increasingly stringent vehicle safety regulations.

The industry is designing, developing, and deploying automotive emission reduction technologies to address these regulations while also meeting customer needs to the benefit of the environment and Canadians. All Canadian jurisdictions (federal government, provinces and territories), must continue to support the national implementation of advanced emission and GHG reducing technologies as the most cost effective approach to emission reductions for governments and consumers. Overlaying sub-national policies on these national regulations, which are aligned across North America, will sub-optimize the industry's ability to effectively deploy these technologies and will do so at an increased cost to consumers. Policies need to be complementary to support the national implementation of advanced technologies. Policies which inadvertently result in a delay of new vehicle sales and extend the life of existing vehicles will compromise environmental benefits and will add further challenges to the timely and cost-effective deployment of advanced emission reducing technologies across the fleet of new vehicles.

Vehicle manufacturers are regulated by the federal GHG regulations to deploy advanced technologies to ensure that their fleets will meet the specified fleet performance requirements. A policy leading to Zero Emission Vehicle (ZEV) standards which regulate that a specific ratio of the new vehicles sold be zero emissions at rates that exceed the natural consumer uptake of these vehicle technologies will unnecessarily force additional costs on consumers and restrict their ability to purchase the new vehicles that they need to transport people, goods or services. This kind of policy will be counter-productive to the public policy objectives to reduce GHGs by unduly restricting the sales of new lower emission technology vehicles and delaying the replacement of older higher emitting vehicles. The impacts on consumers, dealers, provincial revenues and the environment will be in the wrong direction and may be significant if this type of policy is implemented.

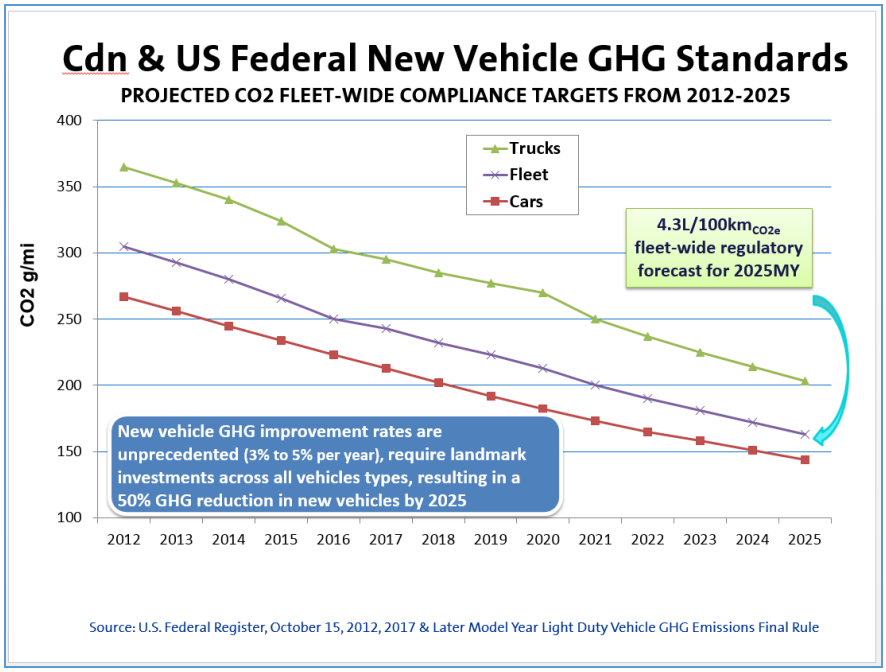
Throughout this submission you will see that the industry is continuing to address the issues of reducing criteria and GHG emission reductions on the most cost effective and national basis. Due to the size and age of the on-road fleet across the country, it will take significant time and effort to replace the older higher emitting vehicles in the fleet. Acceleration of the adoption rates of lower and

zero emission vehicles by placing arbitrary requirements on new vehicle sales percentages – in effect quotas – will have serious economic and environmental impacts. However, there are options to encourage the expansion of battery electric, plug-in electric, hydrogen, and alternative fuel vehicles which do not involve the noted risks inherent in the ZEV regulations enacted by some U.S. states. These options will require a coordinated holistic approach with extensive education and consultation to continue the advancements already made in this area.

Light Duty Vehicle (LDV) GHG Regulations and the Adoption of Advanced Technology Vehicles

As you are aware, the auto industry in Canada has been federally regulated to reduce vehicle greenhouse gas emissions year over year beginning the 2011 model year, across the entire range of new passenger cars and light duty trucks. This very stringent regulation has been adopted on a harmonized basis with the U.S., creating a single and efficient standard on a North American basis (including California) to the benefit of the environment and consumers. Canada and the US have now implemented the second phase of even more stringent vehicle GHG emissions standards for 2017-2025 model years.

Figure 1



The unprecedented stringency of the new 2017-2025 MY GHG standards will require manufacturers to spend an estimated $200 billion USD in advance vehicle technology development focused on vehicle GHG reductions. These regulations require manufacturers to adopt a multi-technology pathway for compliance in which electric vehicles, plug-in hybrid and battery electric, will become increasingly more prominent during this period of rapid technology deployment of new fuel consumption and GHG reducing technologies. Through an unprecedented 3 to 5% year over year improvement requirement, 2025 model year (MY) light duty vehicles are projected to consume 50% less fuel than 2008 MY vehicles. From 2011 MY, this will result in an estimated cumulative reduction of 266 mega-tonnes[1] (Mt) of carbon dioxide equivalent (CO_2) GHG emissions from the LDV fleet. To

[1] SOR/2014-207 RIAS – 174 Mt from 2017MY to 2025 MY and SOR/2010-201 RIAS – 92 Mt from 2011MY to 2016MY

put this into perspective the annual year over year improvement prior to this regulation averaged from 1.1% to 1.3% per year.

These technologies will also come at a cost. The U.S. Environmental Protection Agency (EPA) has estimated an average increase in vehicle cost (multiple technologies) for 2012 – 2016 Model Years [2]

TABLE I.C.2–6—EPA'S ESTIMATED INCREMENTAL INCREASE IN AVERAGE NEW VEHICLE COST

[2007 dollars per unit]

	2012	2013	2014	2015	2016
Cars	$342	$507	$631	$749	$869
Trucks	314	496	652	820	1,098
Combined	331	503	639	774	948

And incremental cost above 2016 models for 2017-2025 Model Years [3]

TABLE I–24—EPA'S ESTIMATED INCREMENTAL INCREASE IN AVERAGE NEW VEHICLE COST RELATIVE TO THE REFERENCE CASE [a b]

[2010 dollars per unit]

	2017 MY	2018 MY	2019 MY	2020 MY	2021 MY	2022 MY	2023 MY	2024 MY	2025 MY
Cars	$206	$374	$510	$634	$767	$1,079	$1,357	$1,622	$1,726
Trucks	57	196	304	415	763	1,186	1,562	1,914	2,059
Combined	154	311	438	557	766	1,115	1,425	1,718	1,836

[a] The reference case assumes the 2016MY standards continue indefinitely.
[b] Projected results from using 2008 based fleet projection analysis.

The costs for natural gas vehicles, plug-in hybrid electric vehicles, battery electric vehicles, and fuel cell vehicles will be significantly higher due to the nature of the high pressure containers for natural gas or hydrogen and the batteries required for plug-in electric vehicles.

In the Final Rule for 2017 and Later Model Year Light-Duty Vehicles the National Highway Traffic and Safety Administration (NHTSA) provides the following estimates of plug-in hybrid and electric vehicle estimated costs for a mid-size passenger car for 2012-2025 model year[4];

TABLE IV–73—NHTSA ESTIMATED NET (ACCUMULATED) TECHNOLOGY COSTS, MIDSIZE PC

Final technology (as compared to baseline vehicle prior to technology application)		MY Baseline	2012	2017	2021	2025
Plug-in Hybrid—30 mi range	PHEV1	2008	$17,415–	$13,060–	$9,727–	$7,772–
		2010	$17,915	$13,449	$10,019	$8,015
Electric Vehicle (Broad Market)—150 mile range.	EV4	2008	$14,970–	$10,526–	$7,682–	$5,640–
		2010	$15,145	$10,648	$7,771	$5,705

These technology cost estimates for a typical mid-size car can be converted to a cost per tonne of CO_2 reduced. Using the range of the NHTSA cost estimates from the 2012 model year and the typical fuel consumption and lifetime of a mid-size car, the total GHG emissions reduced are found to be slightly under 4 tonnes per year and approximately 60 tonnes for the average vehicle lifetime. Therefore, the range of cost to reduce these emissions using plug-in electric vehicles lies between

