

# First Progress Update

JUNE 2006

## MEMORANDUM OF UNDERSTANDING RESPECTING AUTOMOBILE GREENHOUSE GAS EMISSIONS



Canadian Vehicle  
Manufacturers' Association  
Association canadienne  
des constructeurs de véhicules



Association of International Automobile  
Manufacturers of Canada  
L'Association des fabricants  
internationaux d'automobile du Canada



Government of Canada  
Gouvernement du Canada

Canada

Prepared by the Joint Government - Industry Greenhouse Gas (GHG) Memorandum of Understanding (MOU) Committee.

This publication was produced in collaboration with:

Canadian Vehicle Manufacturers' Association  
L'Association canadienne  
des constructeurs de véhicules

[www.cvma.ca](http://www.cvma.ca)



Association of International Automobile  
Manufacturers of Canada  
L'Association des fabricants  
internationaux d'automobile du Canada

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# Table of Contents

<b>1. Introduction</b>	2
<b>2. The Memorandum of Understanding (MOU)</b>	3
Key Components of the MOU	3
The MOU, Its Approach and Benefits	4
The 5.3 Mt Reduction Goal	4
<b>3. Achievements to Date</b>	6
Joint Government-Industry GHG MOU Committee	6
Advanced Technology Introductions	7
Outreach Activities	8
<b>4. The Path Forward</b>	9
<b>Appendix A</b>	
Memorandum of Understanding Between the Government of Canada and the Canadian Automotive Industry Respecting Automobile Greenhouse Gas Emissions	10
<b>Appendix B</b>	
List of the Automotive Industry's Voluntary Agreements	19
<b>Appendix C</b>	
Joint Government-Industry GHG MOU Committee – Terms of Reference and Operational Plan	22
<b>Appendix D</b>	
Key Milestones under the Operational Plan	25
<b>Appendix E</b>	
Advanced Technology Introductions by the Automotive Industry	26

## 1. Introduction

By any standard, Canada's economy is performing well. Canada's gross domestic product (GDP) has increased by 44 percent between 1990 and 2003, unemployment rates are at record lows, and our ratio of debt to GDP is steadily declining. But such economic success also drives many challenges. The amount of energy that Canadians use to heat and cool their homes and workplaces and to operate their appliances, factories and transportation systems has increased significantly over the same period, and the resulting greenhouse gas (GHG) emissions have increased proportionally. To address this challenge, Canada has developed many initiatives that focus on energy efficiency. As a result of this and other factors, growth in total GHG emissions was 24 percent from 1990 to 2003 – half of the growth in the economy.

Altogether, power generation and industry activities account for about half of Canada's total GHG emissions. Although total annual vehicle kilometres travelled by cars and light trucks increased by 24 percent between 1990 and 2003, their GHG emissions have only increased by 21 percent. Nonetheless, Canadians driving passenger cars and light trucks still account for about 12 percent of Canada's total GHG emissions.

Although progress has been made, the Canadian automotive industry accepts that it has an ongoing responsibility to help Canadians continue to address this challenge. On April 5, 2005, a significant step forward was made to further reduce GHG emissions. The Government of Canada and the automotive industry reached a voluntary landmark agreement to reduce annual GHG emissions from Canada's vehicle fleet by 5.3 megatonnes (Mt) in 2010. This agreement represents a strong commitment on the part of the automotive industry to work with the Government of Canada and all Canadians in the pursuit of economic and environmental prosperity. Both parties are particularly proud of

the voluntary nature of this agreement that provides greater GHG reductions in an earlier time frame than would otherwise be possible.

This initiative builds on significant achievements made to date in the reduction of smog-causing, vehicle-related emissions. New Tier 2 emission vehicle technologies now entering the market in Canada and the United States are expected to reduce smog-causing emissions by 99 percent from pre-control levels. Tier 2 standards, which will contribute very significantly to improved air quality as new vehicles replace older ones, are the most stringent national standards in the world and, for the first time, will apply equally to both passenger cars and light duty trucks, including sport utility vehicles.

This agreement also builds on the industry's track record of successful voluntary agreements in Canada in a number of areas including vehicle safety, fuel consumption and emissions reductions.

This is the first report since the Memorandum of Understanding Respecting the Automobile Greenhouse Gases was signed. It provides information on the activities and progress under the Memorandum of Understanding (MOU) through the first quarter of 2006.

## 2. The Memorandum of Understanding (MOU)

The MOU sets out a comprehensive approach to reduce GHG emissions. It calls on the automotive industry to reduce GHG emissions from light duty vehicles (cars, minivans, sport utility vehicles and pickup trucks), so that annual reductions of 5.3 Mt will be achieved in 2010.

The MOU was founded on a framework of key principles that are contained in the Preamble of the MOU (see Appendix A). Several of these key principles are outlined below:

- It is an agreement by both government and the Canadian automotive industry that action will be taken to reduce the growth of GHG emissions in Canada.
- It builds on existing achievements to reduce GHG emissions and improve fuel efficiency through improvements in vehicle technology and in the operation and maintenance of vehicles in Canada.
- It acknowledges that the Canadian automotive industry has made significant progress in reducing GHG emissions and improving fuel efficiency since 1990.
- It recognizes the concomitant goals of improving vehicle safety, addressing vehicle smog-causing emissions and maintaining consumer choice.
- It acknowledges that this MOU is unique because it targets GHG emission reductions that will be achieved by this sector through the products that are sold and therefore are also dependent on consumer behaviour and the availability of appropriate fuels.
- It agrees on the importance of the Parties' (government and industry) mutual goals to attract new investment in Canada, stimulate economic growth and to ensure the continued competitiveness of the Canadian automotive industry as progress is made to reduce GHG emissions. It also recognizes the integrated nature of the North American

auto market and the engineering and production lead times for introducing new technologies to the market.

Both the Government of Canada and the automotive industry are committed to working together to deliver on the commitments of this MOU.

### Key Components of the MOU

The MOU has several key components. They are as follows:

- The MOU voluntarily commits the Canadian automotive industry to achieve a 5.3 Mt reduction in GHG emissions from passenger cars and light duty trucks in 2010, relative to the reference case.
- It is comprehensive in that it includes all the GHGs under the United Nations Framework Convention on Climate Change that apply to the use of motor vehicles. This includes carbon dioxide (CO<sub>2</sub>), nitrous oxide, methane, hydrofluorocarbons and other Kyoto gases that are equated to a CO<sub>2</sub> equivalent value (CO<sub>2</sub>e) in Mt.
- It clearly outlines interim GHG emission reduction goals that the Canadian automotive industry has committed to meet. The interim reduction goals are 2.4 Mt in 2007, 3.0 Mt in 2008 and 3.9 Mt in 2009.
- It focuses efforts on the introduction to the Canadian marketplace of advanced emission technologies, advanced diesel technology, alternative fuel vehicles, hybrids, technologies that promote fuel savings such as on-board diagnostics and tire pressure monitoring systems, as well as other emerging technologies.
- It encourages the appropriate use of a variety of new fuels such as ethanol, clean diesel and biodiesel by working with the government and fuel providers in this regard to support new vehicle technologies.



- It indicates that the automotive industry will support automotive research and development in Canada.
- It provides for a joint government-industry committee to monitor progress and industry performance against interim GHG reduction goals as a means of ensuring accountability for the MOU.

A copy of the MOU is presented in Appendix A.

### The MOU, Its Approach and Benefits

The GHG approach in the MOU recognizes that the primary GHG, CO<sub>2</sub>, is produced from fossil fuel use in vehicles and that there are several other potent GHGs (such as methane and nitrous oxide from the tailpipe and hydrofluorocarbon losses from vehicle air-conditioning units) that are also associated with motor vehicle use. The MOU's GHG approach takes all vehicle-related GHGs into account with regard to their impact on climate change.

This voluntary approach in the MOU focuses on immediate actions to achieve GHG reductions and provides a cost-effective solution for government, industry and consumers. It also allows the industry to select the most appropriate means to achieve the collective 2010 target, while preserving the high value that this important sector brings to Canada's economy. It recognizes that no two companies are alike and that an industry-wide approach is the most practical method to achieve the climate change objectives for Canada because it provides the flexibility that each manufacturer needs to contribute to the overall GHG reduction goal, as appropriate to its unique customer base, product technology portfolio and market strategy.

