Natural Gas Use in the Canadian Transportation Sector – Deployment Roadmap

National Advisory Council on Energy Efficiency

Hamilton, ON – September 23, 2011

Presentation Agenda

- About CNGVA
- Transportation in Canada
- Context Leading to *Roadmap*
- Unique and Effective Process:
  - Broad Stakeholder Engagement
  - Deployment-Focused
  - Consultation with End Users
  - Business Case – Modelled & Verified
  - Targeted Recommendations
  - Industry Perspective
- Progress Since *Roadmap*
- Next Steps - Market Transformation

About CNGVA

- National not-for-profit trade association that advocates for increased use of natural gas and renewable natural gas for the benefit of Canada’s economy and environment

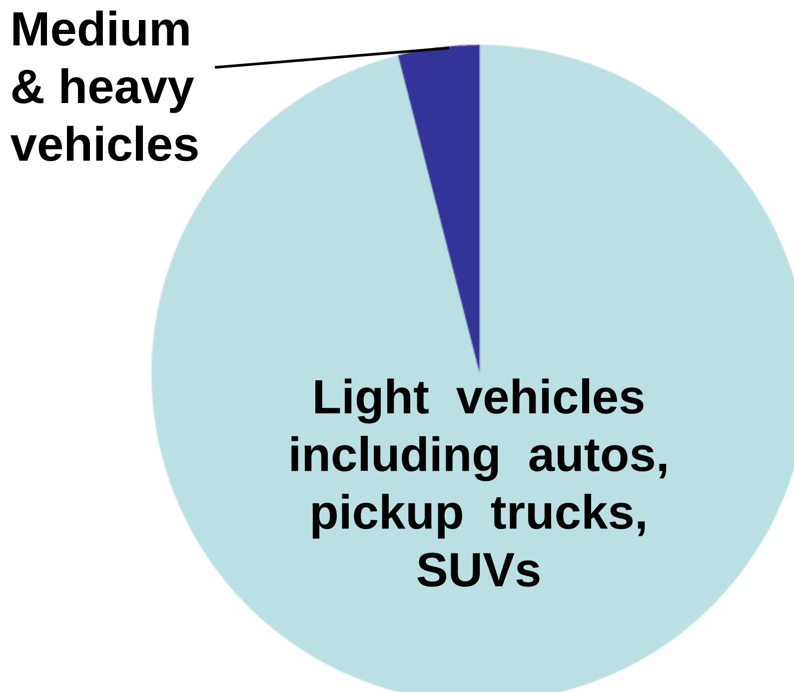
Members:

Natural Gas Value Chain – ATCO Gas, Enbridge Gas Distribution, Encana, FortisBC, Gaz Metro, Shell Canada, Spectra Energy, Union Gas

Vehicle, Equipment & Fuel Suppliers – Agility Fuel Systems, ATW Automotive, CanGas Solutions, Change Energy, Clean Energy, Cummins Westport, DMA Technical, ECO Fuel, Ferus, Hi-Tec, IMW Industries, Jenmar Concepts, Kraus Global, Peterbilt, Viridis, Westport Innovations, Xebec