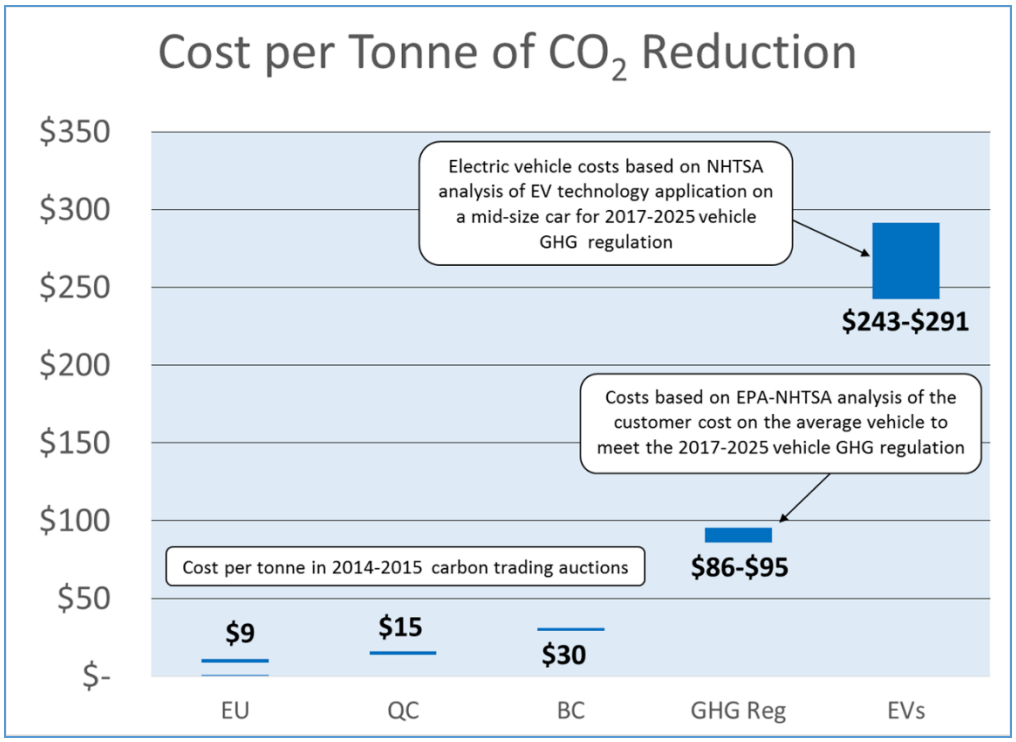
[2] **Reference: Federal Register** / Vol. 75, No. 88 / Friday, May 10, 2010, Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Final Rule (2012 – 2016 Model Years)

[3] **Reference: Federal Register** / Vol. 77, No. 199 / Monday, October 15, 2012 – 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Final Rule

[4] **Reference: Federal Register** / Vol. 77, No. 199 / Monday, October 15, 2012 – 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Final Rule

$243 and $291 dollars per tonne. This cost for GHG reduction is an order of magnitude above the typical cost per tonne of $25 to $30 for other sectors.

Figure 2

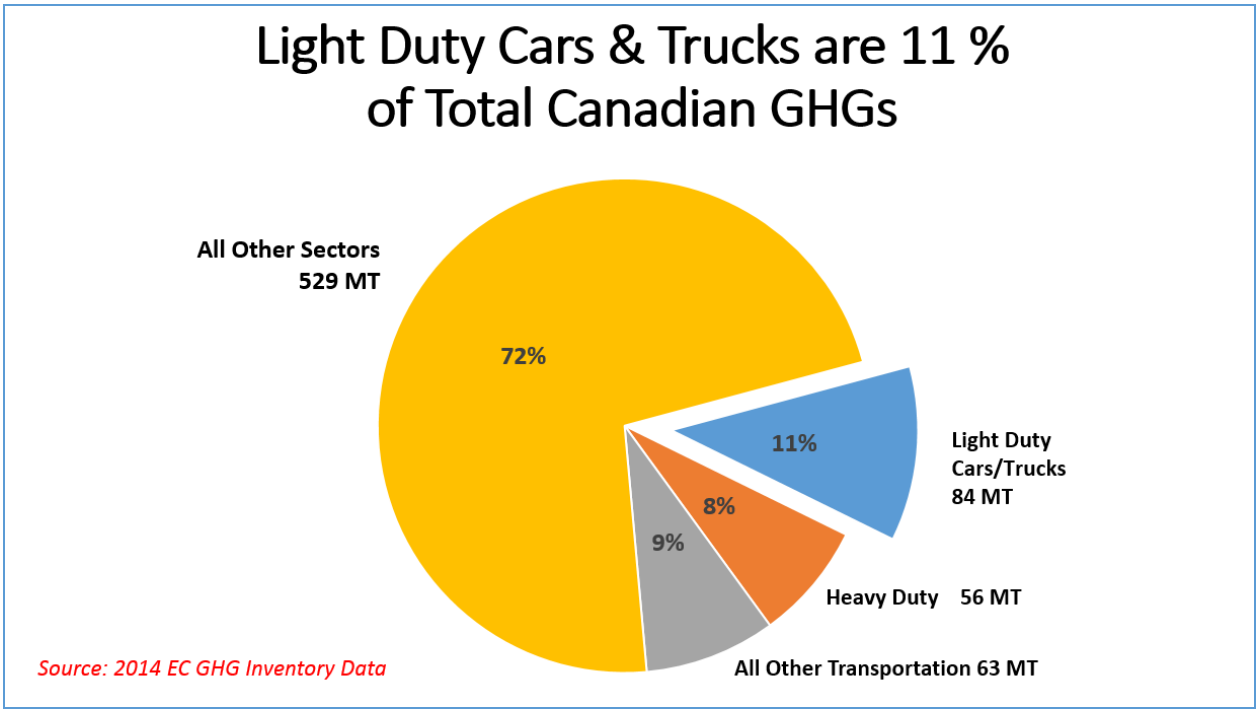


The introduction of a broad range of vehicle technologies meeting the more stringent GHG standards provides a more holistic approach to GHG emissions reductions and encourages greater innovation and additional approaches that, in combination, will help achieve the environmental objectives of the Canadian government.

Similarly, for the heavy duty vehicle fleet, the federal government has published regulations pertaining to the heavy duty vehicle and engine greenhouse gas emissions for the 2014 to 2018 model years. This regulation was effective February 2013 and through its implementation period, it is expected to reduce the average GHG emissions of 2018 heavy-duty vehicles by up to 23%[5]. In September 2014, the federal government also announced its intent to further tightening the heavy-duty vehicle and engine GHG emission requirements for the 2019 model year and beyond, following suit with recent U.S. regulatory developments.

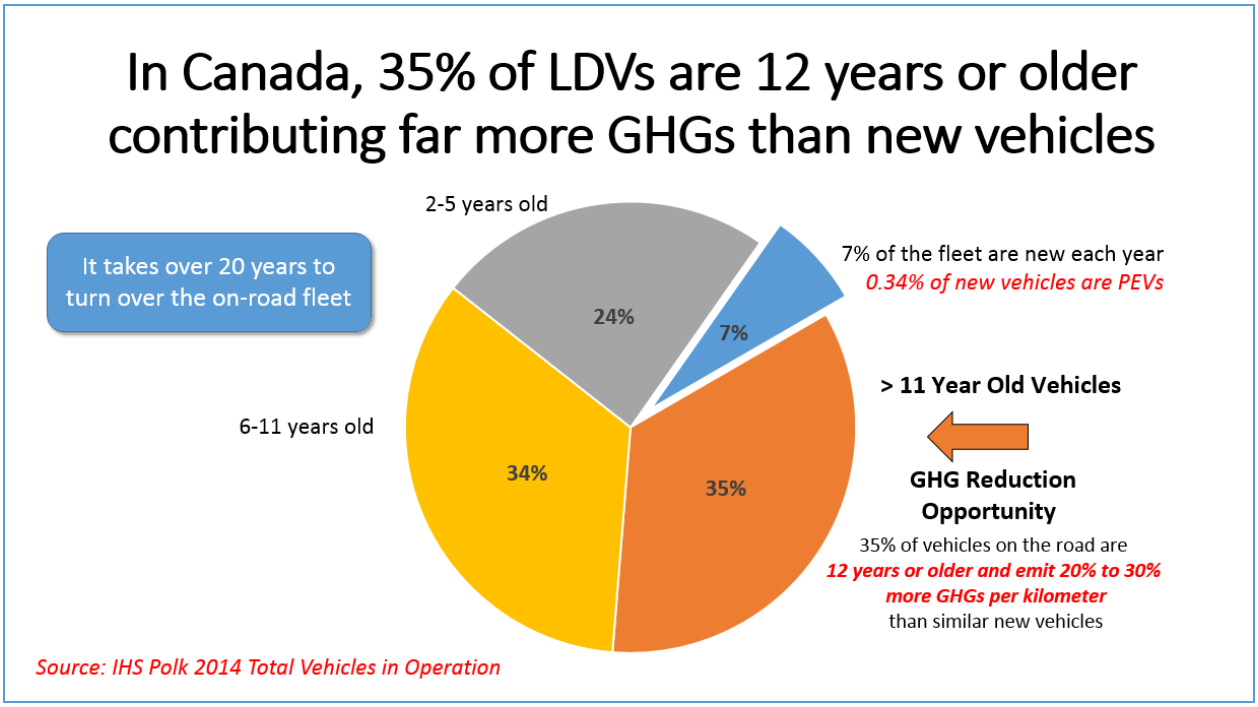
[5] Reference: Environment Canada Heavy Duty Vehicle and Engine GHG Regulations, February 2013

Figure 3



The GHGs for the on-road fleet of light duty vehicle is a relatively small portion of the total inventory in Canada at 11% and this percentage is forecast to steadily drop as new vehicles replace the older vehicles in operation.

