Greenhouse gas emissions performance for 2014 to 2018 heavy-duty vehicles

In relation to the *Heavy-Duty Vehicle and Engine Greenhouse Gas Emission Regulations* under the *Canadian Environmental Protection Act*, 1999

Environment and Climate Change Canada

Environnement et Changement climatique Canada

Canada

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BHP-hr – Brake Horse Power hour

CO_2 – Carbon dioxide

CO_2e – Carbon dioxide equivalent

CEPA – Canadian Environmental Protection Act, 1999

CH_4 - Methane

CI – Compression Ignition

EPA –Environmental Protection Agency

GHG – Greenhouse Gas

g/mile – grams per-mile

GVWR – Gross Vehicle Weight Rating

GCWR – Gross Combined Weight Rating

HHDE – Heavy Heavy-Duty Engine

HDE – Heavy-Duty Engine

HDV – Heavy-Duty Vehicle

LHDE – Light Heavy-Duty Engine

MHDE – Medium Heavy-Duty Engine

N_2O – Nitrous Oxide

SI – Spark Ignition

WF – Work Factor

Executive summary

The *Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulation*[1] (Regulations) under the *Canadian Environmental Protection Act, 1999*[2] establish greenhouse gas emission standards for new 2014 and later model years of heavy-duty on-road vehicles offered for sale in Canada. These Regulations require importers and manufacturers of new vehicles to meet emission standards for greenhouse gases and establish annual compliance reporting requirements.

This report summarizes the fleet average greenhouse gas emission performance of the 2014 – 2018 model year heavy-duty vehicles and engines. This is based on the compliance data submitted to Environment and Climate Change Canada through end-of-model-year reports pursuant to the Regulations. Each manufacturer's fleet is unique, therefore, the data presented in this report provides aggregated values for three separate categories for each model year: class 2B and 3 (non-vocational), tractors and vocational vehicles, and heavy-duty engines. The data depicts the fleet average CO_2 value, the fleet average standard as well as the fleet total credit summary.

Overall, based on the reported data, the Canadian heavy-duty vehicle fleet outperforms the applicable standard for almost all model years. The fleet performance for class 2B and 3 (non-vocational) heavy-duty vehicles shows a fleet average CO_2 emissions decrease of 2.3% from 2014 to 2018. Due to increasingly more stringent standards, the 2018 model year marked the first year in which the compliance values for class 2B and 3 heavy-duty, non-vocational vehicles exceeded the applicable standard by less than 1%. However, the regulations allow companies to remain in compliance with the regulations through use of their own accumulated credits or by purchasing credits from other companies. For vocational vehicles and tractors, the overall compliance values consistently outperformed the standards for all classes of vehicles for all five model years. Emissions decreased 3.7% for class 2B to 5 vocational vehicles, 4.7% for class 6 & 7 vehicles and 12.4% for class 8 vehicles. For heavy-duty engines, all three compression-ignition averaging sets consistently outperformed the standard for all five years. Engine emissions decreased 2.1% for light heavy-duty compression-ignition engines, 4.3% for medium heavy-duty compression-ignition engines, and 2.4% heavy heavy-duty compression-ignition engines for the model years of 2014 to 2018. Companies have generated approximately 7.95 million Mega-grams of CO_2 emissions credits over the 2014 -2018 model years, of which 5.92 million remain available for future use through the 2019 model year.

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[1] https://pollution-waste.canada.ca/environmental-protection-registry/regulations/view?Id=119
[2] https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/publications/canadian-environmental-protection-act-1999.html

1. Purpose of this report

This is the first report summarizing the overall average greenhouse gas emission performance for the new Canadian fleets of on-road heavy-duty vehicles and engines. This report is based on the compliance data within the 2014 through 2018 end of model year reports submitted to Environment and Climate Change Canada pursuant to the *Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations*.

2. Overview of the Regulations

In March 2013, the Government of Canada published *the Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations* (Regulations) under the *Canadian Environmental Protection Act, 1999* (CEPA). The objective of the Regulations is to reduce greenhouse gas (GHG) emissions by establishing performance-based emission standards for new heavy-duty vehicles and engines and test procedures aligned with the Code of Federal Regulations (CFS) of the United States. The Regulations establish progressively more stringent GHG emission standards that apply to Canadian companies which manufacture or import new on-road heavy-duty vehicles and engines for sale in Canada beginning with the 2014 model year. The Regulations apply to the entire spectrum of on-road heavy-duty vehicles, ranging from full-size pick-up trucks and vans to transport tractors manufactured primarily for hauling trailers, including a wide variety of specialized (vocational) vehicles, such as school, transit and intercity buses, as well as freight, delivery, service, cement, refuse and dump trucks. Under these Regulations, companies must submit an end of model year report for all heavy-duty vehicle and heavy-duty engines that are imported or manufactured in Canada, by June 30th of the calendar year following the calendar year corresponding to the model year in question to demonstrate compliance to the Regulations.

