

**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 CO₂, N₂O, CH₄, HFCs and other Kyoto gases that are equated to a CO₂ equivalent value (CO₂e) 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 5TH 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.

MITSUBISHI 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 5TH 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 CO₂e.

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. 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 5TH 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