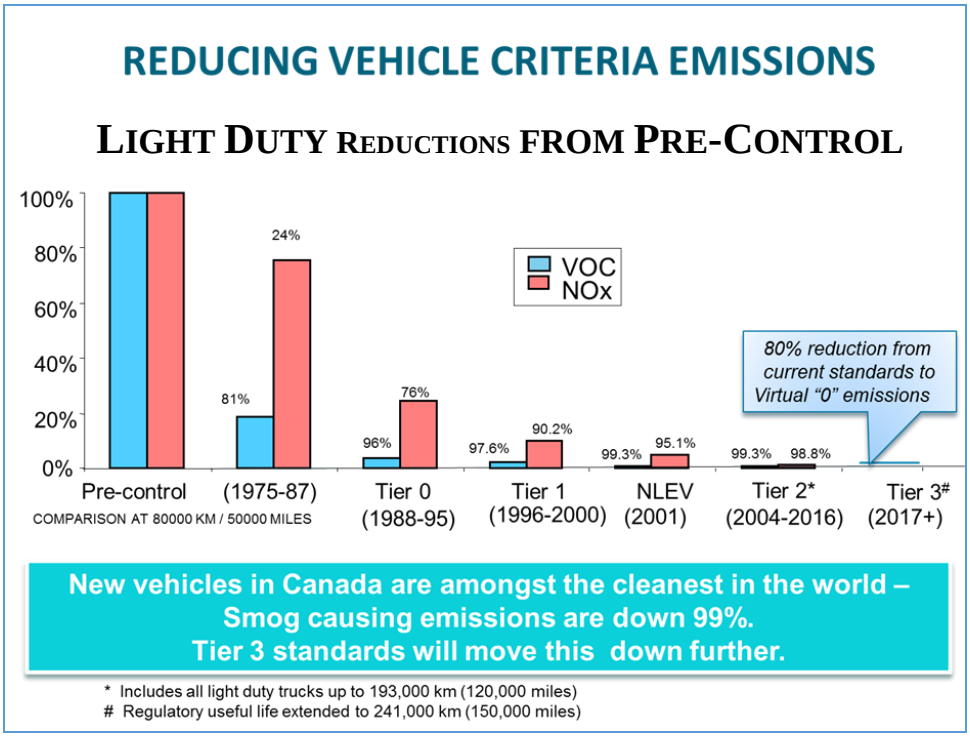
Figure 4



Smog Causing Emissions and Clean Air

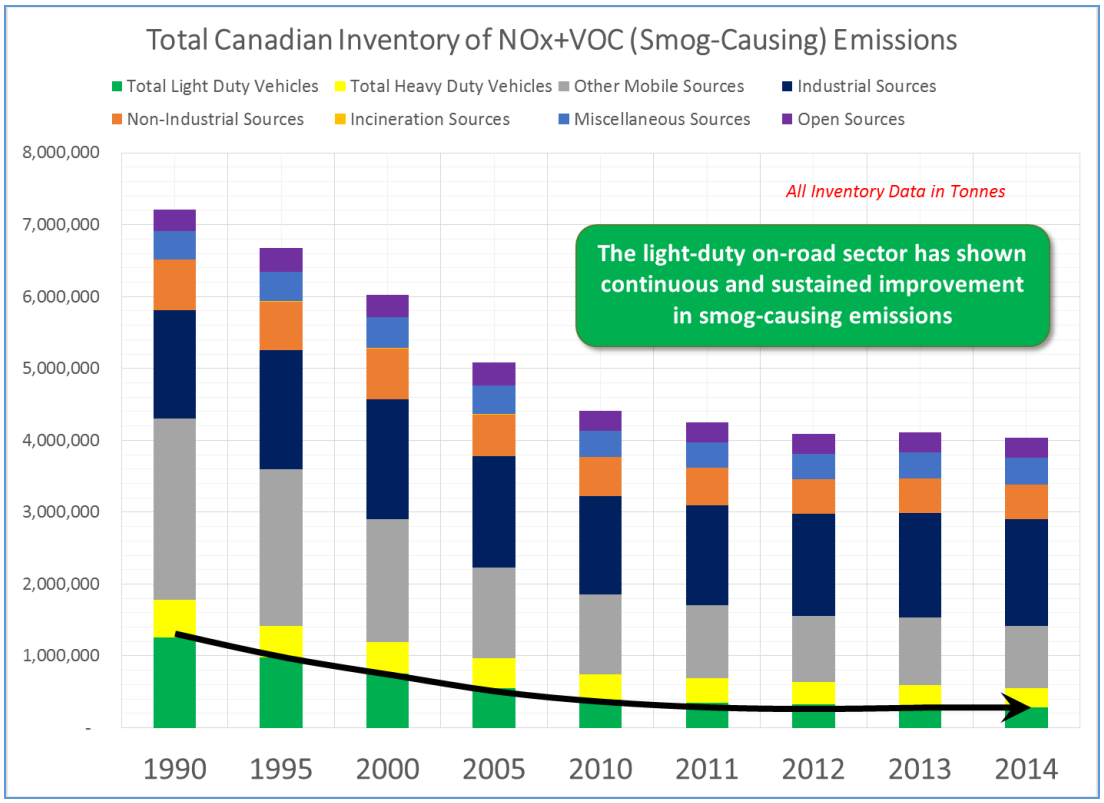
Since the mid-1980's vehicle manufacturers have met increasingly more stringent smog related emission requirements each year. In 2004, Canada adopted the most stringent national smog related emissions standards in the world on a harmonized basis with the United States (Tier 2), thereby reducing emissions by 99% from pre-controlled times. Commencing in 2017, even more stringent smog related standards, Tier 3, will be introduced reducing these small remaining emissions by yet another 80%. These standards are fuel neutral, which means each vehicle must comply with the same smog related standards regardless of the fuel used or vehicle size. As a result of these previous accomplishments and planned additional actions, the light duty vehicle sector has been the only sector to reduce smog causing emissions year over year. These virtually zero smog-related emission vehicles will be supported in the market place with further reductions to sulphur in gasoline, or ultra-low sulphur gasoline (10 ppm sulphur), both of which contribute significantly to achieving these dramatic vehicle emission reductions. Ultra-low sulphur in gasoline and other fuel parameter improvements, like higher gasoline octane, will also support and enable further GHG reducing performance from new internal combustion engine technologies.

Figure 5



The impact on the total Canadian inventory of criteria air contaminant (CAC) emissions has been dramatic. Since 1985 the on-road light duty vehicle sector has demonstrated a sustained and continuous reduction in smog-causing emissions as older vehicles are retired from the fleet. As of the latest available data (2014 calendar year) the auto sector is now under 7% or the total inventory of all man-made sources of smog-causing emissions.

