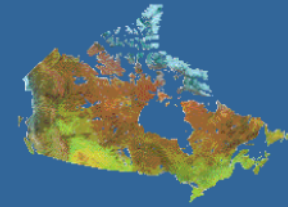


**Presentation to APEC Expert Group  
on New and Renewable Energy  
Technologies**



**“New and Renewable Energies in  
Transportation”  
CANADA**

**Alex MacLeod**

**Washington DC**

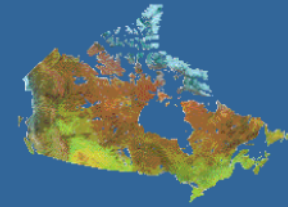
**February 28 to March 4, 2011**



Natural Resources  
Canada

Ressources naturelles  
Canada

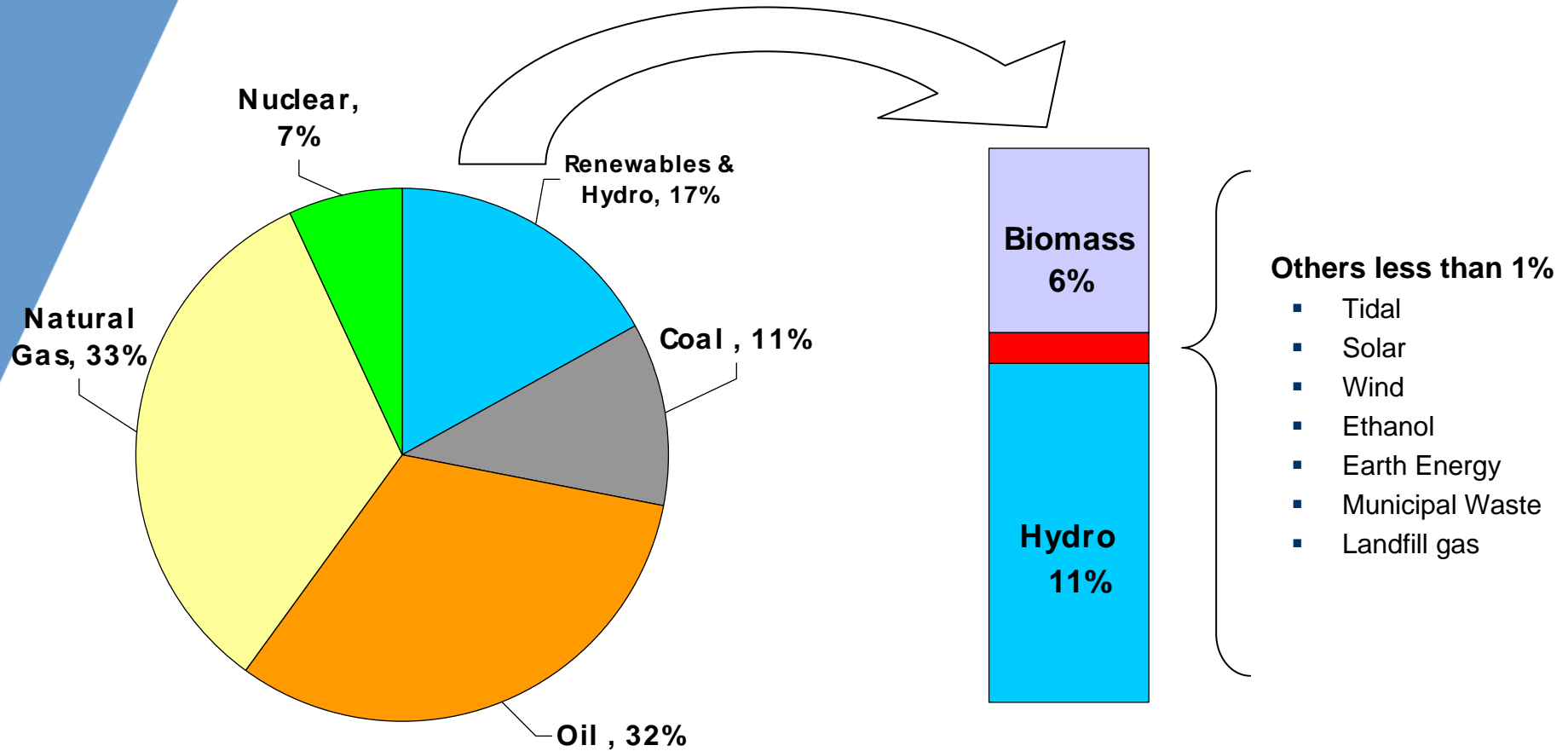
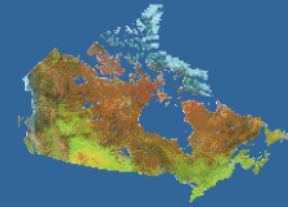
**Canada**