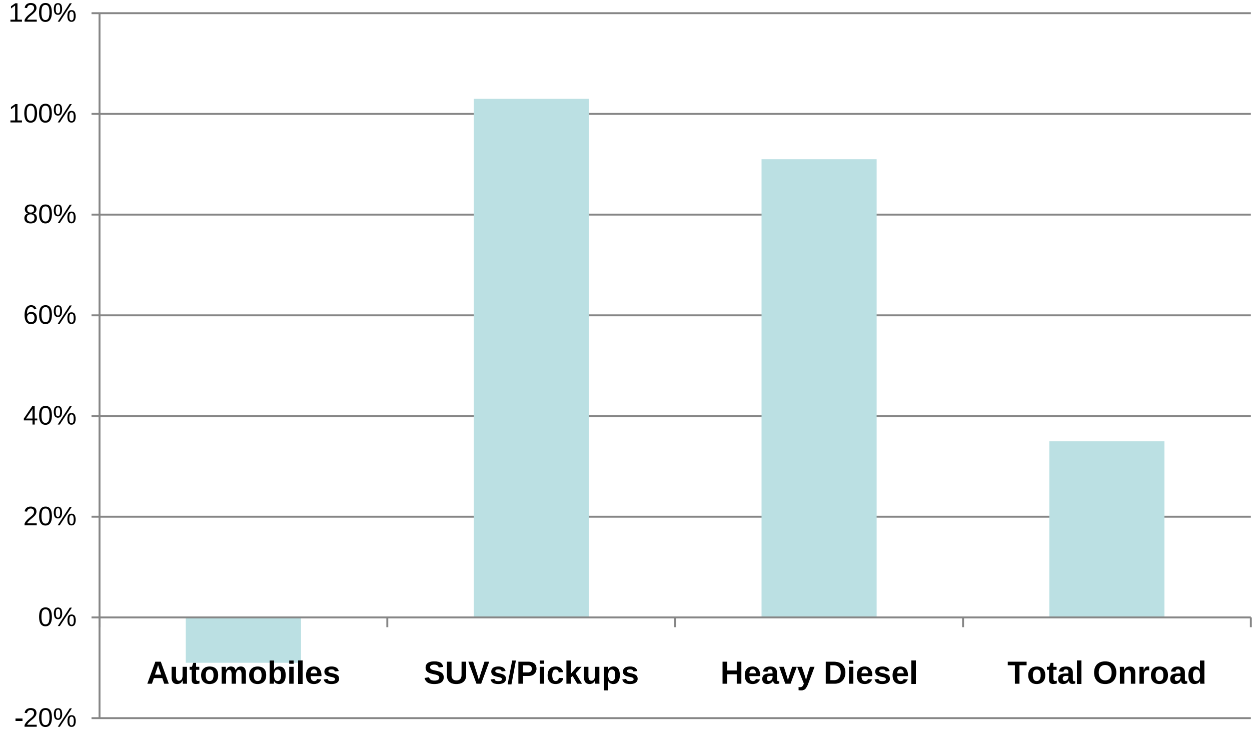
Research Organizations –Powertech Labs, Saskatchewan Research Council

On-Road Transportation in Canada



- Canada had > 20 million vehicles in 2009
- Medium & heavy vehicles were 4% of vehicles, but contributed 29% of greenhouse gas emissions from on-road in 2009

GHG Emissions 1990-2009



- Emissions growth from on-road 2x rate of growth across Canadian economy

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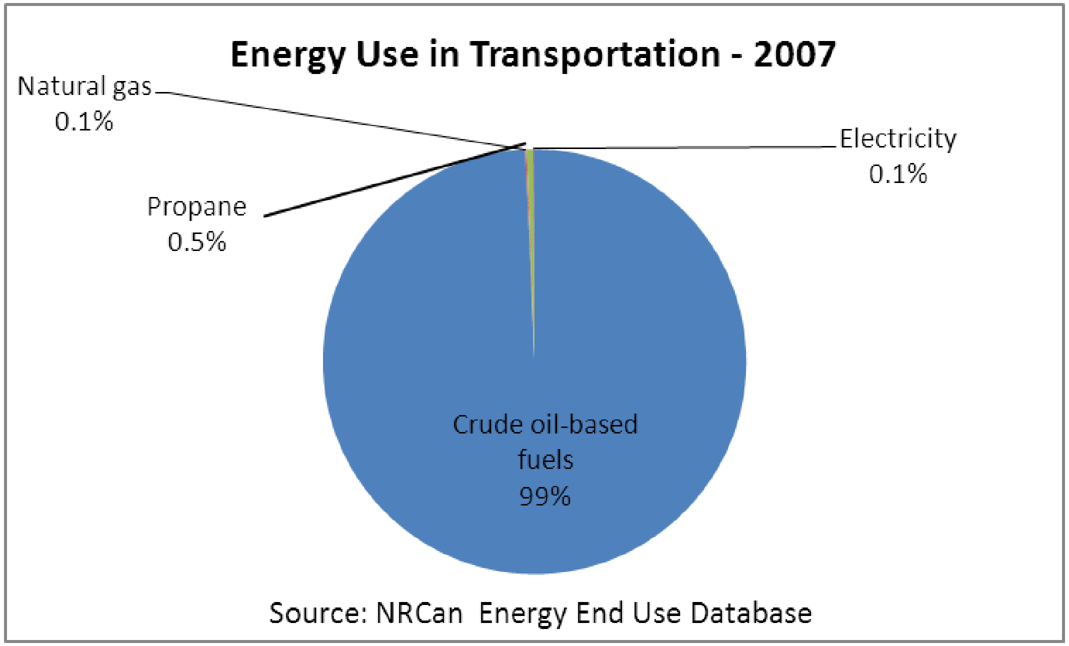
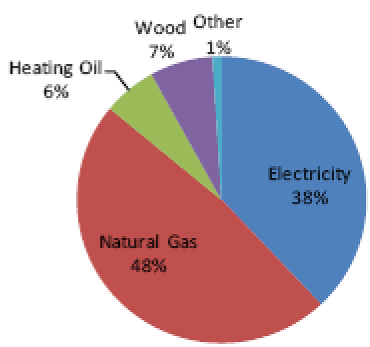
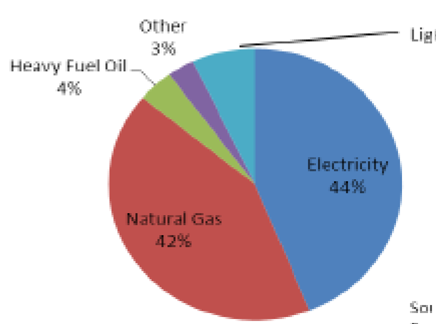
Diversification in Energy Use