Figure 6

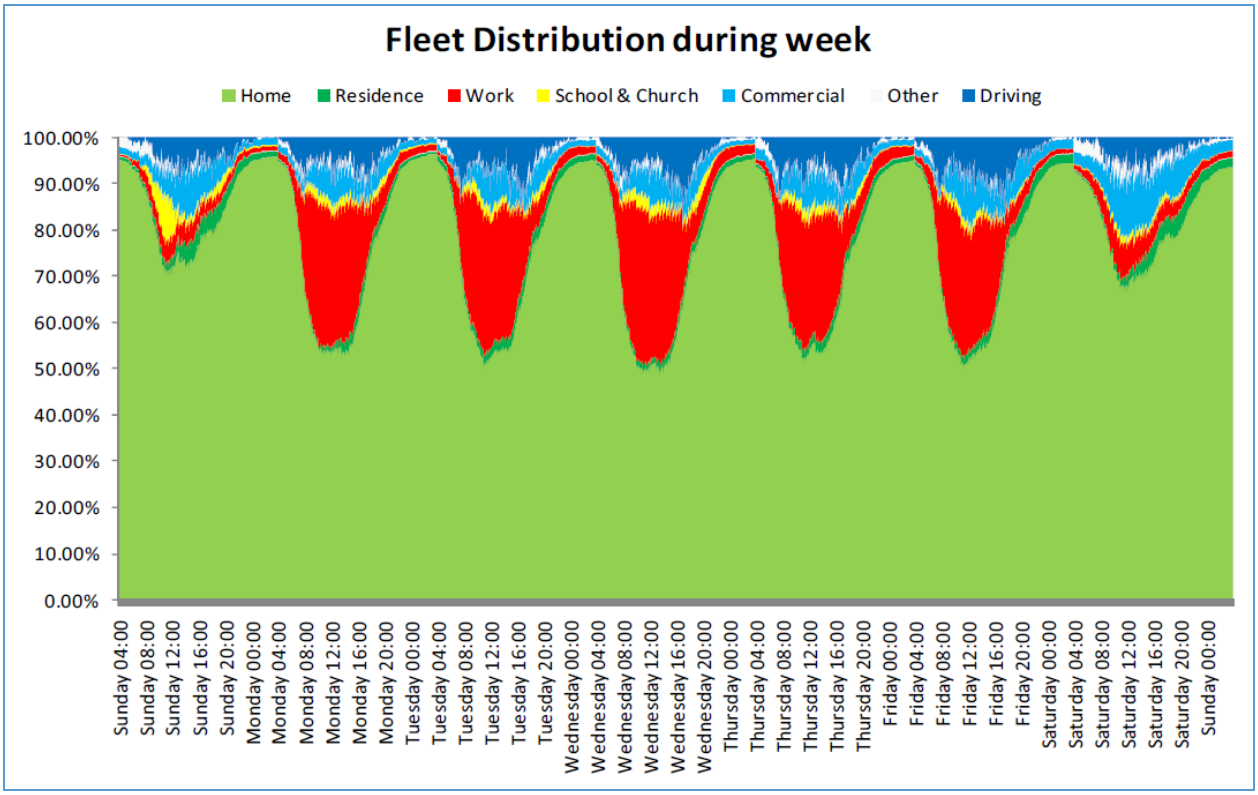


Plug-In Electric Vehicles (PEVs)

In Canada, Québec, British Columbia and Ontario lead in the adoption of plug-in electric vehicles, plug-in electric hybrid vehicles (PHEVs) and battery electric vehicles (BEVs), as a result of a comprehensive set of policies aimed at increasing demand via consumer incentives and supporting consumer adoption though programs that expand the home, work, and public charging infrastructure. The new federal vehicle GHG regulations promote bringing these vehicles to market, however, it is essential that the necessary market supports are in place to encourage and support the increasing consumer adoption of these technologies. Fast charge stations (both level 2 and level 3) networks in and between major cities are needed to make it practical for consumers to consider all plug-in vehicles and maximize electric energy travel.

Figure 7 shows the location of a fleet of electrified vehicles when tracked over a seven day period. It highlights that home is the location where the vehicle stays for the majority of time followed by work and then other locations such as schools, churches and commercial locales. This figure indicates that the best place to invest in charging infrastructure is first at home followed by the workplace and then commercial or public charging. Some jurisdictions are modifying or considering modifying building codes to require home and workplace charging infrastructure to support the expansion of vehicle electrification. Consumers need to have confidence that they will have ready access to before many of them will even consider the purchase or use of electrified vehicles.

Figure 7 [6]

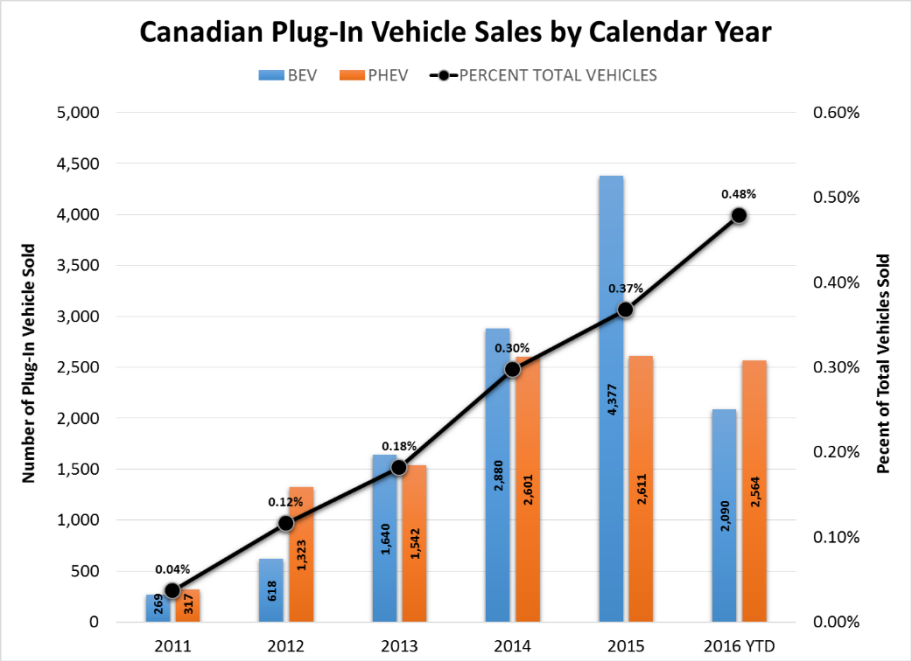


We recommend an expansion of consumer incentives, along with continued enhancement of the charging infrastructure supports (home, work and public), and consider additional indirect consumer motivation supports such as high occupancy vehicle lane access, preferential parking and reduced or eliminated road tolls for plug-in electric vehicles which will further increase consumer demand for and purchase of plug-in vehicles.

While plug-in electric vehicles have the potential to significantly reduce vehicle GHG emissions, there continues to be technological challenges that need to be overcome. The utility and functionality of a battery electric vehicle is currently limited in cold climates and winter driving conditions. In some areas of the country the climate is suitable for most plug-in vehicles. The same cannot be said for the prairies and the north where the distances between major centres as well as the climate provide significant limitations to the use of plug-in vehicles, in particular battery electric vehicles.

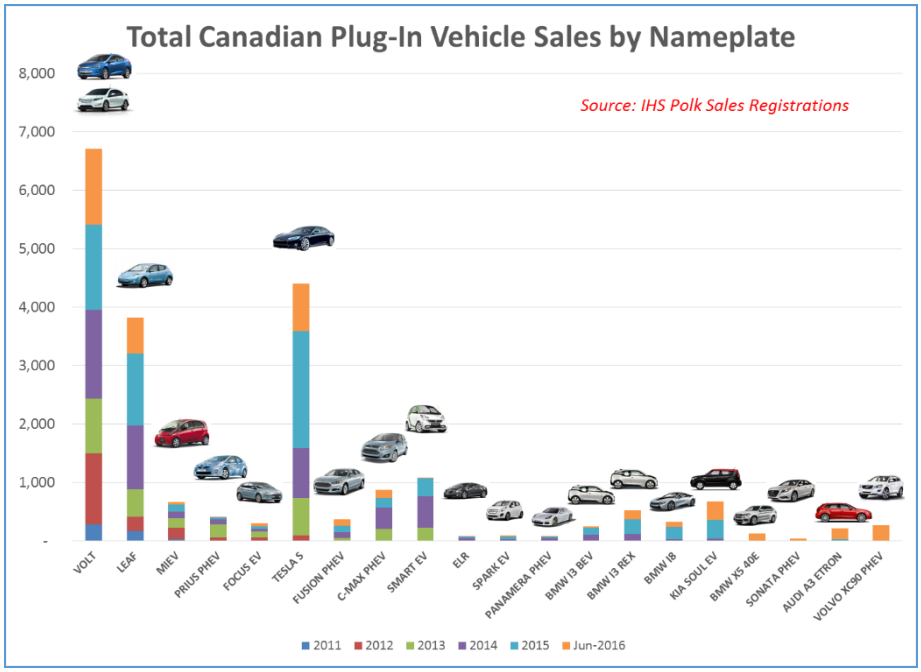
[6] SAE Paper 2009-01-1311 The CO_2 Benefits of Electrification E-REVs, PHEV and Charging Scenarios, Figure 5,