In addition, the automotive industry has a long-standing history and strong track record of meeting voluntary agreements with the government on environmental, safety and fuel efficiency objectives. More than a dozen active voluntary agreements like this one have been

successfully implemented in Canada. (See Appendix B for a list of the voluntary agreements.)

There are several programs and initiatives underway in different countries around the world that focus on reducing GHG emissions and improving fuel consumption. Some of these initiatives could influence the availability of technologies in the Canadian market and the approaches taken by automakers to meet the Canadian MOU. In general, voluntary agreements offer advantages in terms of flexibility, and they can be put in place more quickly than regulatory measures thus leading to earlier actions and greater GHG emissions reductions.

In Canada, the government and the automotive industry have committed to delivering on the MOU and its goal to reduce GHGs.

### The 5.3 Mt Reduction Goal

The 5.3 Mt reduction goal is based on updating the work of the 1999 Government Transportation Climate Change Table and its projections of vehicle-related GHG emissions and Natural Resources Canada's *Canada's Emissions Outlook: An Update*, published in December 1999.

The 5.3 Mt target is measured from a "reference case" level of emissions that is designed to reflect the actions of the automotive industry that would have occurred in the absence of action on climate change. Annex 2 in the MOU outlines key variables that determine vehicle emissions. In terms of the key variables, two kinds are identified: factors that the industry is accountable for, and external factors that cannot be directly controlled by industry. Factors outside the control of the automotive industry relate to economic and demographic variables including those market activities and trends that influence decisions by consumers on what types of vehicle they buy, how many new vehicles they buy every year, and how many kilometres they drive. Factors that the industry is



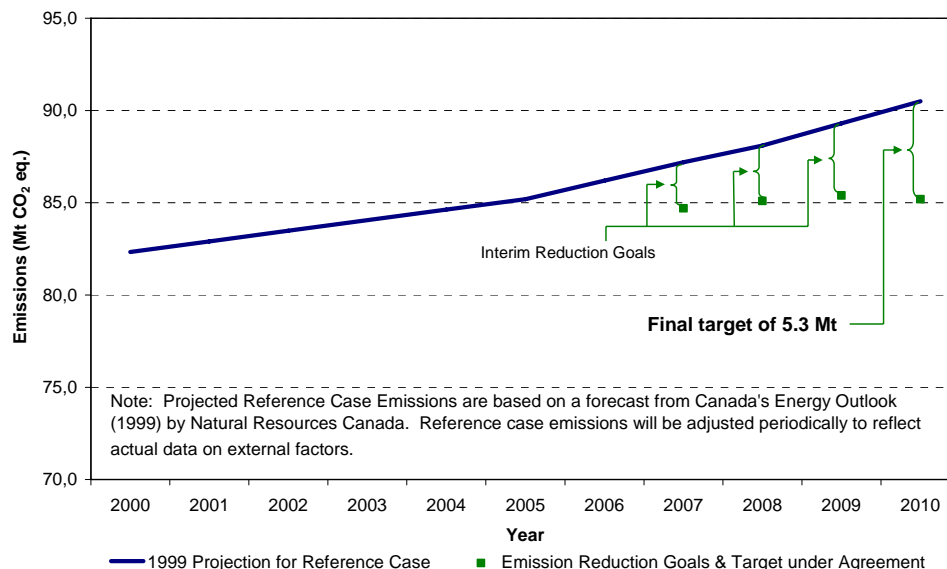
accountable for include fuel type, the level of fuel consumption for new vehicles, adjustments for on-road consumption, and rates of GHG emissions (in grams per kilometre) from vehicle components. These include emission control equipment (nitrous oxide), engine combustion products (methane), air conditioners (hydrofluorocarbons) and lubricants (CO<sub>2</sub>). The reference case includes moderate reductions in average new vehicle fuel consumption and decreasing emission rates of GHGs, such as nitrous oxide and methane from vehicles, based on estimates of the business-as-usual GHG emissions case presented in Study #3 by the Transportation Table in 1999.

The MOU commits the automotive industry to reductions in GHG emissions from vehicles on the road in Canada, so that in 2010 actual emissions for the year will be 5.3 Mt below this reference case. Since the reference case already includes some reductions in GHG

emission rates in the period up to and including 2010, additional efforts by the automotive industry beyond these improvements will be required to achieve the 5.3 Mt target. Figure 1 illustrates the reference case as forecast in 1999 and the emissions reduction goals under the MOU.

Actual GHG emissions from the light duty vehicle fleet in 2010 will be a consequence of the interplay between the external factors and the factors that the automotive industry is accountable for. In order to measure performance under the MOU, that is, whether the actual GHG emissions from light duty vehicles are 5.3 Mt lower than the reference case emissions in the year 2010, a joint government-industry monitoring committee will employ an analytical framework to calculate the reference case and compare these emissions to actual levels.

**Figure 1 - Illustration of GHG Emissions from Light Duty Vehicles**



### 3. Achievements to Date

Since the signing of the MOU, progress has already been made. The key initial milestones specified in the MOU have been met. This includes the formation of a joint government-industry monitoring committee and its associated Mandate and Operational Plan. In addition, the Canadian automotive industry has already introduced many advanced fuel savings technologies into the marketplace. Outreach activities have also been undertaken.

#### Joint Government-Industry GHG MOU Committee

The MOU outlined some specific milestones that were required to be met. The first was the establishment of a joint government-industry committee composed of equal numbers of government and industry members within 60 days of the signing, the purpose of which is to provide an accountability mechanism to track and report on progress on the MOU. The Joint GHG MOU Committee was formed on June 1, 2005, meeting the first milestone in the MOU.

The Committee consists of eight members in total, with four representatives each from government and industry. There are two chairs (co-chairs), one from government and one from industry. There are two representatives from Natural Resources Canada, one from Environment Canada, one from Transport Canada, two from the Canadian Vehicle Manufacturers' Association and two from the Association of International Automobile Manufacturers of Canada.

The second milestone outlined in the MOU was that the Committee would table a Mandate and its Operational Plan for approval to the Parties no later than 180 days from the signing of the MOU. The Committee met to develop the Mandate and the Operational Plan. The Terms of Reference and the Operational Plan were tabled for the Parties on October 2, 2005, within the 180 days specified.

The Mandate of the Committee is clearly outlined in the Terms of Reference. It indicates

that the Committee is a key component of the MOU, responsible for tracking progress towards the industry's 5.3 Mt reduction target. The Terms of Reference also provide for the following Committee activities:

- Data Collection – Identify the range and nature of data needed to track performance, to populate the tracking model, and to define submission and reporting requirements as required.
- Reference Case Updates – The reference case shall be updated in accordance with the principles and procedures described in Annex 2 of the MOU, to reflect new and up-to-date data as they become available.
- Monitoring – Once the reference case is established, the Committee will establish the approach and procedures for tracking performance against the interim annual goals specified in the MOU and the 5.3 Mt reduction commitment.
- Diagnosis – Determine whether industry performance is in line with the goals specified in the MOU and provide recommendations for further actions if industry performance has not achieved, or is not likely to achieve, the goal for the subject year.
- Reporting – The Joint GHG MOU Committee will provide periodic updates on its activities and progress towards the 5.3 Mt target before reporting on the three interim goals and the final target.

The work of the Committee is primarily technical in nature. The Terms of Reference and the Operational Plan for the Committee, which provide further details, are provided in Appendix C.

The Committee has begun its work regarding the data aspects and the analytical framework to monitor the progress on the MOU goals. It has grouped its work into several technical





areas. They are (i) vehicle kilometres travelled, by age and passenger car and light truck categories and annual vehicle stock by model year and by passenger car and light truck categories; (ii) adjustment factors to convert laboratory fuel consumption values to real world on-road performance and vehicle fuel consumption; (iii) diesel and alternative fuels and GHG emissions under the MOU, CO<sub>2</sub> emission factors and the global warming potential for GHGs (CO<sub>2</sub>e); (iv) nitrous oxide and methane emissions; (v) mobile air-conditioner emissions; and (vi) CO<sub>2</sub> emissions from lube oil.