The Regulations establish emission standards for three distinct categories of vehicles and engines. Such is elaborated in the subsections below. These include:

1. class 2B and 3 (non-vocational) heavy-duty vehicles

2. tractors (class 7 and 8) and vocational vehicles (includes class 2B and 3 as well as classes 4 through 6)

3. heavy-duty engines that power vocational vehicles and tractors:

    a)   compression ignition heavy-heavy duty engines
    b)   compression ignition medium-heavy duty engines
    c)   compression ignition light-heavy duty engines
    d)   spark ignition heavy-duty engines

These Regulations also include an emissions credit mechanism whereby companies may earn credits or offset emission deficits based on whether their vehicles or engines are below or above the applicable standard. More details regarding the credit averaging system can be found in section 5 of this report[3].

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[3] Section 2 and 5 of this report contain an overview of the regulatory standards and credit provisions. Readers may wish to consult the Regulations and supporting guidance document for a complete description of the Regulatory standards and credit provisions.

2.1 Class 2B and 3 (non-vocational) Heavy-duty Vehicles

Class 2B and 3 (non-vocational) vehicles include heavy-duty pickup trucks and vans, with a GVWR of more than 8,500 to 14,000 lbs. (3,856 to 6,350 kg). This includes most pickup trucks and vans that are not subject to the *Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations[4]*.

The regulatory CO_2 emission standard represents the volume weighted average CO_2 fleet target value for a particular model year. A CO_2 target value is determined on the basis of each individual vehicle sub-configuration which in turn is determined by a work factor (WF[5]). The WF is determined by the payload, towing and four-wheel drive capabilities of the vehicles in the fleet and provides the flexibility which allows vehicles with larger payloads and larger towing capacities to meet a proportionally adjusted GHG standard. The emission targets are based on the specific vehicle's engine type; compression ignition (CI) or spark ignition (SI) as shown below in Table 1. The target value equation becomes more stringent with each model year as illustrated in Figure 1, however since the average fleet CO_2 standard is calculated using the work factor for each vehicle, the applicable fleet standard can vary between model years.

Table 1: Class 2B and 3 (non-vocational) CO_2 Emission Target Value Calculations

Model Year	Spark ignition CO_2 emission target (grams of CO_2/short-ton mile)	Compression ignition CO_2 emission target (grams of CO2/short ton-mile)
2014	(0.0482 × WF) + 371	(0.0478 × WF) + 368
2015	(0.0479 × WF) + 369	(0.0474 × WF) + 366
2016	(0.0469 × WF) + 362	(0.0460 × WF) + 354
2017	(0.0460 × WF) + 354	(0.0445 × WF) + 343
2018	(0.0440 × WF) + 339	(0.0416 × WF) + 320

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[4] https://pollution-waste.canada.ca/environmental-protection-registry/regulations/view?Id=104
[5] The formula to calculate the WF is described in s.22(3) of the *Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations*

Figure 1: Class 2B and 3 (non-vocational) CO₂ Emission Targets with respect to the Work Factor
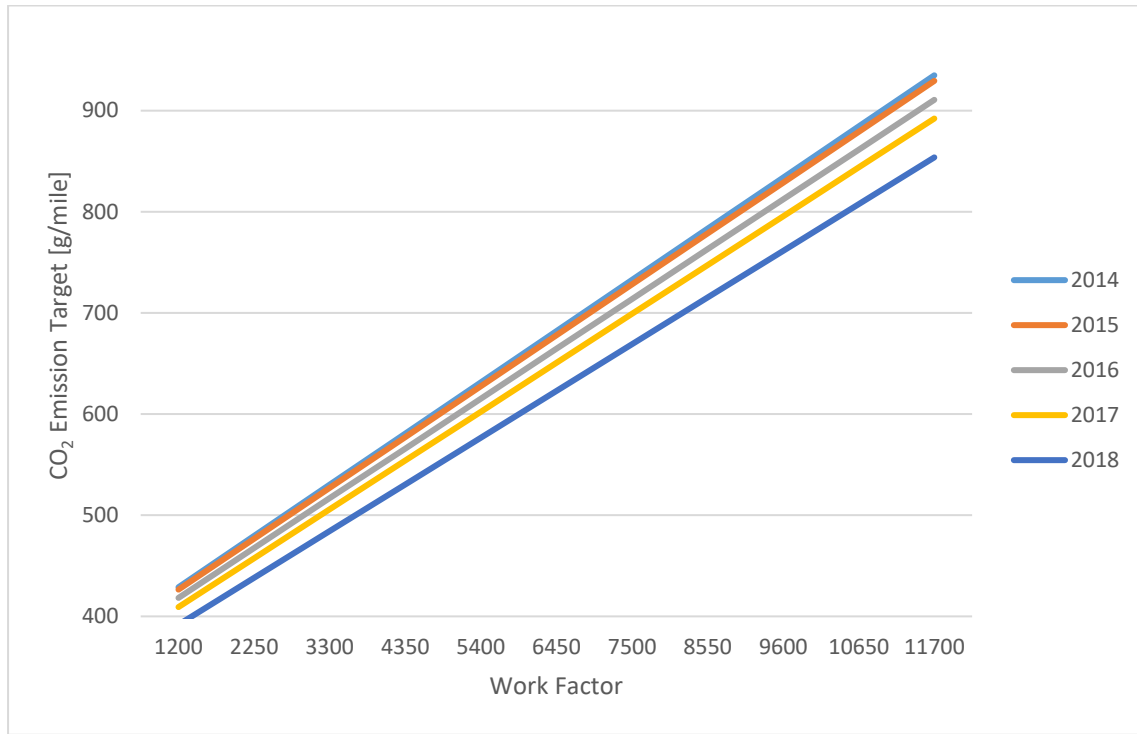
For model years 2014 through 2017, most companies elected to use the phase in options for the fleet average CO_2 emission standard consisting of emission target values that become gradually more stringent. As such, companies have the option, for these model years, to choose the CO_2 target value calculations according to the formulas shown in Table 1 above or the alternative target value calculations shown below in Table 2. These calculations adjust the supporting compliance calculations for fleet average and fleet targets. Under these Regulations, the alternative value calculations are only permitted up to the 2018 model year.