Figure 7



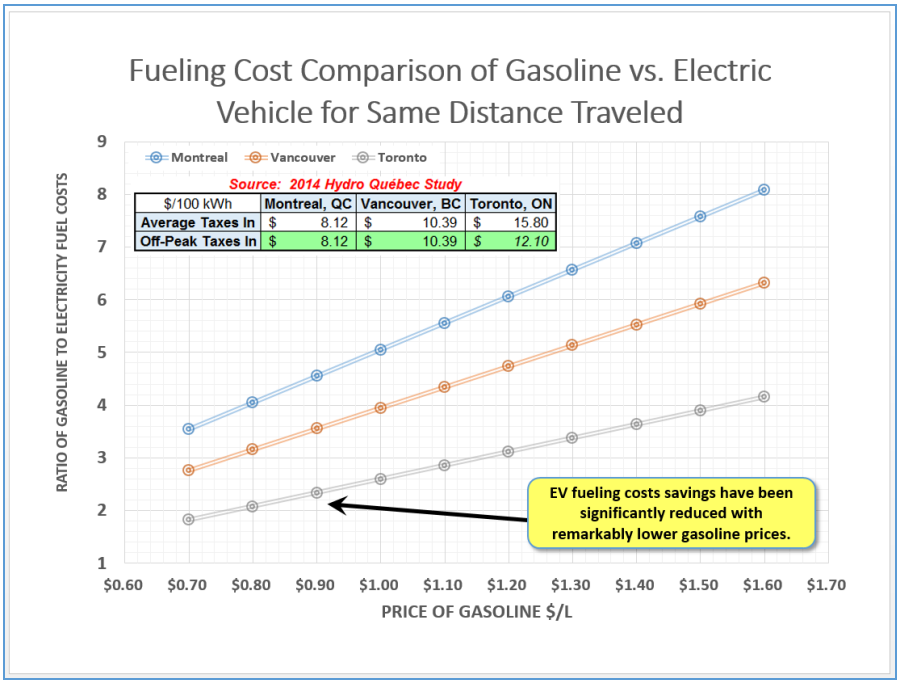
The industry has continued to expand the availability of plug-in electric vehicles in the Canadian market and the result has been a substantial increase in the number plug-in electric vehicles sold since 2011.

Figure 8



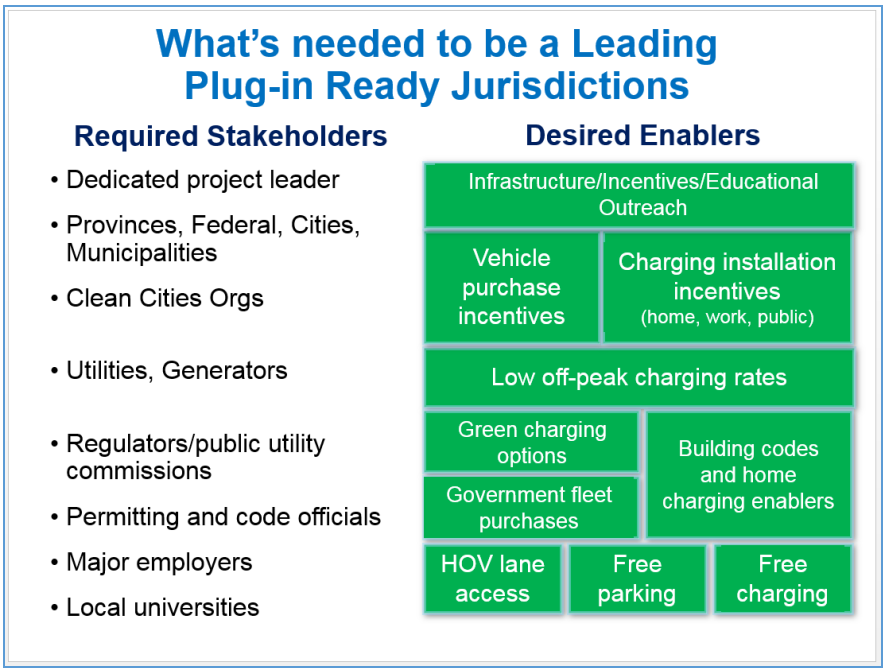
The cost and convenience of fueling conventional vehicles has a bearing when customers are considering the possibility of using a battery electric vehicle with a similar size and utility. In the figure below the cost of refuelling/recharging is compared for five battery electric vehicle models which are also available with conventional gasoline powertrains.

Figure 9



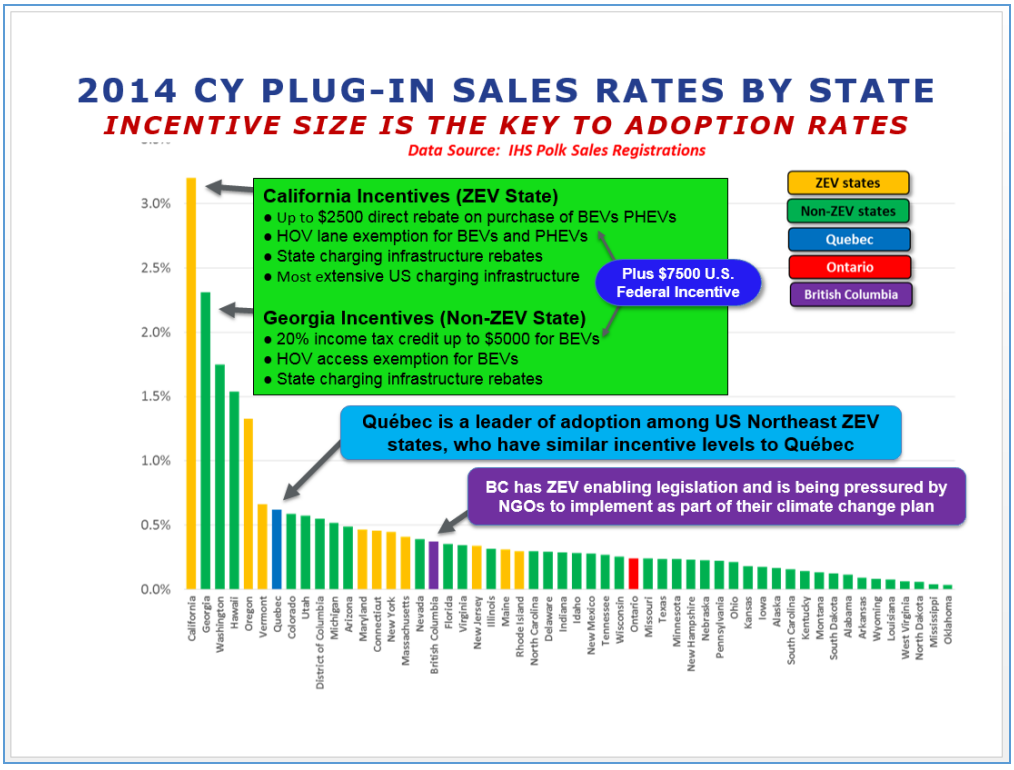
We recommend a continuance and expansion of policies of consumer incentives, along with continued enhancement of the charging infrastructure supports (home, work and public), and consider additional indirect consumer motivation supports such as high occupancy vehicle lane access, preferential parking and reduced or eliminated road tolls for plug-in vehicles which will further increase consumer demand for and purchase of plug-in vehicles. The matrix below provides a number of proven effective enablers to increase the consumer demand for plug-in electric vehicles.

Figure 10



The history of plug-in electric vehicle sales across North American demonstrates that incentive size is the key to higher adoption rates. The following graphic shows that jurisdictions with higher incentives reap the benefits of higher plug-in electric vehicle penetration.

Figure 11



While some U.S. states have introduced costly, complex, and burdensome regulations involving credit mechanisms leading to sales mandates, that ultimately negatively affect dealers, there are other states and countries that have been more successful in introducing plug-in electric vehicles by doing many of the things the provinces are already doing, without a mandate. For instance, Norway's approach has been to focus on creating customer demand by implementing significant consumer incentives (both monetary and non-monetary) to encourage plug-in vehicle sales and is now a world a leader in plug-in vehicle sales without a zero emissions vehicle mandate.

Norway's Approach

Financial Incentives	**Non-Financial Incentives**
• New vehicles: - Low/no vehicle sales/VAT taxes on plug-in vehicles • Fuel Prices/Taxes - Low or no cost charging stations as compared to high price gas and diesel fuels • Annual Registration Fees - Significantly reduced fees on plug-in vehicles • WWF (World Wild Life Fund) study indicates that plug-in consumer incentives effectively total $3000 USD to $8000 USD per year	• No road tolls, congestion charges or ferry tolls for plug-in vehicles • Free parking for plug-in vehicles • Access to HOV and bus lanes for plug-in vehicles • Extensive installation of charging stations (2012 data) - 3700 regular charging stations - 58 fast charge stations in 53 locations

From the chart below you can see that Norway leads in percentage of plug-in vehicles sold. This has been done without a regulation requiring a specific penetration of plug-in vehicles. The Norway experience reinforces the data from North American jurisdictions that shows that ZEV emission vehicle regulations are not effective in increasing the sales of plug-in vehicles on their own.