The Committee plans to provide reports on its activities after the conclusion of each reporting milestone and also on the progress towards the 5.3 Mt target, including the three interim goals and the final target. The Operational Plan outlines the Committee activities and milestones for the duration of the MOU. The key milestones are outlined in Appendix D. This report is for the period associated with the first milestones under the Operational Plan. It provides information on the activities and progress under the MOU through the first quarter of 2006.

It should be highlighted that the three Committee progress updates are not required under the terms of the MOU and are above and beyond the reporting requirements. However, the Committee recognized the importance of sharing early information on its activities to date. The Operational Plan indicates that a communications plan will be developed by the Committee. Its purpose is to ensure clear communication to the public on the progress of the MOU, including the interim goals and the 2010 target, as well as the activities of the Joint GHG MOU Committee. It has three key elements: (i) Committee progress updates, (ii) reports on emissions and the interim goals and (iii) the final report.

1. Committee Progress Updates – These will provide information to the public on the progress on the MOU in advance of the reports on the interim goals.

2. Reports on Emissions and the Interim Goals – These are key deliverables under the MOU and will report on the progress towards meeting the three interim goals for 2007, 2008 and 2009 outlined in the MOU.
3. Final Report – This report will provide the final results on achievement of the 5.3 Mt target in 2010.

### Advanced Technology Introductions

Annex 3 of the MOU provides a potential list of the various types of fuel-saving technologies from the automotive industry that would contribute to a reduction in GHG emissions from vehicles. It was noted that most of the technologies have related effects requiring re-engineering of associated systems, increased computer power and software sophistication, as well as changes to assembly procedures and supplier systems. Some technologies require further research, development and engineering work and in certain applications may not be appropriate, feasible or cost-effective.

Since the signing of the MOU, the automotive industry has already introduced many new models that incorporate technologies that can reduce GHGs. Technologies available in the Canadian market for the 2006 and 2007 model year include:

#### Transmission Improvements

- 6-speed transmissions
- Continuously variable transmissions

#### Engine Improvements

- Cylinder deactivation
- Variable valve timing

#### Other Vehicle Improvements

- Lightweight materials (aluminum, magnesium)
- Tire pressure monitoring systems
- Low rolling resistance tires
- New engine technologies that use a diversity of fuels – ethanol, diesel, biodiesel, etc.



#### Advanced Technology Vehicles

- Hybrid electric vehicles
- Advanced diesel vehicles

Appendix E provides a detailed list of models or technologies that have been introduced. This is by no means comprehensive. It is intended to show that new models are incorporating many advances in new vehicle technology.

#### **Outreach Activities**

Since the signing of the MOU, the Government of Canada and the automotive industry have participated in outreach activities to discuss and share information on the MOU and its intent.

- Conference of the Parties (COP) 11/ Meeting of the Parties (MOP) 1 event in Montréal – November 28 to December 9, 2005
- Ontario Mayors for Automotive Investment in Kitchener – May 2005
- National Advisory Committee on Energy Efficiency in Winnipeg – June 2005
- National Advisory Committee on Energy Efficiency in Toronto – March 24, 2006



## 4. The Path Forward

The Joint GHG MOU Committee has been formed and is moving forward with its work under the MOU, the Terms of Reference and Operational Plan. The agreement between the automotive industry and the government on reducing GHG emissions from light duty vehicles is on track and the basic foundations have been put in place. New vehicle technologies and models are coming to market faster than previously expected, and companies in the automotive industry are making progress in their vehicle fleets that will contribute to the overall industry GHG reductions over the period of the agreement.

The Committee is committed to sharing information on its activities and progress and will continue to deliver its responsibilities as defined by the MOU. The Committee will report on its activities again after the fourth quarter of 2006.

## Appendix A. Memorandum of Understanding Between the Government of Canada and the Canadian Automotive Industry Respecting Automobile Greenhouse Gas Emissions

### MEMORANDUM OF UNDERSTANDING BETWEEN THE GOVERNMENT OF CANADA AND THE CANADIAN AUTOMOTIVE INDUSTRY RESPECTING AUTOMOBILE GREENHOUSE GAS EMISSIONS

This Memorandum of Understanding signed and dated at Windsor, Ontario on the 5th day of April, 2005

Between:

Her Majesty the Queen in Right of Canada as represented by the Minister of Natural Resources Canada (Hereinafter "Government of Canada")

Of the First Part

And

The Canadian Vehicle Manufacturers' Association ("CVMA") and the Association of International Automobile Manufacturers of Canada ("AIAMC"), consisting of the Associations' member companies listed in Annex 1 (Hereinafter the "Canadian Automotive Industry")

Of the Second Part

This is a Memorandum of Understanding ("MOU") respecting the action to be taken by the Canadian Automotive Industry relating to the undertaking given by the Government of Canada to address climate change pursuant to the Kyoto Protocol and is intended to provide a framework for the actions that will be taken by the Canadian Automotive Industry to reduce the emission of greenhouse gases ("GHG") produced by light duty motor vehicles operating in Canada.

#### **PREAMBLE**

WHEREAS the Government of Canada and the Canadian Automotive Industry are in agreement that action will be taken to reduce the growth of GHG emissions in Canada.

AND WHEREAS the Government of Canada has stated this country's resolve to address its climate change commitments under the Kyoto Protocol;

AND WHEREAS the Parties are committed to building on existing achievements to reduce GHG emissions and improving fuel efficiency through improvements in vehicle technology, and in the operation and maintenance of vehicles in Canada;

AND WHEREAS the Government of Canada acknowledges that the Canadian Automotive Industry has made significant progress in reducing GHG emissions and improving fuel efficiency since 1990;

AND WHEREAS the Parties recognize the important need to balance the concomitant goals of improving vehicle safety, addressing vehicle smog-causing emissions and maintaining consumer choice;

AND WHEREAS this MOU does not require additional fiscal measures by the Government of Canada to assist the introduction of new technologies to achieve the GHG objectives of the Canadian Automotive Industry;

AND WHEREAS the Canadian Automotive Industry has shown good faith in meeting their commitments in other Memoranda of Understanding and are currently parties to numerous successful active agreements;



AND WHEREAS the Parties acknowledge that this MOU is unique because it targets GHG emission reductions that will be achieved by this sector through the products that are sold and therefore are also dependent on consumer behaviour and the availability of appropriate fuels;

AND WHEREAS the Parties agree on the importance of mutual goals of attracting new investment to Canada, stimulating economic growth and ensuring the continued competitiveness of the Canadian Automotive Industry as progress is being made to reduce GHG emissions. In this regard, the Parties recognize the integrated nature of the North American auto market and the engineering and production lead times for introducing new technologies to market.

In recognition of the preceding paragraphs which are hereby incorporated into and form part of this MOU, the Parties agree as follows:

#### **COMMITMENT**

1. This MOU voluntarily commits the Canadian Automotive Industry to achieving a 5.3 Mt reduction in GHG emissions from the light duty vehicle sector (cars and light duty trucks) in 2010 relative to the reference case, which will be the benchmark against which GHG emission reductions will be counted. The reference case is based on the 2010 forecast in the 1999 Transportation Table Report (Study 3) on Climate Change, which drew its assumptions on vehicle emissions from NRCan's 1999 emissions forecast *Canada's Emissions Outlook*. The reference case shall be updated in accord with the principles and procedures described in Annex 2.
2. The Parties agree that the Canadian Automotive Industry GHG performance calculation will include all GHGs recognized under the Kyoto Protocol that apply to the Canadian Automotive Industry. These include CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>, HFCs and other Kyoto gases that are equated to a CO<sub>2</sub> equivalent value (CO<sub>2</sub>e) in Mt.
3. The Canadian Automotive Industry will focus efforts on the introduction into the Canadian market place of advanced emission technologies, advanced diesel technology, alternative fuel vehicles, hybrids, high fuel efficiency technologies, and other GHG reducing technologies to accomplish the 5.3 Mt reduction (Examples of GHG reducing technologies are listed in Annex 3).
4. The Canadian Automotive Industry will support automotive research and development in Canada in the areas of lightweight materials, alternative fuels, hydrogen fuel cells and infrastructure, and other advances.