Table 2: Class 2B and 3 (non-vocational) CO₂ Emission Targets with respect to the Work Factor

Model Year	Spark ignition CO₂ emission target (grams CO₂ per short ton-mile)	Compression ignition CO₂ emission target (grams CO₂ per short ton-mile)
2014	(0.0482 × WF) + 371	(0.0478 × WF) + 368
2015	(0.0479 × WF) + 369	(0.0474 × WF) + 366
2016 to 2018	(0.0456 × WF) + 352	(0.0440 × WF) + 339

2.2   Vocational Vehicles and Tractors

Vehicles captured under this section include vocational vehicles and tractors. Vocational vehicles are class 2B to class 8 heavy-duty vehicles such as firetrucks, buses and delivery trucks whilst tractors include class 7 medium heavy-duty trucks and class 8 heavy-duty trucks that are designed to haul a trailer. For the purposes of emission standards, tractors are further subdivided into day cab or a sleeper cab, as well as low, mid and high roof. The CO_2 emission standards for vocational vehicles and tractors are shown in Table 3 and Table 4 below. For the

purposes of fleet average CO_2 values and reporting of fleet emission performance, vocational vehicles and tractors are grouped into three averaging sets based on vehicle weight class (class 2B through 5, class 6 and 7, and class 8). This is due to the requirements of the fleet averaging credit system which is explained in Section 5 below. Engines designed for use in these vehicles must also meet separate engine-based standards. These are described in sub-section 2.3.

Table 3: CO_2 Emission Standards for Vocational Vehicles

Class of vocational vehicle	CO_2 emission standard (grams of CO_2 per short ton-mile)	
	MY 2014 to 2016	MY 2017 and 2018
Class 2B, class 3, class 4 and class 5	388	373
Class 6 and class 7	234	225
Class 8	226	222

Table 4: CO_2 Emission Standards for Tractors

Class of Tractor	CO_2 emission standard (grams of CO_2 per short ton-mile)	
	MY 2014 to 2016	MY 2017 and 2018
Class 7 low-roof tractors	107	104
Class 7 mid-roof tractors	119	115
Class 7 high-roof tractors	124	120
Class 8 low-roof day cab tractors	81	80
Class 8 low-roof sleeper cab tractors	68	66
Class 8 mid-roof day cab tractors	88	86
Class 8 mid-roof sleeper cab tractors	76	73
Class 8 high-roof day cab tractors	92	89
Class 8 high-roof sleeper cab	75	72

The Regulations include a phase-in provision for tractors and vocational vehicles. This phase-in provision allowed companies to progressively include only a portion of their fleet in their percentage calculation if all vehicles in the fleet were EPA certified. The minimum percentage of the fleet required for inclusion in the calculation of the average CO_2 emissions standard progressively increased as shown in Table 5 below, over the 2014 to 2018 model years when all vehicles had to be included. Only the portion of the fleet that were reported included are represented in the fleet average CO_2 values presented in section 4 of this report.

Table 5: Required Percent of Fleet for Fleet Averaging During Transitionary Period

Model Year	Minimum percent included
2014	0%
2015	25%
2016	50%
2017	75%
2018	100%

2.3 Heavy-Duty Engines

Heavy-duty engines include those engines which are installed in tractors or vocational vehicles. They are classified by application (vehicle size and type of vehicle containing the engine) and fuel type (compression ignition which are typically diesel fueled or spark ignition (usually fuelled by gasoline). The emissions from these engines are regulated separately from those of the vehicles they power.

Beginning in 2016, all spark ignition heavy-duty engines must meet the standard of 627 grams of CO_2 per Brake Horsepower-hour [6] (g / BHP-hr). The stringency of the standards for compression ignition engines are based on engine type (light-, medium- or heavy) and application (vocational or tractor). The standards presented in Table 6 below increased in stringency after the 2016 model year.

Table 6: Heavy-Duty Compression Ignition Engine CO_2 Emission Standards

Engine Type	CO_2 emission standard (BHP-hr)	
	MY 2014 to 2016 MY	MY 2017 and2018
LHDE for Vocational Vehicles	600	576
MHDE for Vocational Vehicles	600	576
HHDE for Vocational Vehicles	567	555
MHDE for Tractors	502	487
HHDE for Tractors	475	460

The Regulations also allow for two alternative emissions standards for heavy duty compression-ignition engines. If companies that manufacture or import compression-ignition engines of the 2014 to 2016 model years do not have remaining credits for these model years, they have the option to comply with an alternate CO_2 emission standard which is based on model year 2011 engines. Companies also have the option to comply with alternative phase-in emission standards for compression-ignition engines of the 2013 to 2016 model years. These alternative standards allow companies to follow a phase-in calendar provided that they continue to comply with that calendar for the remaining model years covered by these alternative standards.