- Energy Supply
- Policy
- Initiatives
- Programs
- International Activities



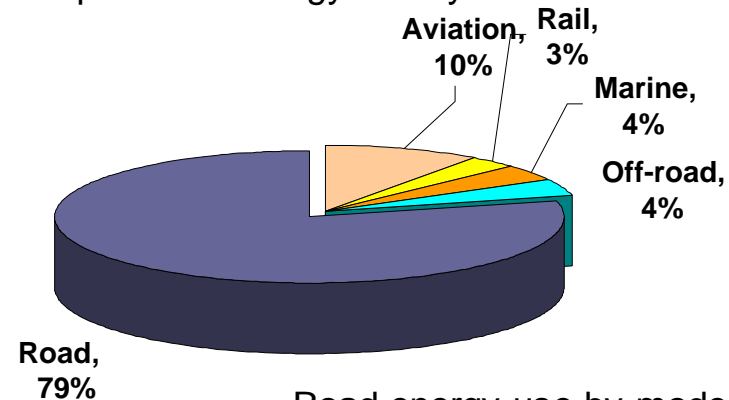
# Canada's Energy Supply



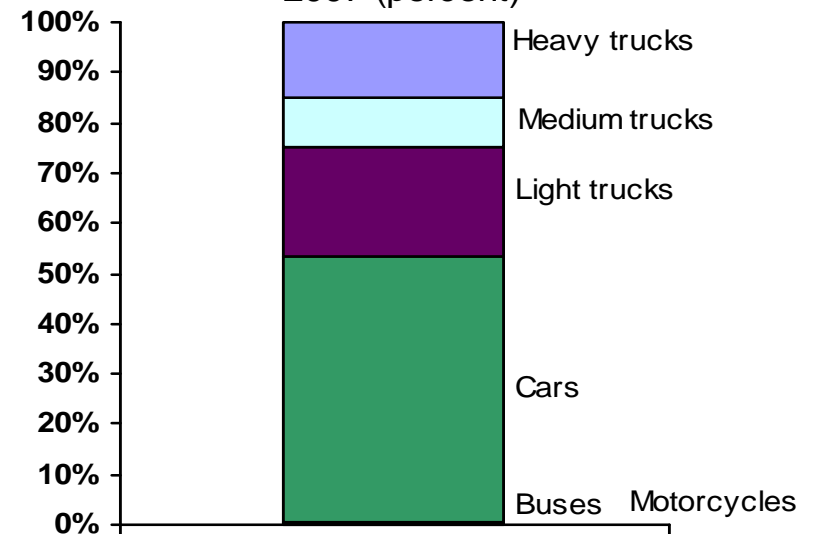
# Transportation Sector's Growing Energy Use and Emissions pose a National Challenge...

