



## Council of Deputy Ministers Responsible for Transportation and Highway Safety: Task Force on Vehicle Weights and Dimensions Policy

Transport Canada: *ecoTECHNOLOGY for Vehicles Program (eTV)*

December 5, 2012





## Purpose

The purpose of the presentation is to:

1. Provide a brief overview of Transport Canada's ecoTECHNOLOGY for Vehicles Program; and,
2. Present an update on the eTV program's multi-year testing & evaluation work-plan.





## About Transport Canada's ecoTECHNOLOGY for Vehicles Program

- Part of Canada's \$870M *Clean Air Agenda* announced in 2011, eTV is a \$37.9M Government of Canada program that tests and evaluates advanced light-duty vehicle (LDV) and heavy-duty vehicle (HDV) technologies.
- Focus of the program is on **near-term commercial technologies** that are anticipated to enter the Canadian market over the next 10-15 years.
- Transport Canada's eTV program coordinates testing priorities and shares results with key Canadian federal departments (i.e. Environment Canada, Natural Resources Canada), Provinces (i.e. Federal/Provincial working groups).
- Program results are being used by Canada to:
  - inform the development of future vehicle environmental regulations;
  - guide the proactive development of new or revised safety regulations, standards, codes and guidelines; and,
  - support the development of non-regulatory industry codes and standards that anchor the market and industry efforts to integrate new vehicle technologies.





## PROGRAM ACTIVITIES AND OUTCOMES

### Key activities include:

- in-depth integrated safety, performance and environmental testing of LDV and HDV technologies – will be conducted in laboratories, on test tracks, and in real world conditions;
- sharing or publishing technical reports, recommendations and guidance documents to inform the development of safety and GHG emissions regulations;
- input of technical information to support the development and alignment of non-regulatory (industry-based) codes and standards; and,
- participating in efforts to align codes, standards and regulations to support North American and global harmonization.



### Key program outcomes include:

- Government of Canada able to assess the safety and environmental performance of advanced vehicle technologies and respond within regulatory framework;
- faster, safer and more cost-effective introduction of advanced technologies;
- increased alignment of codes and standards that better reflect Canadian realities;
- a more transparent and predictable market for Canadian technology development and equipment suppliers; and,
- economic benefits to Canadians through increased fuel savings and increased commercialization of technologies.



## TECHNOLOGY PRIORITIES

- The program's Federal Steering Committee has endorsed the program's Multi-Year Testing & Evaluation Work-Plan, which included testing activities organized into **six high-level technology priorities**:
  1. **Electric Vehicles**, including battery electric and plug-in hybrid vehicles;
  2. **Natural Gas Technologies**, including compressed natural gas (CNG) and liquefied natural gas (LNG);
  3. **Biofuel Technologies**, including biodiesel and various ethanol blends;
  4. **Hydrogen & Fuel Cell Technologies**;
  5. **Light-duty Vehicle Power-train, Emissions and Aerodynamic Improvements**; and,
  6. **Heavy-duty Vehicle Power-train, Emissions and Aerodynamic Improvements**.

The program is currently reviewing **intelligent transportation system technologies** for inclusion as a seventh technology area.







## ecoTECHNOLOGY for Vehicles: Multi-year work-plan

- A Technical Expert Workshop was held on February 9, 2012 in Ottawa, Ontario.
- Over fifty scientists, engineers, policy analysts and other technical specialists from across six federal departments and three U.S agencies attended.
- Six sessions were held around each of the program's key technology priorities. Based on these discussions, **twenty testing campaigns** have been identified over the next 3-4 years.
- Working-level technical committees, comprised of key representatives from government were formed to develop and support each project, and to build linkages with industry, academics and non-profit sectors.
- Over **15 testing program are currently underway** in laboratories, on test tracks and through on-road trials across North America.





## RECENTLY COMPLETED TESTING CAMPAIGNS

- Investigation of the traction performance of low rolling resistance and single-wide tires in winter conditions.
- Testing of EV audible alert systems to support *Regulatory Cooperation Council* efforts to develop quiet vehicle safety standards.
- Cold weather testing on plug-in hybrid vehicles and battery electric vehicles to contribute to SAE standards development (SAE J1634, SAE J1711).



Rolling resistance and durability testing (Smithers Rapara)



GM Cold Weather Facility, Kapuskasing, ON



## **ON-GOING TESTING: HEAVY-DUTY VEHICLE POWER-TRAIN, EMISSIONS SYSTEMS AND AERODYNAMIC IMPROVEMENTS**

### **Enhancing the drag reduction evaluation of HDV aerodynamic technologies**

- Three-year project with the Canadian National Research Council's Institute for Aerodynamic Research.
- Project will significantly enhance modelling of real-world performance of HDV aerodynamic devices, i.e. development of a Ground Effect Simulation System, correlation of results with on-road wind measurements, based on OEM HDV models.
- Results will help identify optimal combinations of aerodynamic technologies to enhance HDV aerodynamic efficiency.
- Subset of this project also will look at boat-tails in Canadian operating conditions.