Figure 12[7]

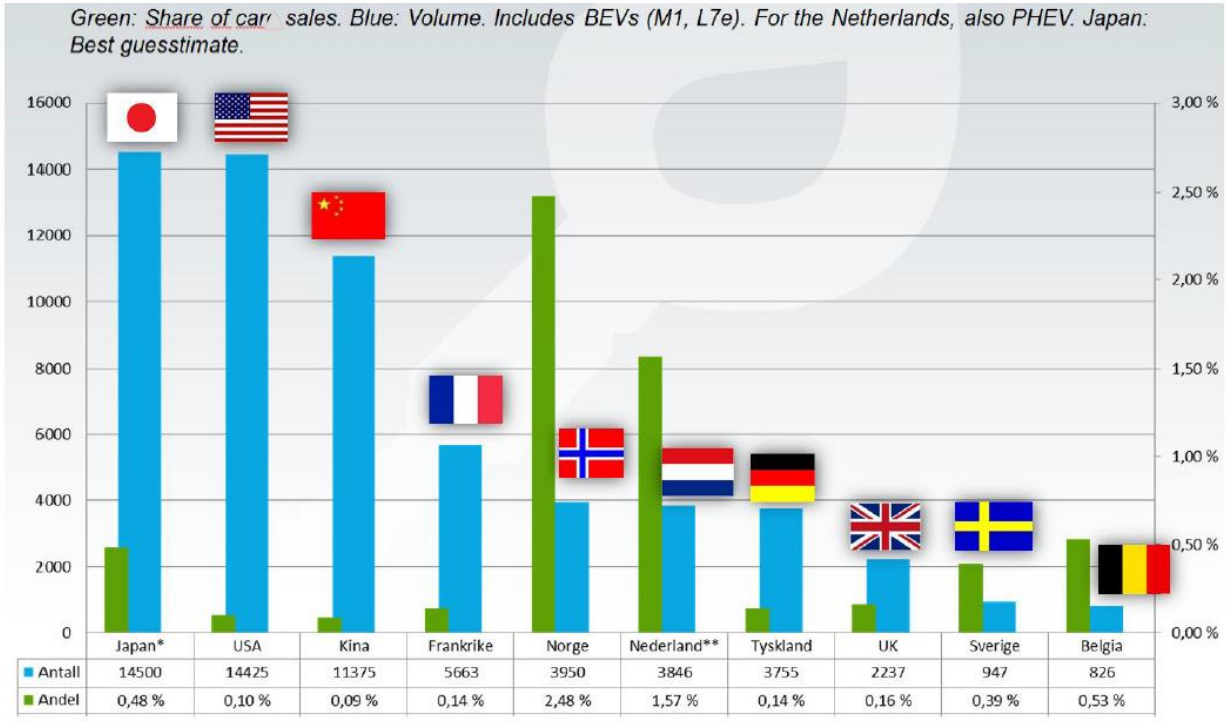


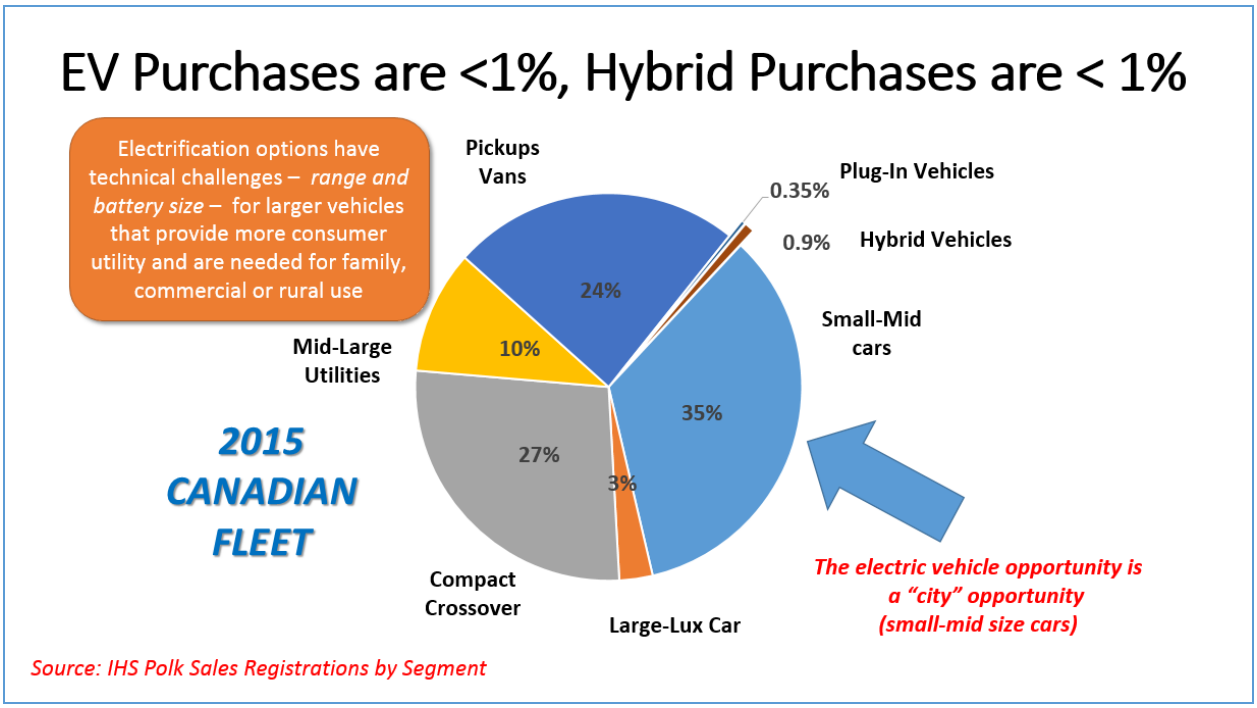
Figure 2: Global EV sales 2012, top 10 countries

Legend: Green bars = percent of total car sales, blue bars = total number of plug in vehicles sold

Part of the challenge for plug-in electric vehicle deployment, particularly battery electric vehicles, is the limitations in battery size to provide a reasonable operating range for customers. Currently this means that primarily only those vehicles of smaller car classes are most feasible for battery electric vehicle configurations. The distribution of vehicle sales in Canada indicates that over two thirds of the vehicles are in classes where there have been no sales of plug-in electric vehicles. Future products are being developed and deployed in other segments. Requiring a sales ratio based upon the total light duty vehicle sales in the province effectively raises the ratio of plug-in electric vehicles in the segments where they are available. So effectively, for example, a 4.5% fleet plug-in percentage becomes a daunting12% to 15% requirement for the small and compact car segment to meet the fleet requirement where currently less than 1% of PEVs are sold annually.

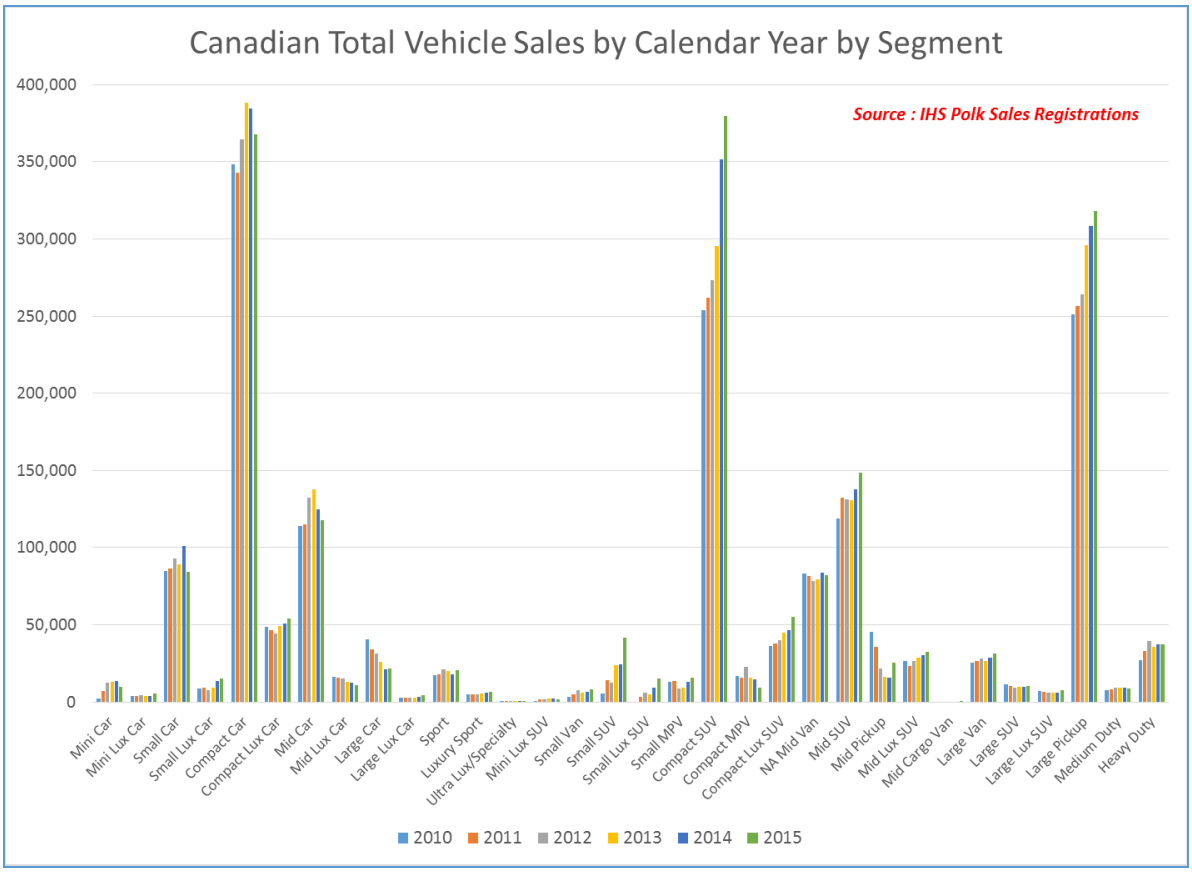
[7] The EV revolution in Norway – Lessons Learned – EVS27 presented in Barcelona, Spain, Nov 2013