#### **JOINT COMMITTEE**

5. The Parties will form a joint Industry Government Committee (the "Committee") to ensure accountability for this MOU.
6. The Committee will be formed within 60 days from the signing of this MOU, will be composed of equal numbers of Government and industry members, and will be co-chaired. The Committee will table a mandate and its operational plan for approval by the parties no later than 180 days from the signing of this MOU. The design of the Committee will provide for mediation for early resolution of technical differences.
7. The Committee will assess and determine the application and use of equivalence factors associated with fuels and individual GHGs. The Committee will perform ongoing analysis of the internal and material external factors impacting automotive GHG emissions and where appropriate, will advise on remedial actions for the Canadian Automotive Industry to fulfill its voluntary commitment referenced in paragraph 1 by 2010.
8. The Committee will analyze GHG data and publicly report total industry performance on an annual basis, with interim projections of performance for the subject reporting year. The Committee will be responsible for monitoring and reporting of progress.



The Committee will draw from existing federal government data collection processes such as Transport Canada's VFEIS program and Environment Canada's Tier 2 vehicle emissions data base and other such sources as deemed appropriate.

#### **INTERIM GOALS**

9. The Parties agree to interim GHG emission reduction goals of 2.4 Mt in 2007, 3.0 Mt in 2008 and 3.9 Mt in 2009, to be measured against the Reference Case for the subject year. Commencing in 2005, the Canadian Automotive Industry will report its projections for GHG emissions for the coming model year by November 30. Actual performance shall be reported for each model year by May 31 following the model year. The Committee will use these forecasts and reports to track progress towards the 2010 objective.

#### **LEGAL LIABILITY**

10. While this MOU does not constitute or establish a legally binding agreement, the Parties confirm that this MOU reflects their mutual desire to work cooperatively to address the challenges posed by climate change.
11. For greater clarity, the Government of Canada has the right to regulate any and all subjects within the government's purview, and will do so if it deems necessary.
12. The parties agree that the taking effect of any legislation and its regulatory standards related to a subject covered by this MOU may result in the termination of this MOU without compensation or delay.

#### **DURATION**

13. This MOU will come into effect on the day of its signing and will remain in effect until at least December 31, 2010 or until one or both of the Parties determine that such an MOU is no longer desirable. Either party may terminate this MOU by giving 90 days notice in writing to the other party of its intention to end its participation in this understanding, or do so by mutual consent. Within and for the purposes of this MOU, the Parties acknowledge and agree that no further actions or measures are required if interim GHG goals are being met.
14. The Parties will consider additional GHG reduction targets beyond 2010, based on the experience of this MOU.

#### **AMENDMENT**

15. The Parties may amend this MOU at any time, in writing, by mutual consent. Any amendment becomes part of this MOU.

#### **NOTICE**

16. Any notice under this MOU shall be in writing to the Deputy Minister of Natural Resources Canada and the Presidents of the CVMA and the AIAMC.



IN WITNESS THEREOF, authorized officials of each of the Parties have executed this MOU hereto:

Her Majesty the Queen in Right of Canada  
as represented by the Minister of Natural Resources.  
The Honourable R. John Efford

The Canadian Automotive Industry has executed this Memorandum of Understanding as of the date specified on the first page of this document by the Board of Directors of the CVMA and the AIAMC, duly authorized for that purpose.

The Canadian Vehicle Manufacturers  
Association

Joseph R. Hinrichs, Chair, CVMA  
and  
President and CEO  
Ford Motor Company of Canada, Limited

The Association of International Automobile  
Manufacturers of Canada

Marcus Breitschwerdt, Chair, AIAMC  
and  
President and CEO  
Mercedes-Benz Canada Inc.



**ANNEX 1**

THIS IS ANNEX 1 TO THE MEMORANDUM OF UNDERSTANDING BETWEEN THE GOVERNMENT OF CANADA AND THE CANADIAN AUTOMOTIVE INDUSTRY MADE AS OF THE 5<sup>TH</sup> DAY OF APRIL, 2005.

**AUTOMOTIVE COMPANIES**

**BMW CANADA INC.**

**DAIMLERCHRYSLER CANADA INC.**

**FORD MOTOR COMPANY OF CANADA, LIMITED**

**GENERAL MOTORS OF CANADA LIMITED**

**HONDA CANADA INC.**

**HYUNDAI AUTO CANADA**

**JAGUAR CANADA, A DIVISION OF FORD MOTOR COMPANY OF CANADA, LIMITED**

**KIA MOTORS CANADA INC.**

**LAND ROVER CANADA, DIVISION OF FORD MOTOR COMPANY OF CANADA, LIMITED**

**MAZDA CANADA INC.**

**MERCEDES-BENZ CANADA INC.**

**MINI MOTOR SALES OF CANADA INC.**

**NISSAN CANADA INC.**

**PORSCHE CARS CANADA LTD.**

**SUBARU CANADA, INC.**

**SUZUKI CANADA INC.**

**TOYOTA CANADA INC.**

**VOLKSWAGEN CANADA INC.**

**VOLVO CARS OF CANADA LTD.**





## **ANNEX 2**

THIS IS ANNEX 2 TO THE MEMORANDUM OF UNDERSTANDING BETWEEN THE GOVERNMENT OF CANADA AND THE CANADIAN AUTOMOTIVE INDUSTRY MADE AS OF THE 5<sup>TH</sup> DAY OF APRIL, 2005.

### **REFERENCE CASE**

This MOU voluntarily commits the Canadian Automotive Industry to achieving a 5.3 Mt reduction in GHG emissions for the Light Duty Vehicle Sector in 2010. The reference case GHG emissions for 2010, as the benchmark against which GHG emission reductions will be counted, is based on the 2010 forecast in the 1999 Transportation Table Report (Study 3) on Climate Change, which drew its assumptions on vehicle emissions from NRCan's 1999 emissions forecast *Canada's Emissions Outlook: An Update, December 1999*, and the detailed Tables in the Annex to the Outlook, which are located at: <http://www.nrcan.gc.ca/es/ceo/update.htm>. The Reference Case greenhouse gas emissions for the light duty vehicle sector in 2010 are 90.51 Mt of CO<sub>2</sub>e.

Study 3 of the Vehicles and Fuels sub-committee, Transportation Climate Change Issues Table 1999, titled *Road Vehicle & Fuels Technology Measures Analysis*, determined the emissions reduction potential of various measures affecting technology and other changes in motor vehicles, and is the source of the analysis behind the reductions cited in this MOU. The study can be located at: [http://www.tc.gc.ca/programs/environment/climatechange/subgroups1/vehicle\\_technology/Vehicle\\_technology\\_sub.htm](http://www.tc.gc.ca/programs/environment/climatechange/subgroups1/vehicle_technology/Vehicle_technology_sub.htm). Study 3 contains detailed assumptions on key variables that determine vehicle emissions. Two types of variables can be distinguished:

1. factors which can be directly controlled by industry to affect vehicle emissions; examples would be engine fuel efficiency, fuel consumption degradation factors (on-road vs. tested), emissions factors relating to other greenhouse gases, such as nitrous oxide, methane and HFCs.
2. external factors that cannot be directly controlled by industry but which can directly or indirectly influence vehicle emissions; examples would be vehicle sales and sales mix, scrappage of vehicles, and annual kilometres travelled by vehicle age.

Updates of factors directly under the control of industry would normally not be subject to further updating for the purposes of the Reference Case against which performance will be measured. Improvement in actual performance against these factors throughout the period of the MOU would be the means by which industry made progress against the emissions target.

Updates of factors outside of industry's control would be made and the Reference Case adjusted to ensure that the calculated impact of industry efforts to meet the emissions reduction target fairly reflects industry's efforts.

As may be necessary, a professional third party, acceptable to both Parties acting reasonably, may be enlisted to assist in the assessment of both internal and external factors impacting the measures necessary for the Canadian Automobile Industry to achieve its GHG reduction goal. Either the government or industry may invoke the right to have a mutually agreed third party mediate in cases where there is disagreement over the treatment of a factor.