3. Annual Reporting

Under the Regulations, companies are required to submit an annual end of model year report that is used to assess compliance to the applicable standard for its fleets of class 2B and 3 (non-vocational) vehicles, heavy-duty engines, and tractors and vocational vehicles. Companies with a fleet average below the standard accrue emission credits that can be used to offset an emissions deficit, or traded, to achieve compliance to the Regulations. Companies with a fleet average exceeding the standards accrue an emissions deficit that must be offset within three model years.

To recognize early action and good performance prior to the 2014 model year, the Regulations enable companies to earn "early action" credits for their 2013 model year products. This provision requires that companies provide a full report on their 2013 model year fleets, and that the net credit balance be positive.

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[6] Brake Horsepower or BHP means a unit of brake power that is equal to 745.7 watts, expressed in horsepower

Given that a small number of companies elected to use this option, the performance for the early action years is not presented in this report.

3.1 Reported Products

Companies submitted a report pursuant to the Regulations during each of the model years covered in this document. The compliance reports from the top five manufacturers and importers within each sector (class 2B and 3 (non-vocational), tractors, vocational vehicles and heavy-duty engines) represented the vast majority of vehicles and engines reported within each category. For example, in the case of class 2B and 3 (non-vocational), five companies represented over 99% of their class' respective imported into and/or manufactured total units in Canada. In the case of vocational vehicles and tractors and their engines, five companies represented 71% and 78% respectively.

The majority of vehicles reported for the first five model years were class 2B and 3 pickup trucks and vans (non-vocational) at an average of 115 000 annually. As well, approximately 55,000 vocational vehicles and tractors were reported per model year. On average, 43,000 engines were reported per model year. The number of engines reported is not equal to the number of vehicles primarily due to vocational vehicles or tractors using engines of an earlier model year. For instance, in the 2015 model year reports, all reported vehicles are of the 2015 model year but the engines in these vehicles although predominantly expected to be of the 2015 model year were engines of the 2014 or earlier model year. These dynamics reflect common industry practices and therefore, for any given model year, the number of engines reported may differ from the total number of vehicles.
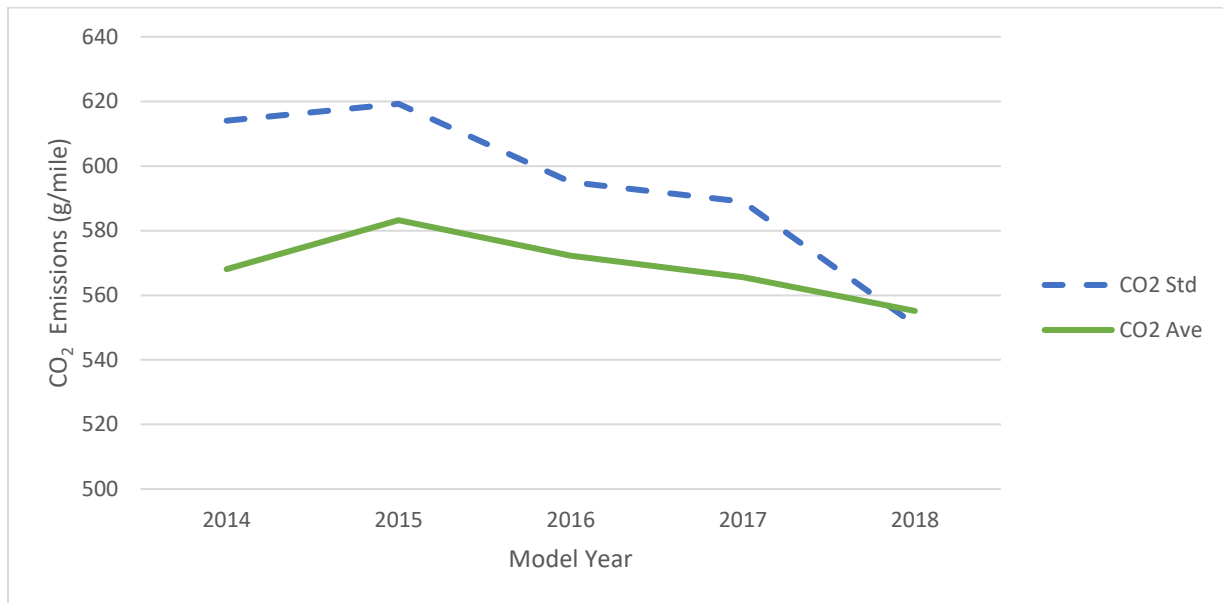
4. Fleet Performance

Results are presented at the fleet level based on data obtained from annual compliance reports submitted by companies to ECCC pursuant to the Regulations. The data presented below are based on aggregated values for all companies and are intended to depict the overall average year over year performance for class 2B and 3 (non-vocational) vehicles, tractors and vocational vehicles, and heavy-duty engines over the 2014 to 2018 model years. It should be noted that each company's fleet is unique; ECCC evaluates individual submissions to assess each company's compliance with the regulatory standards. Nonetheless, the results are presented as an average of the standard value by classes at the fleet level for each of the categories. This provides a measure of the overall trend of the fleet average CO_2 value and the fleet average standard for each category. For a full description of the fleet average performance and percentage reduction in each category, see Appendix I.