- 90% of gasoline and diesel is used in transport
- <5% of energy used in Canada's transportation sector is from low carbon energy sources such as biofuels
- 27% of Canada's GHG emissions - largest Canada:
- Emission of criteria air contaminants impact air quality and health

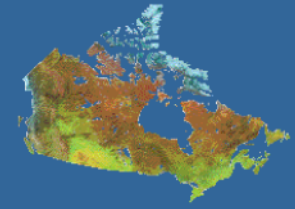
Transportation energy use by mode



Road energy use by mode, 2007 (percent)



# Policy Drivers



- Policy drivers for Canada include:
  - Moving to a low-carbon economy
  - Green economic recovery and growth
  - Clean energy
  - Climate change
- Activities in the transportation sector must have an integrated approach to transition to a new low-carbon reality (energy -> vehicles -> end-use).

Activities can have economic benefits through technology development, development of clean energy supplies, and ensuring competitiveness of Canadian industry.



# Three Pillars to Reduce the Carbon Intensity of Transport Sector ...

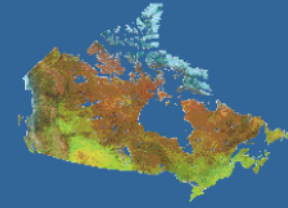


Fuels	Fleet Efficiency	System Efficiency
<ul style="list-style-type: none"> <li>▪ Improve characteristic of the existing fuel mix based on GHG life-cycle</li> <li>▪ Advance research, development and demonstration of alternative fuels</li> <li>▪ Regulation</li> </ul>	<ul style="list-style-type: none"> <li>▪ Deployment of more fuel efficient fleets via regulatory, fiscal or economic instruments</li> <li>▪ Support current best practices</li> <li>▪ R&amp;D in emerging technologies</li> <li>▪ Reduce total distances travelled</li> </ul>	<ul style="list-style-type: none"> <li>▪ Improve efficiency and sustainability of modes within current system</li> <li>▪ Promote alternative, less intensive modes</li> <li>▪ Enhance user awareness</li> </ul>

Transition to clean energy use in the transportation sector must address both short term as well as long term target areas that require significant ongoing investment.



# Interest and Responsibility in these Three Pillars is Shared

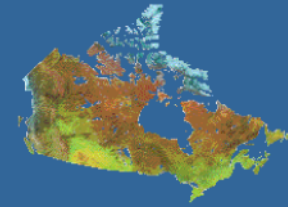


- Federal:
  - **Natural Resources Canada:** legislative role in energy conservation and efficiency as well as alternative fuels and energy policy.
  - **Environment Canada:** capacity to regulate GHG and air pollutants under CEPA.
  - **Transport Canada:** transportation systems, modal shifting, vehicle technology, and safety. Emissions from other modes
  - **Various Departments and Agencies:** Research and Development
- Provincial:
  - Energy conservation and efficiency; fuels and energy policy; fuels standards; fuel tax; and,
  - Road policies such as speed limits, weights and dimensions, and licensing of commercial and light-duty vehicle drivers.

Collaboration between federal departments and other levels of government is essential to the development of an effective transportation energy policy. Each has a role to play.



# Vehicle Energy Efficiency

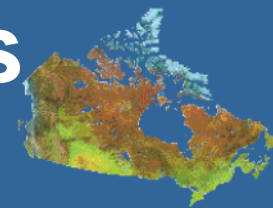


- ecoENERGY for Fleets - improve the behaviour of commercial drivers and promote the uptake of fuel efficient fleet technologies
- ecoENERGY for Personal Vehicles - improve the driving behaviour of personal vehicle drivers and promote the purchase of more energy efficient vehicles.