### **Use of LIDAR to enhance reliability of vehicle aerodynamic drag assessments**

- Project to develop and validate a non-intrusive wind LiDAR and associated analytical methods to enhance the reliability of aerodynamic drag assessments from test tracks.
- Will help measure free-stream wind velocity vector far forward of a travelling vehicle, enhancing reliability and accuracy of aerodynamic drag coefficient measurements.
- Results will help inform the development of coast-down test procedures for HDVs, and the development of aerodynamic technologies for HDVs.

### **Use of cameras as HDV side-mirrors**

- Part of a larger project that is investigating drag reduction technologies for HDVs that will look at replacing HDV side mirrors with on-board camera systems.
- Phase one (FY2012-13) will involve developing a conceptual method to evaluate camera concepts and wind tunnel testing.
- Phase two (FY 2013-14) will involve conducting preliminary on-road in-field trials to examine operational and human factors considerations.





## ONGOING TESTING: ELECTRIC VEHICLES

### Cold Weather Performance Investigations

- Dynamometer testing to gather actuarial data on the performance of various EVs after several Canadian winters.
- Extended severe cold weather performance testing (up to  $-40^{\circ}\text{C}$ ) of several battery electric vehicles to be conducted in Winter 2013.

### Quiet Vehicle Audible Alert Systems

- Conducted phase II testing on audible alert systems for quiet vehicles to support Canadian RCC efforts, in partnership with TC's Road Safety group and NHTSA.

### Battery Safety Investigations

- Partnership with TC's Road Safety Group, which is leading the Canadian portion of RCC efforts with NHTSA to evaluate EV battery safety.

### Support for Canadian Codes & Standards Development

- Participating in efforts to modernize and align the *Canadian Electric Code* with US standards (UL) for electric vehicle service equipment.



Mitsubishi iMiEV undergoing cold weather testing.



Quiet vehicle noise emissions testing



## ON-GOING TESTING: RENEWABLE FUELS



### Emissions testing of gasoline direct injection engines and various ethanol blends

- Emissions testing of GDI vs. PFI engines to assess the effects of various ethanol levels on PM emissions at various temperatures and blends to support RCC Air Pollutants (black carbon) work-plan.
- Long-term mileage accumulation and re-testing will be performed over a 24 month period.
- Results will also support the development of reference fuel requirements for engine/vehicle certification.

### Emissions testing of renewable diesel

- Emissions testing of renewable diesel fuels/blends to measure emissions performance (including black carbon), cold temperature operation, and long-term effects of different renewable fuels on emission treatment systems and engine components.
- Long-term mileage accumulation and engine tear-down on several light HDV trucks will be performed.
- Results will support RCC Air Pollutants (black carbon) work-plan.



## ON-GOING TESTING: COMPRESSED NATURAL GAS

### Environmental and Performance Testing of CNG/LNG Vehicles

- Laboratory testing (emissions/energy consumption) of several OEM dedicated and bi-fuelled CNG light-duty and heavy-duty trucks and Class VIII LNG tractors.

### LNG Fuel Systems Safety Testing

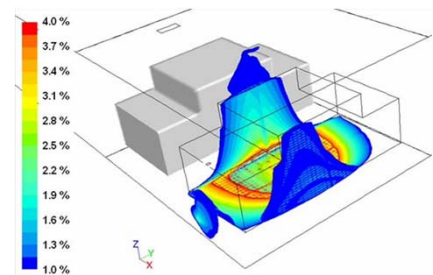
- Working with TC's Road Safety Division to assess the regulatory requirements for LNG vehicles.

### CFD Modelling of a Natural Gas Leak In an Enclosed Structure

- Conducting a qualitative and quantitative analysis of the risks of a leak from a CNG vehicle in an enclosed structure, versus conventional fuels.
- A computational fluid dynamics model will be developed and validated against stakeholder input and real-world CNG leakage incidents;
- Supporting the development of Canadian building code & CNG installation standards.

### (Proposed) Evaluation of the winter performance of CNG Refuse Trucks

- Study of the winter performance capability of 58 OEM CNG refuse trucks in Winnipeg, MB.
- Under the auspices of the with NG Technical Advisory Group.





## LIGHT-DUTY VEHICLE POWER-TRAIN AND EMISSIONS SYSTEMS AND AERODYNAMIC IMPROVEMENTS

### Alternative Fuel Cross-Comparison

- Laboratory dynamometer testing to cross-compare various conventional and alternative fuelled vehicles over regulated duty cycles and temperatures.
- Cross comparisons will include electric, plug-in hybrid, CNG, propane, diesel and gasoline variants of equivalent platforms.
- Supports Canadian participation in the International Energy Associations' *Advanced Motor Fuels* agreement.





## AREAS OF POTENTIAL FUTURE TESTING

- The program is currently consulting with key Canadian federal departments, industry and other program stakeholders about several areas of future testing priorities, including:
  - **Intelligent Transport Systems:** connected vehicle system in Canadian operational conditions, e.g. heavy-duty vehicle platooning concepts, environmental & safety impacts.
  - **Field Operational Trial to Assess the Influence of in-vehicle fuel consumption displays and training** on driver behaviour.
  - **Low friction lubricants & advanced transmission technologies**, e.g. improvements in emissions, fuel consumption performance.
  - **Hydrogen fuel cell vehicle** safety, energy consumption and range testing;
  - **Light-weighting materials.**





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