4.1 Average GHG Emissions Performance – Class 2B and 3 Heavy-duty Vehicles

The fleet average CO_2 emissions are shown in Figure 2 below along with the fleet average standard for model years 2014 through 2018. During this period, the fleet average CO_2 values decreased from 568 to 555 grams per short ton-mile while the overall fleet standard increased in stringency (dashed line) from 614 to 551 grams of CO_2 per short ton-mile. Model year 2018 was the first model year where the overall fleet performance exceeded the fleet average standard with a fleet average CO_2 value 1% higher than the average CO_2 emission standard. Section 6 presents a discussion on the overall industry performance and its impact.

Figure 2: Fleet Performance 2B and 3 (Non-Vocational Vehicles)

4.2 Average GHG Emissions Performance – Vocational Vehicles and Tractors

The requirements of the fleet averaging credit system influence how vehicles and engines are reported when evaluating the fleet performance of vocational vehicles and tractors. These products are divided into three averaging sets based on vehicle weight class as seen in Figure 3 and further described in Table 7 below. The emission credit system is further explained in Section 5 of this report.

For all the various averaging sets, there is one applicable standard for the 2014 – 2016 model year and a more stringent standard beginning for the 2017 model year. For class 2B through 5 vocational vehicles, the fleet average CO_2 performance value is the average of all vehicles reported, including those from companies who opted out of credit averaging. The fleet average CO_2 performance value is consistently just below the standard. From the 2014 model year through the 2018 model year, the fleet average CO_2 performance values decreased from 386 to 372 grams per short-ton-mile.

The class 6 and 7 vocational vehicles and tractors averaging set comprise a number of subcategories with different standards. Therefore, the fleet average CO_2 standard can also vary from year to year depending on the sales mix in a given year. From 2014 to 2018 the fleet average CO_2 performance values decreased from 231 to 220 grams per short-ton-mile.

The class 8 vocational vehicles and tractors averaging set also contain a number of subcategories with different standards creating a possible average fleet standard variance from year to year. From the 2014 through 2018 model years, the fleet average CO_2 performance values are also just below the average standard. From 2014 to 2018 the fleet average CO_2 values have decreased from 165 to 145 grams per short-ton mile.

Figure 3: Fleet Performance for Heavy-duty Vocational Vehicles and Tractors
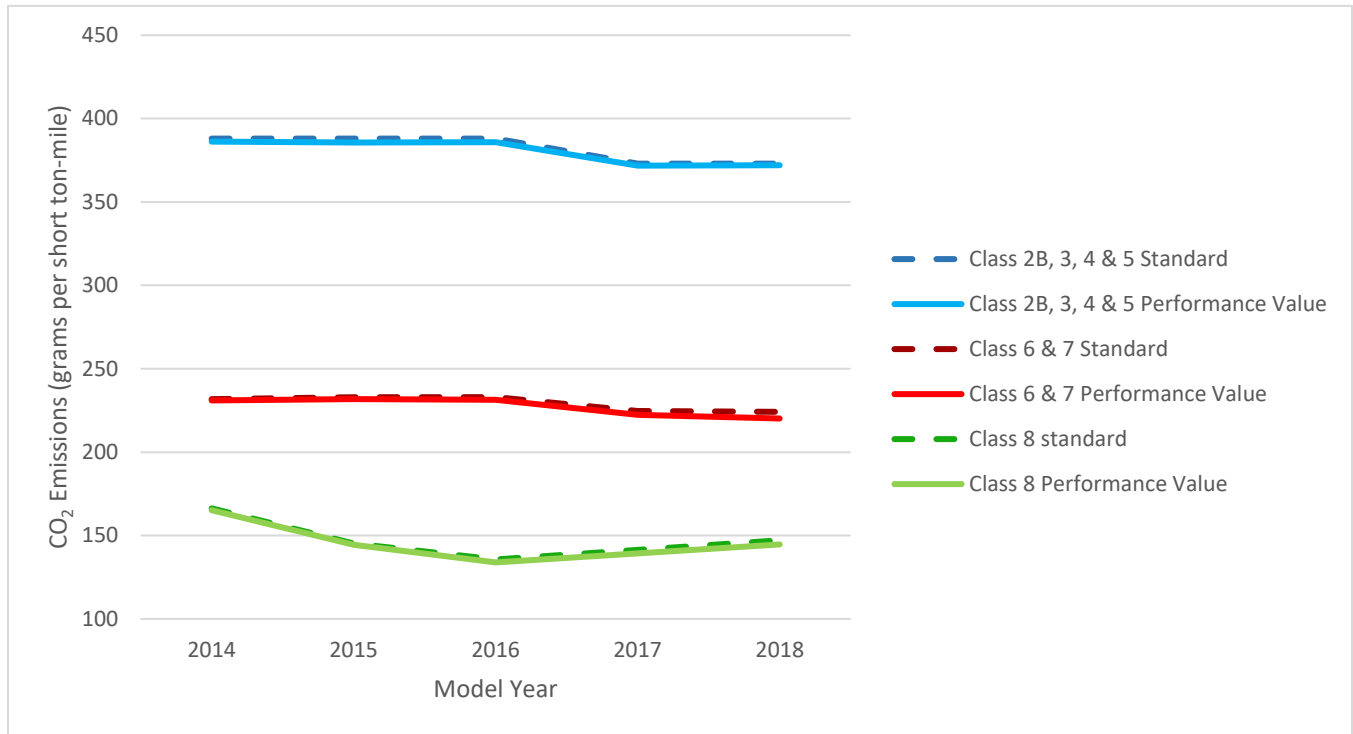
4.3   Average GHG Emissions Performance – Heavy-duty Engines