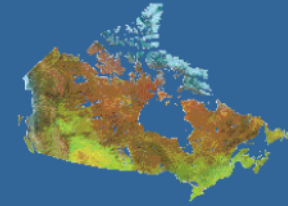
# Canadian Renewable Fuels Strategy



- 1. Establish demand through regulation**
  - 5% based on the gasoline pool December 15, 2010
  - 2% in the diesel and heating oil pool by July 1, 2011 subject to performance testing
  - Regulation published in Canada Gazette Part I April 2010
- 2. Stimulate domestic production**
  - ecoENERGY for Biofuels (up to \$1.5 billion over 9 years)
- 3. Support farmer participation in biofuels production**
  - ecoABC (\$200 million over 4 years with repayable contributions of up to \$25 million per project)
- 4. Deployment of next-generation technologies**
  - NextGen Biofuels Fund™ (\$500 million over 8 years)



# Biofuels Blending Mandates

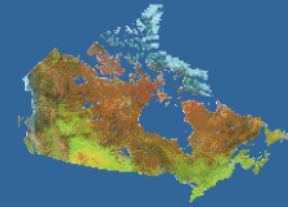


Province	Mandate Average Renewable Content in Gasoline	Date Effective
British Columbia	5.0%	Jan. 01, 2010
Alberta	5.0%	Apr. 01 2011
Saskatchewan	7.5%	Jan. 15, 2007
Manitoba	8.5%	Jan. 01, 2008
Ontario	5.0%	Jan. 01 2007
Quebec	<u>Target</u> : average 5.0% ethanol in gasoline	2012

Province	Mandate Renewable Diesel Content	Date Effective
British Columbia	3.0% 4.0% in 2011 5.0% in 2012	Jan. 01, 2010
Alberta	2.0%	Apr. 01 2011
Manitoba	2.0%	Nov. 01, 2009



# National Renewable Diesel Demonstration Initiative



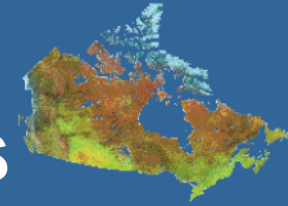
*To address industry and end-user questions about renewable diesel use by demonstrating how it will perform under Canadian conditions*

Questions such as:

- cold temperature operability;
- long term storage stability;
- interaction with seasonal variations of ULSD;
- materials/engine compatibility;
- distribution and storage infrastructure, etc;



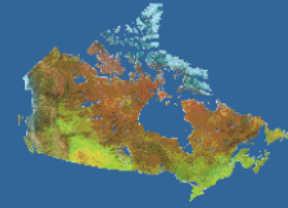
# National Renewable Diesel Demonstration Initiative Status



- Program launched in December 2008
- Projects completed:
  - Imperial Oil: cold flow, stability
  - Royal Military College: formation of impurities
  - Gensets: long-term storage
  - Forestry and Construction: use, infrastructure
  - Agriculture: use, storage
  - Rail: locomotives



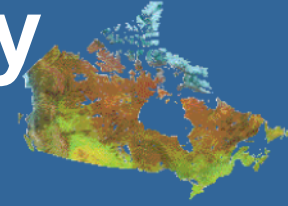
# Natural Gas Roadmap



- Joint industry-government effort to explore NG applications in the transportation sector
  
- Working groups focused on assessing:
  - NG markets and supply forecasts,
  - Vehicle readiness and R&D,
  - Infrastructure readiness and R&D,
  - End-user needs,
  - Codes and standards, and
  - Market transformation and policy analysis.
  
- Final report completed December 2010.



# Electric Vehicle Technology Roadmap



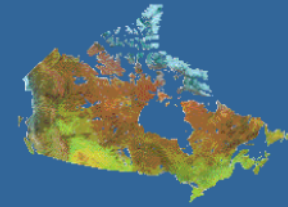
- Focused on the development and adoption of EVs in Canada, while building a robust industry.
- The Roadmap covers a wide range of topics related to the vision of 500 000 or more EVs in Canada by 2018.
- The topics include energy storage, components for EVs, vehicle integration, business models and opportunities for EVs, government policies, regulatory and human resource issues, as well public awareness and education.

Developed recommendations for actions in the following Areas

- Technology
  - Codes, standards, regulations and infrastructure readiness
  - Studies and assessments
  - Education and Outreach
- Report released in September 2009



# Sustainable Development Technology Canada (SDTC)



## Role

- finances and supports the development and demonstration of clean technologies which provide solutions to issues of climate change, clean air, water quality and soil, and which deliver economic, environmental and health benefits to Canadians.