### **ANNEX 3**

THIS IS ANNEX 3 TO THE MEMORANDUM OF UNDERSTANDING BETWEEN THE GOVERNMENT OF CANADA AND THE CANADIAN AUTOMOTIVE INDUSTRY MADE AS OF THE 5<sup>TH</sup> DAY OF APRIL, 2005.

**BELOW IS A LIST OF POTENTIAL TECHNOLOGY IMPROVEMENTS TO VEHICLES THAT WOULD CONTRIBUTE TO A REDUCTION IN GHG EMISSIONS FROM VEHICLES.**

Note: Most of these technologies have related effects requiring re-engineering of associated systems, increased computer power and software sophistication, changes to assembly procedures and supplier systems. Some technologies will require further research, development and engineering work or may not be appropriate, feasible or cost-effective in certain vehicle applications.

#### **Powertrain Improvements and Features**

##### **Transmission**

- **Continuously Variable Transmission**
  - Enables the engine to run precisely at peak efficiency under a wide range of vehicle operating conditions
- **6+ Speed Transmissions**
  - Enables the engine to operate closer to peak efficiency more of the time
- **Advanced Overdrive Systems**
  - Enables the engine to operate at lower speed during highway operation, reducing friction losses & improving fuel efficiency (FE)
- **Electronically Controlled Torque Converters**
  - Adjusts torque converter settings to most efficiently match engine & transmission operation to vehicle requirements

##### **Engine**

- **Cylinder Deactivation** (Displacement on Demand, Variable Cylinder Management, etc.)
  - Application to V6 & V8 engines
  - Selectively shuts down engine cylinders based upon power demand
  - Cuts fuel, ignition & valve activity in certain cylinders
  - Reduced friction & pumping losses provide improved FE
- **Turbocharging & Supercharging**
  - Allows engine downsizing while maintaining required peak power
  - Smaller engine produces fewer friction & pumping losses
- **Variable Valve Timing & Lift (V V T)**
  - Optimizes valve operation over entire engine speed & load range
  - Engine produces more power, enabling downsizing & improved FE



**Other forms of valve control used to enhance engine efficiency include:**

- **Two Stage Valve Timing & Lift**
  - Valve timing & lift are selected for either high or low engine speed
  - Engine produces more power in low & high speed operating modes than with single stage timing, enabling downsizing & improved FE
- **Variable Valve Load Control**
  - Enables control of engine load without use of throttle
  - Reduced pumping losses result in improved FE
- **Cam Phasers**
  - Optimizes relative cam timing on twin overhead cam engines
  - Engine produces more power, enabling downsizing & improved FE
- **Electronic Throttle Control**
  - More quickly responds to changing engine operating conditions
  - Less unburned fuel due to more precise control leading to improved FE
- **Spark Ignition Direct Injection (SIDI)**
  - Fuel is injected directly into combustion chambers rather than intake
  - More efficient distribution of air/fuel mixture results in gasoline engines
- **Variable Induction Tuning**
  - Adjusts intake geometry maximizing air flow efficiency throughout the engine's speed range
  - Engine produces more power, enabling downsizing & improved FE
- **Port Deactivation**
  - Selective actuation of individual valves in a multi-valve head
  - Reduces internal engine friction, improving FE
- **Low Friction Engine Technologies**
  - Reduced friction, parasitic and pumping losses due to low tension piston rings, ceramic coatings, roller lifters, etc.
- **OBD II (On Board Diagnostics)**
  - Continuous monitoring detects & flags deterioration in engine performance which may affect FE
- **Common Rail Direct Injection for Diesels**
  - More efficient delivery of fuel to the cylinders (variable injection rate)
  - Improved engine efficiency especially during cold starts & reduced load
- **Engine Start Stop Systems**
  - Shuts down engine when power is not needed
  - Reduced idle fuel consumption improves FE
- **Dual Ignition**
  - Reduces combustion time & incidence of misfire
  - Engine efficiency increased through improved combustion
- **Combustion Optimization**
  - Enhanced air/fuel mixing, advanced ignition timing strategies, etc.
  - Engine efficiency increased through improved combustion
- **Reduced Friction Lubricants & Monitoring**
  - Advanced lubricants reduce friction losses between moving engine, transmission & differential components, improving FE
  - Engine lubricant monitoring promotes
- **Advanced Diesel Catalyst Systems**
  - Advanced catalysts required to meet stringent new emission standards
  - May enable high efficiency diesel engines to be used in future vehicles
- **Selective Catalyst Reduction Systems**
  - Additional aftertreatment for reduction of NOx in diesel engines
  - May enable high efficiency diesel engines to be used in future vehicles
- **Advanced Diesel Engines**
  - Use of electronic fuel injection enhances combustion efficiency

**Other Improvements (Applied to the Powertrain)**

- **System Controls for Towing & Heavy Loads**
  - Optimizes powertrain management under heavy loads
- **Regulated Voltage Controlled Fuel Pumps**
  - Electrical energy consumption varies with engine fuel demand
- **Electric Coolant & Power Steering Pumps**



- Reduced weight & parasitic losses by elimination of belts & pulleys
- Advanced Powertrain Controls
  - More comprehensive management of engine & transmission
  - Drivetrain components are more closely matched under a wider range of speed & load conditions, for improved FE
- High Efficiency Alternators
  - Reduce energy losses in production of vehicle electrical power
  - Improved FE due to decreased alternator power requirements
- Hydraulic Cooling Systems
  - Draws power only when needed to cool engine
- **Other Improvements (Applied to the Entire Vehicle)**
- Lightweight Materials
  - Reduce weight without compromising safety compliance
  - Moving less weight requires less fuel
- Advanced Modelling Tools
  - Drivetrain components are designed and manufactured using advanced systems and processes incorporating the latest technology
  - Vehicles are designed to meet or exceed all owner expectations in addition to satisfying all laboratory test requirements
- Improved Aerodynamics
  - Reduces drag & power demand, especially at highway speeds
  - Less power is required, improving FE
- Tire Pressure Monitoring System (TPMS)
  - Signals out-of-range air pressure in one or more tires
  - Low air pressure can have a significant negative impact on FE
- Low Rolling Resistance Tires
  - Produce less drag & reduced power requirements, improving FE
- Alternative Fuels
  - Renewable fuels such as ethanol (E10, E85), biodiesel & hydrogen produce much lower levels of GHGs than fossil fuels
- Hybrid Technology Vehicles
- Advanced Simulation & System Optimization Methods
  - Drivetrain components are designed & manufactured using advanced systems & processes incorporating the latest technology
  - Vehicle components incorporate the same advanced technology throughout all vehicle subsystems to maximize FE & durability
- On-Road Optimization
  - Vehicles are designed to meet or exceed all owner expectations in addition to satisfying all laboratory test requirements
- Future Hydrogen Technology Vehicles

## Appendix B. List of the Automotive Industry's Voluntary Agreements

This appendix provides a list of the Government of Canada's voluntary agreements with the automotive industry.<sup>1</sup>

In the past, the Government of Canada has had great success in negotiating voluntary agreements with the automotive industry in areas such as vehicle safety, fuel efficiency, vehicle emissions and pollution prevention. In total, there are 14 voluntary agreements in effect (ten on vehicle safety and four on vehicle fuel efficiency), two Memoranda of Understanding (MOU) that have been completed successfully on vehicle emissions, and one initiative on pollution prevention that is ongoing by industry on its own.

### *Vehicle Safety*

There are currently ten voluntary agreements on vehicle safety.

#### **Memorandum of Understanding Between Transport Canada and all Canadian Automobile Manufacturers on Side-Impact Protection**

The purpose of this MOU was to set out the general terms and conditions with regard to side-impact protection applicable to passenger cars, multi-purpose passenger vehicles, trucks and buses with a gross vehicle weight rating of 2722 kilograms (6000 pounds) or less, except for walk-in vans and certain other special purpose vehicles.