Figure 13



Canadian new vehicle sales are divided into three dominant segments: compact cars, compact sport utility vehicles (SUVs) and large pickups. There is growth in the compact SUV segment which some believe will result in higher GHG emissions. This is not the case. Under the federal GHG regulations compact SUVs classified as passenger cars must improve their year over year GHG emission levels and have to meet the same extremely stringent GHG standards as similar sized compact cars. The federal GHG regulations all light vehicle classes of passenger cars and light-duty trucks must improve their GHG emission levels by 3.5% to 5% each year and heavy vehicles must improve 1.5% to 2.5% each year.

Figure 14

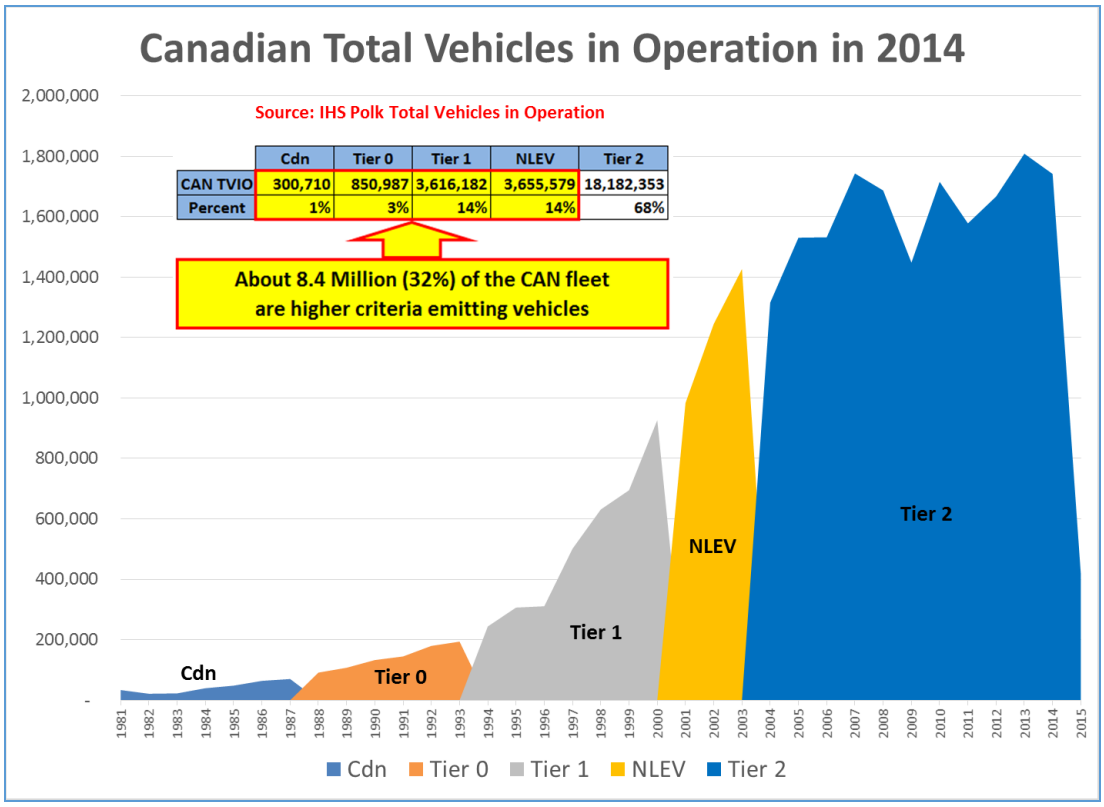


Electrification of vehicles comes with technological challenges which limit the current implementation of battery electric vehicle models to smaller vehicles that provide less overall utility. While some SUV models are now being offered with plug-in capability and introduction of plug-in electric technology in other segments is growing, there are currently no pickup trucks which offer this technology. Battery electric vehicles are almost exclusively limited to compact to mid-size cars where the battery size for acceptable range capability is possible. Consumers need to be able to make a value judgement on whether plug-in vehicles meet their needs both from a utility and financial point of view. Appropriate incentives and charging infrastructure are the keys to making this value calculation more appealing to drive consumer demand.

Further Emission Reduction Opportunities

New vehicles are reducing fleet GHG and smog-causing emission inventories; however, new vehicles represent less than 10% of the total number of vehicles in the on-road fleet in Canada. Older vehicles have significantly higher smog-causing emissions as well as higher GHG emissions. Approximately 32% of the Canadian fleet is greater than 10 years old and do not meet the existing Tier 2 smog related emissions standard. Therefore, the greatest opportunity for immediate reductions in smog-causing emissions would be government policies and programs which accelerate the replacement of these older higher emitting vehicles.

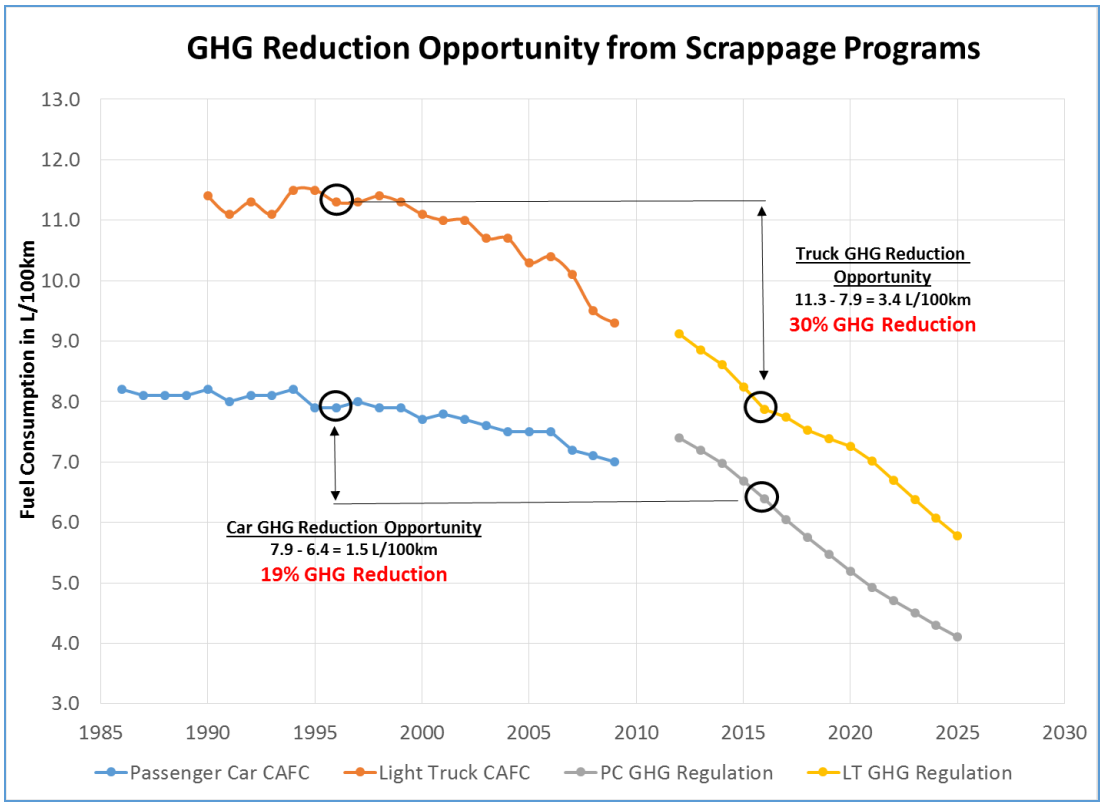
Figure 15



An incentive program to retire older vehicles will also significantly contribute to reductions in GHG emissions from the on-road fleet. Similar results could also be seen in the vehicle GHG emission reductions and energy efficiency improvements from the heavy-duty vehicles. Canada could realize these significant environmental benefits from the existing on-road vehicle fleet in the near term while the existing federal regulations address further criteria emission and GHG regulations from new vehicles out to 2025.