## Bridging the gap

- development and demonstration in preparation for commercialization
  - \$550 million SD Tech Fund™
  - Aimed at development and demonstration of emerging clean technologies.
  - \$478 million allocated to 195 projects.



SD Tech Fund™

SUSTAINABLE DEVELOPMENT  
TECHNOLOGY CANADA



Natural Resources  
Canada

Ressources naturelles  
Canada

Canada

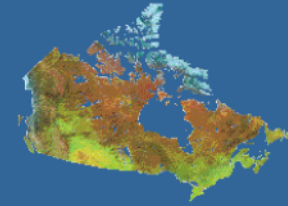
# Natural Sciences and Engineering Research Council of Canada (NSERC)

- Green Aviation Research and Development Network
- Bioconversion Network
- Greencrop Network
- Hydrogen Canada Network (H2Can)
- NSERC Magnesium Network (MagNet)
- Developing Intelligent Vehicular Networks and Applications (DIVA)
- Auto 21
- Bioindustrial Innovation Centre
- Automotive Partnership Canada





# CTS Portfolio Overview



- **Clean Transportation Systems (CTS) Portfolio:**
- Develop, implement, maintain and reinforce the research, development and demonstration activities for advanced vehicle technologies, including hydrogen and fuel cells, plug-in hybrid electric vehicles, emission reduction technologies, advanced fuels and **advanced materials**.
- **5 Program Areas:**

## 1. P&E

Particles &  
Related  
Emissions

## 2. AFTER

Advanced Fuels and  
Technologies for  
Emissions Reduction

## 3. ASM-NGV

Advanced Structural  
Materials for Next  
Generation Vehicles

## 4. H2FC

Hydrogen and  
Fuel Cells

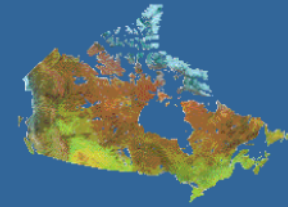
## 5. EM

Electric  
Mobility

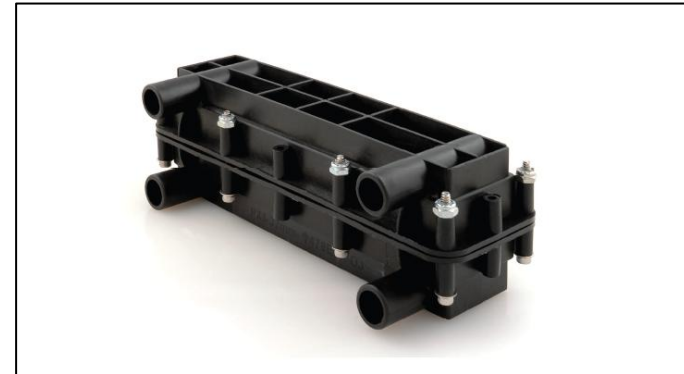


# CTS Programs

## H2FC R&D Highlights



- dPoint Technologies developed a low-cost
- Proton Exchange Membrane (PEM) fuel
- cell humidifier that resulted in a drastically
- reduced cost: from \$2,500 to \$60 per
- humidifier. The new low-cost humidifier
- has been supplied to over 65 fuel cell
- companies in 15 different countries

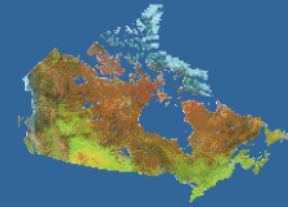


Hydrogenics Corporation has demonstrated an increase in the continuous operation of their PEM water electrolyzer: from 8,000 to 19,800 hours. This is now approaching Hydrogenics's requirements of 20,000-40,000 hours that is needed to be competitive with traditional H2 generation technologies