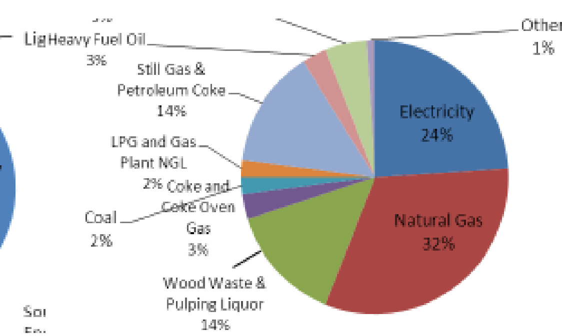




Residential



Commercial



Industrial

Roadmap Context - HISTORY

- Extensive experience with natural gas use in transportation in Canada:
  - Canada an early technology leader
  - Many programs over 20 year timeframe
  - Domestic market uptake not sustained
- Current status:
  - < 0.1% of energy for vehicles is natural gas
  - Estimated 9,500 on-road natural gas vehicles
  - 50 public stations, 15 private stations, 350 vehicle refuelling appliances
- All compressed natural gas (CNG) vehicles, no liquefied natural gas (LNG) vehicles

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Roadmap Context - CHANGES

#1 – Improved natural gas supply outlook

#2 – Natural gas producer interest in transportation market (e.g. Encana)

#3 – Maturity of engine technologies

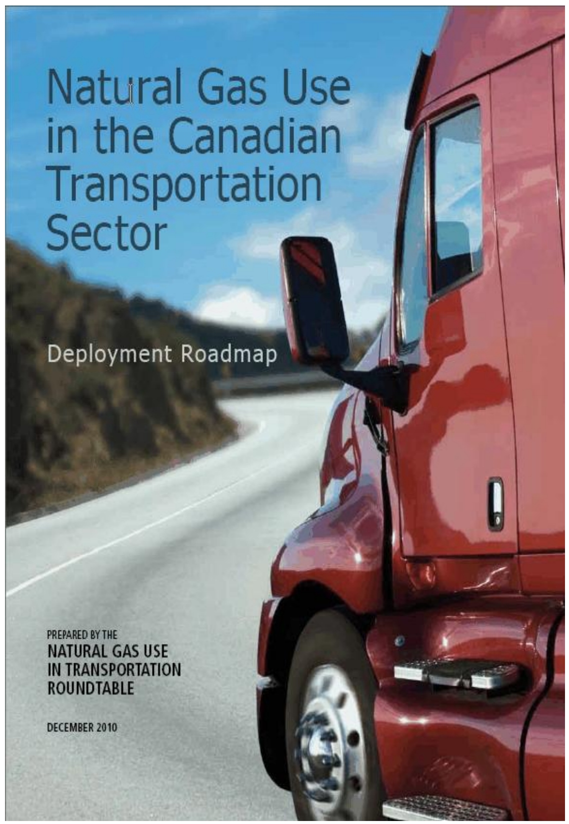
#4 – Availability of factory-built medium- and heavy-duty vehicles

#5 – Emergence of renewable natural gas

#6 – Greater understanding of niche role for natural gas as an alternative fuel

Roadmap – Unique & Effective

2010 – Roundtable organized by NRCan
2011 – *Roadmap* report released in January



Six working groups:

1. Natural gas supply and price outlook
2. Vehicle supply chain readiness, R&D
3. Infrastructure supply chain readiness, R&D
4. End User needs
5. Codes & standards
6. Market transformation

Broad Stakeholder Engagement

End Users – CTA, CUTA, CAMFM, refuse, school bus

Vehicle Original Equipment Manufacturers - Daimler

Industry – CGA, CAPP, TransCanada, CNGVA & members

Environmental – C3, Pembina, Pollution Probe

Academia – AUTO 21

Provincial Governments - AB, BC, QC

Federal Government

Diverse views contributed to comprehensive and rigorous analysis

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Deployment-Focused – Niches

- Five niches considered:
  - Heavy duty on-road
  - Medium duty on-road
  - Light duty on-road
  - Marine (short-sea shipping)
  - Rail applications
- Transformation in transportation is difficult; need to target niche where have best opportunity for success
- Forging consensus among stakeholders was a key part of scoping work

Deployment-Focused – Scoping Example

MARINE	Description	Status
Technology Availability	▪ Engine technology is commercially available today ▪ LNG supply poses current constraint	
Energy Use	▪ High unit consumption, 1 ship = 50 Class 8 trucks	
Environment	▪ GHG reductions - TBD ▪ Economical given upcoming low-sulphur regulations ▪ CAC emissions benefits increasingly important	
Economics	▪ Routes near trucking corridors may allow common infrastructure use ▪ Payload tradeoffs with fuel tank space needed ▪ Very high acquisition costs (40-50 M$) ▪ Fuel costs/savings transferred to customers	
Market Potential	▪Low turn-over rates (ship life = 25 - 40 years)	

Deployment-Focused – Target Market

- Focus on medium- and heavy-duty factory-built vehicles in return-to-base and regional corridor fleets
- Core R&D work done and engine technologies at “top of curve”:
  - Match diesel efficiency (Westport)
  - Power and torque similar to diesel
  - Operational benefits with spark-ignited engine - no DPF or urea (Cummins Westport)
- More 50 vehicle models from 20 OEMs
- Challenges all related to adoption and deployment in market

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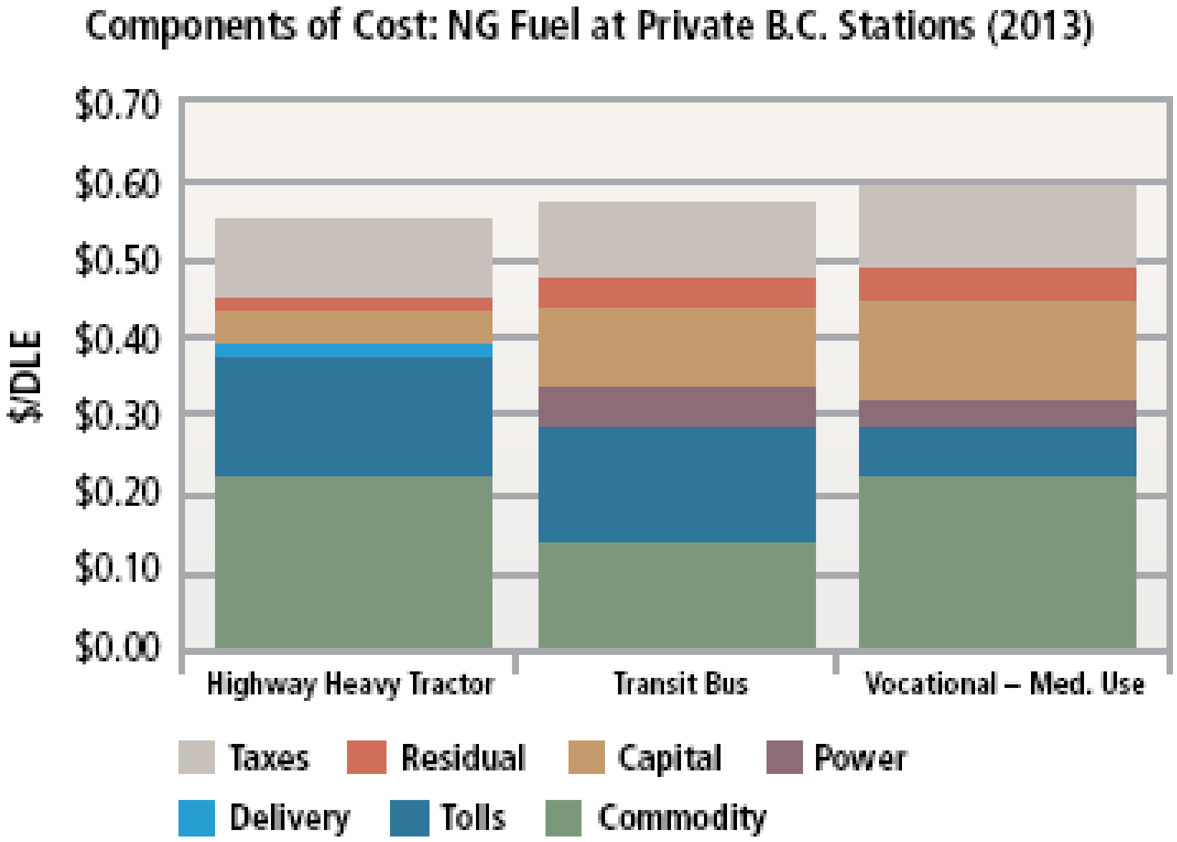
Consultation with End Users