### **Driver and Passenger Front Air Bags**

In response to a 1989 letter from the Minister of Transport, manufacturers voluntarily began installing air bags in Canadian vehicles, on the same timetable as the U.S., in the absence of regulatory framework.

### **Anti-Lock Braking Systems (ABS)**

Manufacturers began installing ABS on vehicles in the late 1980s, and these systems are either standard or optional equipment on all vehicles today.

### **Traction Control, Stability Control and Roll Stability Control Systems**

In the mid-1990s, manufacturers began making these active systems available to provide enhanced vehicle control in adverse weather and road conditions.

### **Three-Point Lap and Torso Belt Systems in Centre Seating Positions**

Manufacturers began phasing-in centre rear three-point belt systems even though the regulations only require a two-point lap belt system. This voluntary initiative applied until September 1, 2005, at which time a regulation came into force.

### **Depowered Air Bags**

In response to public and government concerns regarding the deployment of "full-powered" air bags, manufacturers petitioned for new test procedures that allowed the installation of less aggressive air bags, starting with the 1998 model year.

### **Side Air-Bag Systems**

To provide enhanced occupant protection in side impacts, manufacturers began phasing-in side air bags in the late 1990s.

### **Internal Emergency Trunk Release**

Beginning in 2001, manufacturers began equipping Canadian vehicles with internal emergency trunk releases, complying with the U.S. FMVSS 401 standard, in the absence of any regulatory requirement to do so in Canada.

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<sup>1</sup> Source: MOU Announcement Backgrounder – April 5, 2005



### **Enhanced Interior Head Protection**

Starting in the 2000 model year, manufacturers began the phase-in of vehicles that met the requirements of the U.S. FMVSS 201 standard for enhanced head protection, even though there is no equivalent requirement in Canada.

### **Advanced Occupant Restraint Systems**

As early as the 2000 model year, manufacturers began introducing vehicles that have advanced occupant protection systems, including dual stage air bags, seat belt pre-tensioners and load limiters, and occupant classification systems.

### **Vehicle Fuel Efficiency**

Voluntary agreements on vehicle fuel efficiency consist of one voluntary program and three MOUs.

#### **Transport Canada Voluntary Motor Vehicle Fuel Consumption Program**

This voluntary program sets minimum levels of fuel efficiency performance for the automotive industry. Separate levels are set annually for new passenger cars and for new light duty trucks. A company's performance is measured by averaging fuel efficiency across its fleets. The levels are harmonized with U.S. fuel economy standards.

#### **Memorandum of Understanding between the Motor Vehicle Manufacturers' Association (MVMA) and Her Majesty the Queen in Right of Canada as represented by the Minister of Natural Resources concerning Motor Vehicle Fuel Efficiency**

This MOU was designed to support and enhance the important role that fuel-efficiency improvements can play in reducing greenhouse gas (GHG) emissions across the transportation sector. The most cost-effective method of realizing such improvement is through a balanced

approach aimed at vehicle owners and operators, as well as vehicle technology.

#### **Memorandum of Understanding between the Association of International Automobile Manufacturers of Canada (AIAMC) and Her Majesty the Queen in Right of Canada as represented by the Minister of Natural Resources concerning Motor Vehicle Fuel Efficiency**

Similar in details and in scope to the MOU signed between Natural Resources Canada (NRCan) and the MVMA (see above), this agreement recognizes the role that can be played by fuel efficiency in reducing GHG emissions across the transportation sector.

#### **Memorandum of Understanding between the Canadian Automobile Dealers Association (CADA) and Her Majesty the Queen in Right of Canada as represented by the Minister of Natural Resources concerning Motor Vehicle Fuel Efficiency**

Similar in details and in scope to the MOU signed between NRCan and the MVMA (see above), this agreement recognizes the role that can be played by fuel efficiency in reducing GHG emissions across the transportation sector.

### **Vehicle Emissions**

Emissions from automobiles and light-duty trucks have been regulated in Canada since 1971. Given the importance of harmonizing standards, MOUs have been used successfully as interim measures to account for updates in U.S. federal emissions programs, until appropriate Canadian regulations or legislation could be implemented.

#### **Memorandum of Understanding between the Motor Vehicle Manufacturers' Association (MVMA) and the Association of International Automobile Manufacturers of Canada (AIAMC) and Her Majesty the Queen in Right of Canada as represented by the Minister of Transport Canada for 1994–95 Model Year Light-duty Vehicles**

This MOU was signed between Transport Canada and the MVMA and the AIAMC for the 1994–95 model years. It set out general terms and



conditions applicable to a gasoline-fuelled, light-duty vehicle emissions phase-in program for model years 1994 and 1995, consistent with the phase-in objectives of the U.S. regulations (Tier 1 emissions standards). Amendments to the *Motor Vehicle Safety Act* (MVSA) came into force in 1995, providing new features to facilitate alignment with U.S. rules. Regulations were subsequently adopted under the MVSA in 1997 to align with U.S. Tier 1 standards.

**Memorandum of Understanding Between the Minister of the Environment, representing Her Majesty the Queen in Right of Canada and the Canadian Vehicle Manufacturers' Association (CVMA)<sup>2</sup> and the Association of International Automobile Manufacturers of Canada (AIAMC) for Light-duty Vehicle and Light-duty Truck Vehicle Emissions 2001–2003 Model Years**

This MOU was signed between Environment Canada and the CVMA, the AIAMC and their member companies. It was designed to provide for the sale of low-emission light-duty vehicles and light-duty trucks in the 2001–2003 model years consistent with a voluntary program in the U.S.

Regulations came into effect in January 2004 under the *Canadian Environmental Protection Act* (CEPA) to align Canadian regulations with U.S. Tier 2 emissions standards.

***Pollution Prevention***

There is currently one initiative on pollution prevention.

**Canadian Automotive Manufacturing Pollution Prevention Project**

This MOU was signed between Environment Canada, the Ontario Ministry of the Environment and the CVMA in 1992. It was designed to foster the concept of pollution prevention and had the specific goal of producing a verifiable reduction of toxic substances and other environmental contaminants of concern that are used, generated or released from the participating companies. The cooperative effort resulted in a reduction and/or elimination of more than 440 000 tonnes of toxic substances and other substances of concern, and demonstrates that large industry is proactive in progressive environmental management.

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<sup>2</sup> The MVMA was renamed the CVMA in 1996.

## Appendix C. Joint Government-Industry GHG MOU Committee – Terms of Reference and Operational Plan

### TERMS OF REFERENCE FOR THE JOINT GHG MOU COMMITTEE

#### The Government-Industry Monitoring Committee established pursuant to the MOU to track GHG Emissions from Light Duty Vehicles (the “Committee”)

#### Background

On April 5, 2005, the Government of Canada and the Canadian Automotive Industry signed a Memorandum of Understanding (MOU) whereby the Canadian Automobile Industry voluntarily committed to reducing greenhouse gas (GHG) emissions from the light duty vehicle sector (cars and light duty trucks) in Canada, to achieve a reduction in GHG emissions of 5.3 megatonnes (Mt) in 2010 relative to the reference case.

#### Mandate

The Committee is a key component of the MOU, responsible for tracking progress towards the Industry’s commitment to achieve a 5.3 Mt reduction target. The MOU provides for the following activities by the Committee:

- Data Collection – Identify the range and nature of data needed to track performance and to populate the tracking model(s) and define submission and reporting requirements as required. The Committee will draw from existing federal government data collection processes such as Transport Canada’s VFEIS program and Environment Canada’s Tier 2 vehicle emissions data base and other such sources as deemed appropriate.
- Reference Case Updates – The reference case shall be updated in accord with the principles and procedures described in Annex 2 of the MOU, to reflect new and up-to-date data as they become available.

- Monitoring and Forecasting – Once the reference case is established, the Committee will establish the approach and procedures for tracking performance against the interim annual goals specified in the MOU (the “Goals”) and the 5.3 Mt reduction commitment. The Committee will also establish an agreed-upon system for projecting the performance toward the Goals for the reporting year and perform ongoing analysis of the internal and external factors impacting this performance.
- Diagnosis – Determine whether industry performance is in line with the Goals; provide recommendations for further actions if industry performance has not achieved, or is not likely to achieve, the Goal for the subject year.
- Reporting – The Committee will approve an annual public report on total industry performance toward the Goals and a final report on the 5.3 Mt reduction commitment.
- Progress Updates – The Committee will provide periodic updates on its activities and progress.