The fleet performance of heavy-duty engines is divided into four averaging sets as shown in Figure 4 below and further described in Table 7. All three of the compression ignition (CI) engine classes are required to meet separate standards for the 2014 through 2016 model years and then a more stringent separate standard beginning with the 2017 model year. All spark ignition (SI) engines must meet the standard of 627 grams of CO_2 per BHP-hr beginning with the 2016 model year. Furthermore, companies may elect to use alternative standards set by the regulations. Therefore, the average fleet standard for each averaging set can vary from year to year. Because each manufacturer's fleet is unique, the data presented in Figure 4 below is based on the aggregated values for all companies, and is intended to depict the average results.

For the heavy heavy-duty compression ignition averaging set, the average fleet emissions are consistently below the average standard for all five model years. From the 2014 through the 2018 model year the average CO_2 performance values have decreased from 500 to 488 grams per BHP-hr.

For the light heavy-duty compression ignition averaging set, the average fleet emissions are below the average standard for all five model years. From the 2014 through the 2018 model year the average CO_2 performance values have decreased from 588 to 575 grams per BHP-hr.

For the medium heavy-duty compression ignition averaging set, the average fleet emissions are below the average standard for all five model years. From the 2014 through the 2018 model year the average CO_2 performance values have decreased from 566 to 542 grams per BHP-hr. The spark ignition heavy-duty engine

performance values have matched the standard of 627 grams per BHP-hr from the 2016 through the 2018 model years.

Figure 4: Fleet Performance for Heavy-Duty Engines
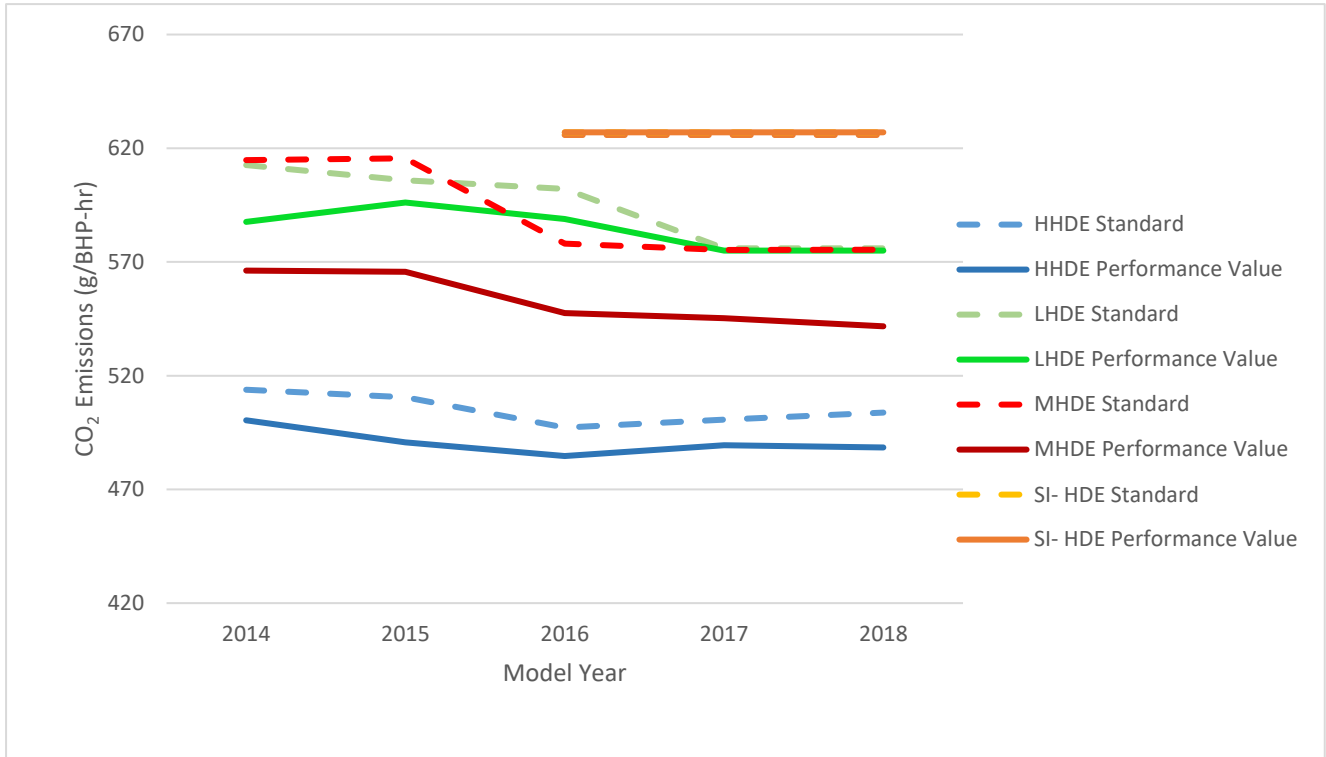
5. CO_2 Emission Credit System

The Regulations include a system of emission credits to help meet overall environmental objectives in a manner that provides the regulated industry with compliance flexibility. The system allows companies to generate, bank and trade emission credits. Under this system, companies may elect to manufacture or import a mix of vehicles and engines whose performance may be less or more stringent than the CO_2 emission standards provided that their average fleet emission level does not exceed the applicable emission standard.