- Understanding end user needs is fundamental to market transformation
- Five end user consultations held:
  - Trucking fleets (CTA)
  - Transit fleets (CUTA)
  - Municipal fleets (CAMFM)
  - Refuse fleets (direct interview)
  - School bus fleets (direct interview)
- Findings were categorized with common elements identified
- Two key groups - those with experience and those without experience

Business Case Modelled & Verified

- All-in cost of ownership compared to diesel fleet ownership



Business Case Modelling - Outcomes

- Thirteen fleet applications modelled
- Top ranking applications with strong internal rates of return:
    1. LNG highway tractors
    2. LNG urban tractors
    3. CNG transit buses
    4. CNG refuse trucks
- Good business case for right type and scale of fleet, but market not acting on potential financial returns

Targeted Recommendations

Four key recommendation areas:

1. De-risk investment & early adoption
2. Address information gaps
3. Increase capacity to sustain markets
4. Ensure ongoing competitiveness

Temporary fiscal measures, outreach to market, and technical capacity building all important in developing market

Phased approach critical so as to leverage strengths and ensure ongoing viability of refuelling infrastructure

Industry Perspective

- *Roadmap* work required time, but provided valuable insight into best approach to market development
- Negative and positive perspectives were shared which helped inform industry's understanding of key issue areas
- Confirmation of business case invaluable to support ongoing discussions with broad stakeholder audiences including media
- *Roadmap* beneficial to build awareness and establish baseline set of facts to inform broader dialogue

Progress Since *Roadmap* - Refuse

First Canadian refuse truck projects:

- Waste Management
  20 CNG refuse trucks in BC with 20 more trucks to be added by 2012

- City of Surrey, BC
  First municipal RFP to require CNG with 60-75 trucks late 2012

- Early demo trucks in ON, BC & QC
- Increased knowledge is building confidence regarding fuel savings, performance, and maintenance

Progress Since *Roadmap* - Trucking

First Canadian LNG truck projects:

- Robert Trucking -180 LNG trucks ON/QC
- Vedder Transport –50 LNG trucks in BC

- Many implementation learnings for early adopters related to training, facilities, compliance/approvals
- Other fleets monitoring project activity
- Producers encouraging well-site service truck use of natural gas

Progress Since *Roadmap* - Investments

- Shell Canada investment in liquefaction facility in Alberta
  - Plus market development partnerships announced related to on-road trucks, marine, rail, and heavy off-road trucks
- Encana investment in mobile refuelling for LNG trucks to give fleets fuel access
- Utility (FortisBC, GazMetro) investments in 4 private refuelling stations for heavy vehicle fleets
- Major Western Canadian municipality proposes CNG transit project

Progress Since *Roadmap* – Capacity Building

- Industry partnered with NRCan on three capacity building activities in Q1 2011:
    1. Communications Plan
    2. 5-Year Codes & Standards Workplan
    3. Draft LNG Code
- CSA Z276 Committee agreed to add transportation to Canadian code
- Industry & municipal sector webinar
- Ongoing dialogue with BC, AB, ON, QC, and NS regarding market opportunities

Next Steps re Market Transformation

- Share and leverage learnings from new projects taking place in Canada
- Take next steps to address codes and standards need and issue areas
- Increase education and outreach activities to market
- Partner with local stakeholders to reach out to fleets in regional markets
- Where possible, "institutionalize" learnings and embed information in vehicle purchase process

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Thank You & Questions

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