The work of the Committee is to be technical in nature and the chairs will ensure the Committee does not stray into policy issues. The Committee will direct and approve the work to be undertaken. Natural Resources Canada (NRCan) staff will lead the analytical work, with input from other departments and industry, as appropriate. The decision to obtain input from modelling and technical experts will reside with the Committee.

#### Membership

The Committee will consist of eight members in total, with four representatives each from government and industry. There will be two chairs (co-chairs), one from government and one from industry.





Government representatives on the Committee will include a co-chair from NRCan and one member each from NRCan, Environment Canada and Transport Canada (“Government”).

Industry representatives will include two representatives or industry members from each of the two Canadian motor vehicle manufacturer associations (Canadian Vehicle Manufacturers’ Association and the Association of International Automobile Manufacturers of Canada) (the “Industry”).

Quorum will consist of a minimum of three Government and three Industry members. Member substitution at individual meetings will not be considered, but replacement members may be required in the future, if appointed members become unavailable.

Government and Industry will choose their own representatives with their appointment not requiring the approval of the Committee.

### **Decision Making**

The Committee will operate through a consensus, while respecting the views of those who may disagree from time to time.

As may be necessary, a professional third party, acceptable to both Government and Industry, acting reasonably, may be enlisted to assist in the assessment of “technical issues” where the Committee cannot reach agreement. Either the Government or Industry may invoke the right to have a mutually agreed third party mediate in cases where there is disagreement over technical issues.

### **Term of Committee**

The Committee will remain active until:

- 1) the time when a report and conclusion can be made relating to the 5.3 Mt reduction commitment in the year 2010; or
- 2) December 31, 2012; or
- 3) termination of the MOU.

### **Milestones**

As provided in the MOU, the Committee was formed within 60 days from the MOU’s signing (April 5, 2005). The Committee will table a mandate and its operational plan for approval no later than 180 days from the signing of the MOU (Sunday, October 2, 2005).

### **Administration**

#### **Budget**

The budget for the Committee will be drawn from the Government of Canada’s climate change funds for the Motor Vehicle Fuel Efficiency Initiative, and the Committee will approve its disposition.

#### **Secretary**

A secretary shall be approved by the Committee and need not be a member of the Committee. The secretary will work closely with the Committee but will not be a voting member unless the secretary is a member of the Committee otherwise than as a secretary.

The secretary will be responsible for:

- convening meetings
- recording decisions
- following up on actions
- drafting correspondence
- administrative support to Committee activities such as data procurement, analysis, contracting and preparation of materials

#### **Meeting Frequency**

Meetings shall be scheduled semi annually for the duration of the MOU. The co-chairs may also call meetings, when required. Initially, more frequent meetings will be required to establish the work of the Committee.



## OPERATIONAL PLAN FOR THE JOINT GHG MOU COMMITTEE

<b><i>Task</i></b>	<b><i>Date</i></b>
<b>Meetings of the Joint GHG MOU Committee</b>	
▪ Inaugural meeting and confirmation of joint government-industry members	June 10, 2005
▪ Meetings to be scheduled bi-annually, or more frequently at the call of the co-chairs	TBD
<b>Terms of Reference</b>	
▪ Committee adoption	October 2, 2005
<b>Process for Resolution of Technical Issues</b>	In process
<b>Communications Plan</b>	
▪ Develop plan for outreach and communications	First quarter 2006
<b>Operational Plan</b>	
▪ Committee adoption	October 2, 2005
▪ Plan implementation	Ongoing
• Data collection	
• Reference case updates	
• Monitoring and forecasting	
• Diagnosis	
<b>Review and Assessment of Operational Plan</b>	As required
<b>Committee Reports</b>	
Committee progress update – First	<b>Period Ending</b> First quarter 2006
Committee progress update – Second	Fourth quarter 2006
Committee progress update – Third	Second quarter 2007
Report on 2007 Interim Goal	May 2008
Report on 2008 Interim Goal	May 2009
Report on 2009 Interim Goal	May 2010
Report on 2010 Target	May 2011



## Appendix D. Key Milestones under the Operational Plan

### Committee Reports

Committee progress update – First  
Committee progress update – Second  
Committee progress update – Third  
Report on 2007 Interim Goal  
Report on 2008 Interim Goal  
Report on 2009 Interim Goal  
Report on 2010 Target

### Period Ending

First quarter 2006  
Fourth quarter 2006  
Second quarter 2007  
May 2008  
May 2009  
May 2010  
May 2011

## Appendix E. Advanced Technology Introductions by the Automotive Industry

### BMW Canada Inc.

- 6 series and 7 series automobiles: Introduction of Valvetronic into 8- and 12-cylinder engines with both variable valve timing and variable valve lift, eliminating the throttle body; these engines are approximately 15 percent more efficient; 6-speed transmissions in either manual or automatic
- 2006 model year 325, 330, 525 and 530 series sedans and station wagons: Introduction of Valvetronic into 6-cylinder engines in 80 percent of BMW fleet, with both variable valve timing and variable valve lift to eliminate the throttle body
- 2006 model year: Introduction of 6-speed automatics into all 3 series and 5 series automobiles
- 2006 model year M5: Introduction of 7-speed automatic shifting manual transmission
- 2006 model year 3 series: lightweight aluminum and magnesium engine
- Two-mode hybrid development with General Motors and DaimlerChrysler

### Daimler Chrysler Canada Inc.

- 2007 model year new Dodge Caliber compact car available with three new 4-cylinder World Engines with dual Variable Valve Timing (VVT) and intake manifold with flow control valves, 5 percent improved fuel efficiency over the engines they replace
- 2007 model year new Dodge Caliber compact car available with a second generation Continuously Variable Transmission (CVT2), 6–8 percent improved fuel efficiency compared with a traditional 4-speed automatic
- 2006 model year Dodge Durango: Multi-displacement system (MDS) on 5.7-L engine applications
- 2006 model year Jeep Commander: Multi-displacement system (MDS) on 5.7-L engine applications, engine knock sensor, tire pressure monitoring standard
- 2006 model year: Offering of ethanol (E85) flexible fuel vehicle (FFV) in Chrysler Sebring, Dodge Caravan, Caravan C/V, Grand Caravan, Grand Caravan C/V, Dodge Ram 1500 2x4, Ram 1500 4x4, Dodge Durango
- Two-mode hybrid development with General Motors and BMW

- 2006 model year: Introduce use of lower viscosity 5W20 Oil
- 2006 model year Chrysler 300, Chrysler 300C, Dodge Magnum, Dodge Charger: Multi-displacement system (MDS) on 5.7-L engine applications, 5-speed automatic transmission, electronically modulated converter clutch (EMCC), transmission variable hydraulic line pressure for 2.7-L engine applications
- 2006 model year Dodge Ram Pickup: Increased compression ratio on 3.7-L engine, engine knock sensors, 6-speed manual replaces 5-speed manual, brake drag reductions, lower rolling resistance tires, transmission variable hydraulic line pressure for 3.7-L engine applications, multi-displacement system (MDS) on 5.7-L engine applications (light duty trucks), front axle disconnect on 4-wheel drive vehicles
- Chrysler PT Cruiser, Chrysler PT Cruiser Convertible: Electronically modulated converter clutch (EMCC)
- Dodge Dakota: 3.7-L, 6-cylinder engine 6 percent more fuel efficient, 8-cylinder engines 4 percent more fuel efficient; 6-speed manual transmission replaces 5-speed manual
- Jeep TJ: 6-speed manual replaces 5-speed manual
- Jeep Liberty: Increased Compression Ratio on 3.7-L engine; 6-speed manual replaces 5-speed manual; introduce 2.8-L 4-cylinder turbo common rail diesel. Diesel Liberty CRD factory fuelled with 5 percent biodiesel blend
- Jeep Grand Cherokee: 3.7-L engine replaces 4.0-L engine, multi-displacement system (MDS) on 5.7-L engine applications, electronically modulated converter clutch (EMCC)