Depending on the characteristics of the fleet, compliance using fleet averaging may or may not be required. For the purpose of a company's participation in the CO_2 emission credit system a company can group vehicles or engines into fleets which are set out in the Regulations and can be seen in Table 7.

Table 7: Summary Table of Averaging Sets and Fleets for Credit Averaging Purposes

Averaging sets (pursuant to subsection 1(1) of the Regulations)	Fleets* (pursuant to section 18 of the Regulations)
Class 2B and class 3 heavy-duty vehicles and cab-complete vehicles	Class 2B and class 3 heavy-duty vehicles and cab-complete vehicles
Class 2B, class 3, class 4 and class 5 vocational vehicles	Class 2B, class 3, class 4 and class 5 vocational vehicles
Class 6 and class 7 heavy-duty vehicles	Class 6 and class 7 vocational vehicles
	Class 7 low-roof tractors
	Class 7 mid-roof tractors
	Class 7 high-roof tractors
Class 8 heavy-duty vehicles	Class 8 vocational vehicles
	Class 8 low-roof day cab tractors
	Class 8 low-roof sleeper cab tractors
	Class 8 mid-roof day cab tractors
	Class 8 mid-roof sleeper cab tractors
	Class 8 high-roof day cab tractors
	Class 8 high-roof sleeper cab
Heavy-duty spark-ignition engines	Heavy-duty spark-ignition engines
Light heavy-duty engines that are compression-ignition	Light heavy-duty engines that are compression-ignition engines and designed to be used in vocational vehicles
Medium heavy-duty engines that are compression-ignition engines	Medium heavy-duty engines that are compression-ignition engines and designed to be used in vocational vehicles
	Medium heavy-duty engines that are compression-ignition engines and designed to be used in tractors
Heavy heavy-duty engines that are compression-ignition engines	Heavy heavy-duty engines that are compression-ignition engines and designed to be used in vocational vehicles
	Heavy heavy-duty engines that are compression-ignition engines and designed to be used in tractors

*All fleets have an applicable corresponding standard value

For class 2B and 3 (non-vocational) vehicles, fleet averaging is always required for CO_2 emissions. Therefore, net credits are calculated for a company's entire 2B and 3 fleet in a single averaging set. Deficits for N_2O and CH_4 levels above 0.05 g/mile are calculated and added to CO_2 credit balances. For other vehicle classes, such as tractors and vocational vehicles, fleet averaging is only required if one or more of the vehicles exceed the emission standards. In addition, for tractors and vocational vehicles, credit averaging is optional for companies where every vehicle in the fleet meets the applicable standard. For this group, credits are categorized into three averaging sets based on vehicle weight class (class 2B through 5, class 6 and 7, and class 8) cannot be transferred between the averaging sets. For engines, credits are split into four averaging sets based on engine classification (SI, CI-light heavy-duty, CI-medium heavy-duty, CI-heavy heavy duty). Credits are not transferable between the

averaging sets and companies where every engine in the fleet meets the standards are not required to adhere to the CO_2 emission credit system.

The ability to earn and bank credits, including early credits, is an important aspect of the Regulations. It is intended to give manufacturers flexibility to meet the increasingly more stringent emission standards for subsequent model years. The credits represent the emission reductions that manufacturers have achieved in excess of those required by the regulatory standards. The ability to accumulate credits allows manufacturers to plan and implement an orderly and predictable phase-in of emissions control technology. Credits obtained for an averaging set of heavy-duty vehicles or heavy-duty engines of a given model year may be used for that averaging set up to five model years following the model year for which the credits were obtained, after which the credits are no longer valid and expire.

Because each manufacturer's fleet is unique, the data presented in this section are also based on the aggregated values for all companies and are intended to depict the average results.

Table 8 and Table 9 below illustrate the net credits earned each model year for heavy-duty vehicles and heavy-duty engines. Heavy-duty vehicles include class 2B and 3 (non-vocational) vehicles, class 2B through 5 vocational vehicles, class 6 to 7 vocational vehicles, and class 8 tractors. The heavy-duty engines are separated into light heavy-duty engines intended for use in class 2B through 5 vehicles, medium heavy-duty engines intended for class 6 and 7 tractors, and heavy heavy-duty engines intended for class 8 tractors.

Up to the end of the 2018 model year, companies have generated approximately 9.6 million Mg of CO_2 emissions credits of which approximately 1.7 million Mg of CO_2 have been used to offset a deficit and 0.32 million Mg of CO_2 have expired. There are currently 7.9 million Mg of CO_2 credits available to offset deficits of which 2 million Mg of CO_2 will expire after the 2019 model year[7].