The following chart demonstrates that replacing a 20 year old vehicle with a new vehicle will result in a significant GHG reduction due to the fuel consumption improvements that are designed into new vehicles. Trucks have improved by 30% in the 20 year period and cars have improved by 19%. Due to the steep slope of the average car and truck fuel consumptions improvements driven by the 2012 to 2025 light duty vehicle GHG regulations that improvement will increase in the coming years.

Figure 16



Currently the 0.45% penetration of plug-in vehicles in first part of 2016 calendar year in Canada corresponds to a sales ratio of one to 220. Implementation of ZEV emission vehicle targets based upon California ZEV regulations requiring 4.5% of vehicles to be plug-in models in 2018 model year and ramping up to 22% by 2025 model year means that the ratio will have to reduce from one in 140 in 2015 to one in 22 in 2018 and one in 4 in 2025.

Figure 17

ZEV Standard % Quotas – Result in Restricted Non-ZEV Sales

- The New California 2018 to 2025 ZEV Standard effectively sets annual required percentages (or ratios) of Plug-in vehicle to Non Plug-in vehicle that each manufacturer must sell to their dealer network. These annual required percentages (or ratios) are as follows:

	2018	2019	2020	2021	2022	2023	2024	2025
Mandated Plug-In Sales	4.5%	7.0%	9.5%	12.0%	14.5%	17.0%	19.5%	22.0%

- This effectively means that for every Plug-in vehicle a manufacturer sells to their dealer network, they are only be able to sell them the following number of Non Plug-in vehicles

	2018	2019	2020	2021	2022	2023	2024	2025
Non Plug-In Sales	22	14	11	8	7	6	5	4

Based on early 2016 Canadian PEV sales rate of 0.45% the current market non plug-in vehicle sales to plug-in sales ratio is about 220 to 1. Orders of magnitude different than the 11 to 1 ratio that would be required in 2020 under a new California ZEV standard.

Requiring an unrealistic ratio of plug-in to conventional vehicles will drive a reduction of conventional vehicle sales and retention of older vehicles. Adoption of a ZEV type standard that drives California level plug-in electric vehicle penetration ratios and if consumers are unwilling to purchase plug-in electric vehicles at the required ratio will require restrictions to conventional vehicle sales to maintain the required ratio on plug-in electric vehicles to conventional vehicles. The impact will result in sustainability issues for dealers and manufacturers as the overall sales volumes decline.

This will result in consumers holding on to their current vehicles longer. There are multiple impacts from delayed new vehicle purchases. The first and most obvious is the loss of revenue from new vehicle sales which will negatively impact the tax revenue from the sales of those vehicles.

Delayed vehicle retirement will also create a spiral of higher CAC and GHG emissions which is counter-productive to the stated GHG goals of the Canadian Government as new GHG reducing technology continues to enter the market across the new vehicle fleet. Newer vehicles are 20% to 30% more GHG efficient per kilometer driven (see figure17) so replacing older vehicles will result in a forecast reduction of GHG emissions. If older higher emitting vehicles are retained and used in place of newer more efficient vehicles then there is a demonstrable degradation of both criteria and GHG emissions. This annual increase can be added for every year that new vehicle purchases are delayed.

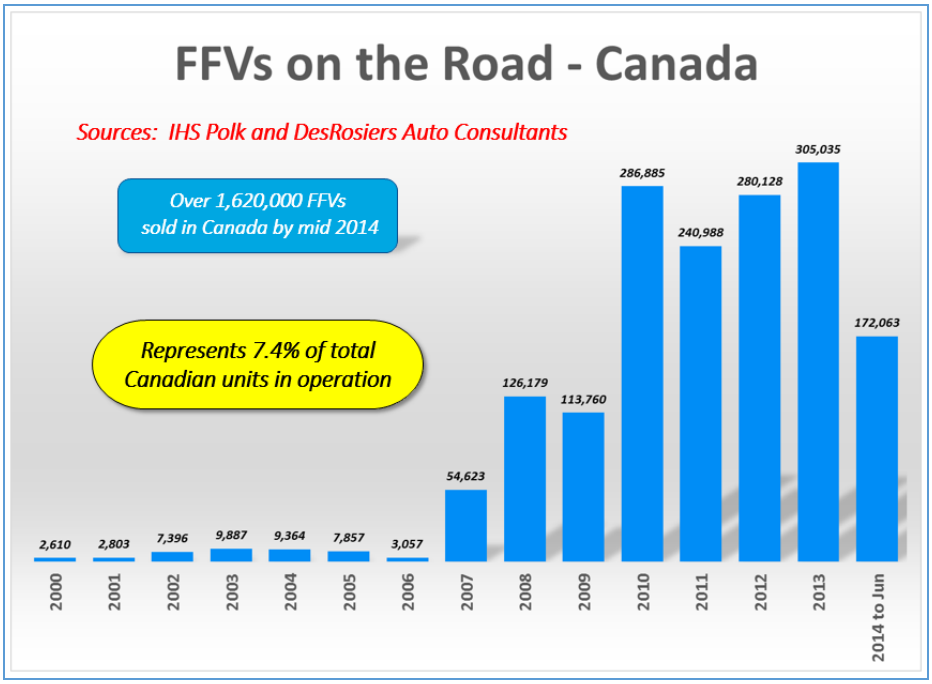
Low Carbon Fuel Standards

ETHANOL – Conventional gasoline vehicles from approximately 1990 model year to date were certified for operation with fuels up to 10% ethanol (E10). In recent years, manufacturers have been validating many conventional gasoline vehicles on fuels up to E15. Flexible fuel vehicles (FFVs) are vehicles that are designed to be run on fuels with gasoline with no ethanol content (E0) right up to

fuel containing up to 85% (E85). The following chart shows the number of registered vehicles which are E85 capable. Approximately 1.62 million vehicles in operation in Canada (approximately 7.4%) are FFVs which can operate on higher level blends of ethanol. The legacy fleet, typically cannot operate on fuels higher that E10 without damage or emission concerns, however, a number of recent model year vehicles can operate on blends up to E15. Forcing the ethanol content in Canadian gasoline above a maximum of 10% to 20% as proposed in some recommendations will put legacy vehicles at risk of durability and operability issues that they were never designed for. A number of global studies[8] demonstrate that emission system failures and engine durability issues are likely when the large number of legacy (non-FFV) models are exposed to higher ethanol content gasoline.

Higher level ethanol blends greater than 10% may also have significant risks for other non-road gasoline powered equipment. Equipment that use centrifugal clutches such as trimmers and chain saws have demonstrated safety concerns when operated on high oxygenate blend fuels. The Canadian Government should ensure that handheld equipment manufacturers[9] are consulted before a decision is made to move forward with higher ethanol blends for hand-held equipment.

Figure 18



BIODIESEL – Legacy diesel vehicles have been demonstrated to be or were designed to accept biodiesel fuels only up to levels of 5% (B5). Some newer diesels are validated to operate on fuels up to B20 under specific storage and fuelling conditions, but cold weather operability as characterized by the cloud point of middle distillate (diesel) fuels limits the amount of bio-content based upon the composition of the fatty acid methyl ester (FAME) in the fuel. High cloud point fuels cause waxing and filter plugging at low ambient temperatures resulting in the inability for diesels to

[8] Coordinating Research Council (CRC) Mid-Level Ethanol Blend Studies
http://www.crcao.com/news/Mid%20Level%20Ethanol%20program/index.html
[9] Outdoor Power Equipment Institute

start and run in cold temperatures. Higher levels of FAME raise the cold point which results in fuel producers having to add more kerosene (a limited volume lighter middle distillate fuel typically used as jet fuel) to the blend. Technical, supply and economic limits exist to the amount of kerosene that can be added to the middle distillate fuels to offset the increase in cloud point temperature. The Alberta Renewable Diesel Demonstration (ARDD). 2009, showed that operation on B2 was acceptable in cold weather which resulted in Environment Canada limiting their required biodiesel concentrations to an average of 2%. Even renewable diesel which is incorporated further upstream in the refining and blending process has technical limitations that must be considered when increasing its volume from current practice. An increase in the biodiesel content above 5% to 20% is expected to create significant technical problems developing for vehicles not designed and validated to accept these fuels and may cause cold weather operability issues. The experience in the winter of 2011-2012 in Europe showed that the use of B7 in cold ambient temperatures resulted in many diesels failing to start and run in those conditions.