### Ford Motor Company of Canada, Limited

- 2007 model year 4.6-L Explorer Sport-Trac: 6-speed automatic transmission
- 2007 model year 3.5-L Ford Edge and Lincoln MKX: 6-speed automatic transmission and variable cam timing
- 2007 model year 5.4-L Expedition: 6-speed automatic transmission
- 2006 Escape Hybrid: Full hybrid offering up to 50 percent improvement in fuel consumption
- 2006 Freestyle: Continuously variable transmission (CVT)
-



- 2006 Five Hundred: Includes both continuously variable transmission (CVT) and 6-speed automatic transmission
- 2006 model year Fusion and Zephyr: 6-speed automatic transmission and variable valve timing
- 2006 model year 4.6-L Explorer: 3-valve head, variable valve timing and 6-speed automatic transmission
- 2006 model year Mustang: 5-speed and 6-speed automatic transmissions; 6-speed manual transmission
- Most 2006 model year vehicles: Electronic throttle control
- 2006 model year Taurus available as a flexible fuel vehicle (FFV) capable of running on E85 (85 percent ethanol)
- 2006 model year, Ford will offer ethanol (E85) flexible fuel vehicle (FFV) capability on F-Series trucks, Crown Victoria, Grand Marquis and Lincoln Town Car
- Ford launched a three-year real world demonstration of five Ford Focus Fuel Cell Vehicles in Vancouver in April 2005
- GM's hybrid propulsion system is currently offered on transit buses providing significantly better fuel efficiency than traditional transit buses and dramatically reduced emissions
- Hybrid pickup truck: 2006 GMC Sierra and Chevrolet Silverado models
- 2007 Saturn VUE Green Line Hybrid: Combination of price and reduced fuel consumption benefits are intended to make this the best value hybrid system on the market
- 2008 Tahoe/Yukon Two Mode Hybrid: Leverages GM's leadership in automatic transmissions and electronic controls with integrated, powerful and compact electric motors to provide full hybrid capability and efficiency as well as superior acceleration and continuous power
- Six-speed Allison 1000 series automatic transmission applied to certain pickup trucks – 2006 Chevrolet Silverado and GMC Sierra
- GM's Regional Engineering Centre in Oshawa continues to work on the development and application of hybrid technology for GM's global vehicle portfolio

### General Motors of Canada Limited

- GM offers a range of 4-, 5-, 6-, and 8-cylinder engines with variable valve timing (VVT). The 2006 model year Impala has the first cam-in-block VVT application in the industry.
- Active Fuel Management (AFM) seamlessly deactivates 4 cylinders under light loads to provide fuel savings on a wide array of V8 engine applications: 2006 Trailblazer / Envoy, 2005/06 Trailblazer EXT / Envoy XL, 2006 Saab 9-7X, 2006 Rainier, 2007 Tahoe / Suburban, 2007 Yukon / Yukon XL, 2006 Grand Prix GXP, 2006 Monte Carlo and Impala SS
- Ethanol (E85) blended fuel option available on Chevrolet Impala, GMC and Chevrolet full-size pickup trucks and sport utility vehicles, including the Tahoe, Suburban, Avalanche, Silverado, Yukon and Sierra
- Improved power density through supercharging and turbocharging facilitates the use of smaller displacement engines: Cobalt SS, Ion Red-Line, Saab 9-3, and Saab 9-5
- GM patented Regulated Voltage Control (RVC) technology optimizes battery charging for improved fuel efficiency: broad portfolio application

### Honda Canada Inc.

- 2006 model year Odyssey, Accord hybrid and Civic hybrid: VCM (Variable Cylinder Management)
- 2006 model year Civic hybrid: DSI (Dual Spark Plug Ignition)
- 2006 model year Accord Hybrid, 2006 model year Civic hybrid: Hybrid Air Conditioning system
- Most 2006 models: DBW (Drive by Wire)
- 2006 model year Acura RL, TL, MDX, Honda Pilot and Ridgeline: TPMS (Tire Pressure Monitoring System)
- 2006 model year Acura MDX, Honda Pilot and Ridgeline: VTM-4 (Variable Torque Management System)
- 2006 model year Civic, Accord, CR-V, Element and Acura RSX and CSX: i-VTEC + VTC (Intelligent Variable Valve Timing & Lift Electronic Control + Variable Timing Control)
- Odyssey, Accord hybrid, Civic hybrid: i-VTEC + VCM (Intelligent Variable Valve Timing & Lift Electronic Control + Variable Cylinder Management)
- Acura EL, TL, RL, NSX, MDX; Pilot; Civic Si; S2000 and Ridgeline: VTEC (Variable Valve Timing and Lift Electronic Control)



### Hyundai Auto Canada

- 2006 model year Elantra, Tiburon, Accent, Sonata, Azera, Tucson: Continuously variable valve timing on 2.0-L, 2.4-L, 3.3-L and 3.8-L engines
- Adoption of low viscosity 5W20 engine oil on all vehicles and lower viscosity 75W-90 manual transaxle oil
- 2006 model year: Introduction of 5-speed automatic transaxles with variable line pressure control
- 2006 model year: Introduction of variable angle swash plate air conditioning compressors which reduce engine load
- 2006 model year: Open-type water cooling jackets on 2.4-L, 3.3-L and 3.8-L engines reduces engine warm up time
- 2006 model year 2.7-L Tiburon: 6-speed manual transaxle
- 2006 model year: 2.4-L engine with dual stage oil pump with bypass to provide the required amount of oil pressure, reducing pumping losses and wasted energy
- 2007 model year Santa Fe and Entourage: Lightweight all-aluminum engines with variable valve timing

### Mercedes Benz Canada Inc.

- smart fortwo and M-B E320CDI vehicles equipped with advanced diesel technology engines
- 2006 model year: CVT transmission in the new B-Class and 7-speed transmission in passenger cars with V6 engines
- New M-Class (Sport Utility Vehicle): 7-speed automatic transmission
- 2007 model year GL Class: V8 engine variable valve timing, aluminum block and cylinder heads with low friction silicon-aluminum cylinder liners with secondary internal exhaust gas recirculation

### Mazda Canada Inc.

2007 MZR 2.3 DISI Turbo engine; direct fuel injection, using an atomized spray delivered directly into the combustion chamber improving fuel consumption and reducing emissions; also available in Mazda 3, 6 and the new CX-7 Crossover vehicle

### Suzuki Canada Inc.

- 2006 Grand Vitara, 2006 XL-7: 5-speed automatic replacing 4 speed
- 2006 Grand Vitara, 2006 Swift+, 2006 Verona: Throttle by wire

### Toyota Canada Inc.

- 2006 model year Prius, Highlander Lexus 400h: Equipped with Hybrid Synergy System
- 2007 model year Camry, Lexus GS 450h: Equipped with Hybrid Synergy System
- 2007 model year Lexus LS 460: World's first 8-speed automatic transmission
- 2006 model year Lexus LS 430, Lexus GS300: Dual variable valve timing
- 2006 model year Lexus 250/350: Direct injection gas engine
- 2006 model year Lexus IS 250/350, Lexus SC430, Lexus LS430, Lexus GS 300/430: 6-speed automatic
- Avalon: Dual variable valve timing
- Prius, 2006 model year Lexus IS250/350, Lexus GS 300/430: Electric power steering
- Prius: Weight reduction aluminum body panels
- Lexus SC 430: Weight reduction aluminum body panels

### Volkswagen Canada Inc.

- 2006 model year Jetta TDI: Turbocharged, diesel, direct injection 1.9-L engine with high pressure injector fuel atomizer at each cylinder
- 2006 model year Golf: 6-speed automatic transmission
- 2007 model year Passat Wagon, Audi Q7: 6-speed transmission
- 2006 model year Golf GTI: Turbocharged 2.0-L engine with drive-by-wire throttle control and fuel straight injection (FSI)
- 2007 Passat Wagon: 2.0-L turbocharged, intercooled direct injection engine with variable valve timing
- 2007 Audi Q7: Fuel straight injection (FSI) on 4.2-L engine