Table 8: Yearly Net Credits Earned for Heavy-Duty Vehicle Averaging Sets (Mega grams of CO_2)

Model Year	Class 2B to 3 Heavy-Duty Non-Vocational Vehicles	Class 2B to 5 Heavy-Duty Vocational Vehicles	Class 6 to 7 Heavy-duty Vehicles	Class 8 Heavy-duty Vehicles
2014	336,776	6,106	2,693	43,691
2015	408,827	8,954	4,943	141,208
2016	246,584	6,649	7,881	286,626
2017	310,747	2,780	10,724	169,614
2018	-64,020	1,395	16,100	243,182

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[7] See Appendix II for the credit values in each category

Table 9: Yearly Net Credits Earned for Heavy-Duty Engine Averaging Sets (Mega grams of CO_2)

Model Year	CI - LHDE (Cl 2b-5)	CI - MHDE (Cl 6-7)	CI - HHDE (Cl 8)	SI-HDE*
2014	17,153	244,618	1,070,897	NA
2015	14,451	303,087	917,542	NA
2016	21,394	144,749	504,936	0
2017	835	348,835	722,318	0
2018	873	245,537	898,155	0

6. Overall Industry Credit Performance

The results from the 2014 to 2018 model year regulatory reports indicate that the average emission rate of the Canadian fleet is below the average standard for all three sub-categories of heavy-duty vehicles (class 2B and 3, vocational vehicles and tractors, and heavy-duty engines). The one exception is the fleet average of class 2B and 3 vehicle averaging set for the 2018 model year which was 1% above the average standard. However, even with this one year increase there is still an overall percent reduction of 2.3% for the class 2B and 3 averaging set with respect to the 2014 model year.

The credit accumulation rate has generally decreased from the 2014 to the 2018 model year, therefore compliance margins are narrower for classes 2B through 5 and classes 6 and 7. This is due to phase-in provisions ending for certain averaging sets and standards becoming more stringent in 2017.

To date, companies have generated approximately 7.95 million Mg of CO_2 emissions credits over the 2014 through 2018 model years, of which 5.92 Mg of CO_2 emissions credits remain available for future use through the 2019 model year.

Appendix I: Summary Tables of Fleet Performance for Heavy-Duty Vehicles and Engines

Model Year	Class 2B & 3 Non-vocational Heavy-duty Vehicles			Class 2B to 5 Heavy-duty Vehicles			Class 6&7 Heavy-duty Vehicles			Class 8 Heavy-duty Vehicles		
	Standard	Value	% wrt Standard	Standard	Value	% wrt Standard	Standard	Value	% wrt Standard	Standard	Value	% wrt Standard
2014	614.03	568.06	-7.49	388	386.19	-0.47	231.86	231.02	-0.36	166.29	165.20	-0.66
2015	619.24	583.23	-5.82	388	385.65	-0.60	232.95	231.81	-0.49	145.19	144.40	-0.54
2016	594.98	572.20	-3.83	388	385.76	-0.58	232.98	231.47	-0.65	135.68	133.89	-1.32
2017	589.00	565.55	-3.98	373	371.79	-0.33	224.71	222.28	-1.08	141.35	139.21	-1.51
2018	550.90	555.14	0.77	373	372.06	-0.25	224.17	220.19	-1.77	147.19	144.74	-1.67
Total Fleet Average Reduction MY 2014 through MY 2018 (%)	2.27			3.66			4.69			12.39		

Model Year	CI - LHDE (Cl 2b-5)			CI - MHDE (Cl 6-7)			CI - HHDE (Cl 8)			SI-HDE*		
	Standard	Value	% wrt Standard	Standard	Value	% wrt Standard	Standard	Value	% wrt Standard	Standard	Value	% wrt Standard
2014	612.60	587.60	-4.08	614.78	566.20	-7.90	513.82	500.38	-2.61	N/A	N/A	N/A
2015	605.92	596.14	-1.61	615.57	565.64	-8.11	510.46	490.62	-3.89	N/A	N/A	N/A
2016	602.09	588.93	-2.19	578.03	547.53	-5.28	497.19	484.67	-2.52	627.00	627.00	0.00
2017	576.00	575.00	-0.17	575.29	545.27	-5.22	500.70	489.44	-2.25	627.00	627.00	0.00
2018	576.00	575.00	-0.17	575.33	541.71	-5.84	503.71	488.50	-3.02	627.00	627.00	0.00
Total Fleet Average Reduction MY 2014 through MY 2018 (%)	**2.14**			**4.33**			**2.37**			**0.00**		

Appendix II: Summary Table of Credit Balances of Heavy-Duty Vehicles and Engines Remaining after 2018

Vehicle and Engine Averaging Set	Heavy-Duty Vehicles Averaging Sets				Heavy-Duty Engines Averaging Sets		
	Class 2B and Class 3 (Non-Vocational)	Class 2B, 3, 4 and 5 (Vocational)	Class 6 and 7 (Vocational)	Class 8 (Non Vocational)	CI - LHDE (Cl 2b-5)	CI - MHDE (Cl 6-7)	CI - HHDE (Cl 8)
Mega-grams of CO$_2$	902,138	19,779	39,647	840,629	37,553	1,042,208	3,042,951