# CTS Programs

## H2FC Demo Project



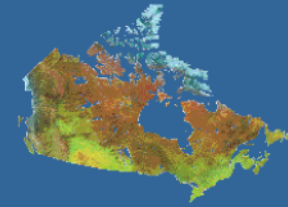
### B.C. Hydrogen Highway: H<sub>2</sub>i Campaign Results

- 20 hydrogen fuel cell electric buses, the world's largest fleet running in one location, Whistler, B.C. which ran throughout the Olympic games



- 15 additional fuel cell vehicles (Ford, GM, and Mercedes) were used to transport visiting media, dignitaries, VIPs and the general public
- 8 total fuelling stations in Victoria, Whistler, and Vancouver were used to fuel the demonstration vehicles





## Hydro-Québec i-MiEVs – Boucherville, QC

In December 2010, the first five all-electric i-MiEVs arrived in Boucherville as part of Hydro-Québec and Mitsubishi's EV demonstration project.



In collaboration with the city of Boucherville, Hydro-Québec will test the performance of up to 50 all-electric iMiEVs under a variety of conditions, notably Canadian winter conditions.



# Canadian Biomass Innovation Network (CBIN)

## Sustainable Feedstocks

- Agriculture crops and crop residues,
- forest fibre, residues and short-rotation woody crops
- livestock manure and MSW, etc.



## Biomass Conversion

- Combustion, gasification, pyrolysis, fermentation, digestion, transesterification, etc.



## Bioplexes and Biorefineries

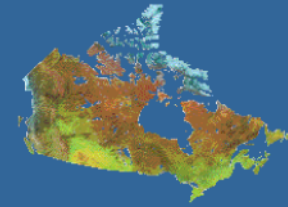
- Sustainable biofuels and co-products, innovation clusters, etc.

## Governance, Sustainability and Performance Measurement Tools

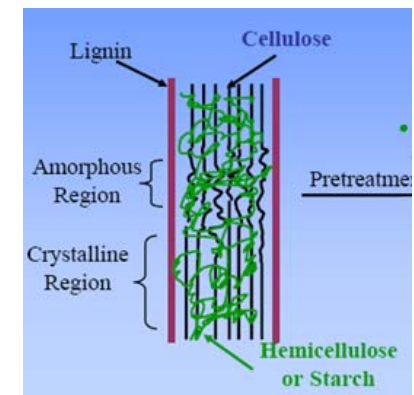
- Assessment framework, life cycle analysis, policies, etc.



# Agricultural Bioproducts Innovation Program (ABIP)



- The nine networks focus primarily on bioproduct opportunities and maximized cross-Canada regional participation. Approved funding \$74.4M (August 2008)
- The Cellulosic Biofuels Network
- Agricultural Biorefinery Innovation Network for Green Energy, Fuels & Chemicals
- Sustainable Cropping System Platforms for Biodiesel



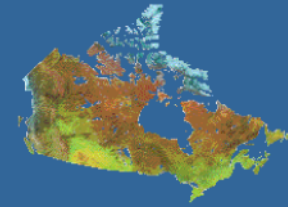
# National Bioproducts Program (NBP)



1. Chemical and ethanol production from lignocellulosic materials
2. Use of biomass and municipal waste to produce energy and chemicals through anaerobic digestion, gasification and pyrolysis
3. Establishing a Canadian capacity to produce biofuels from marine algae



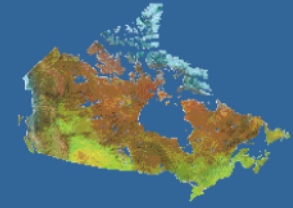
# As We Go Forward ...Considerations



- Need to continue to deliver awareness measures to inform consumer choices and driver behaviours
- Industry is looking for long-term policy signals and support
- Transition to a low-carbon future in transportation is complex, involves many stakeholders and significant investment (requires ***consultation, buy-in and \$\$***).
- Low-carbon strategy for transportation must be **long-term** and must take a **well-defined integrated approach**







*Thank You*

Canada 

