



# Natural Gas for Transportation – From the Margins to the Mainstream

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# Transportation as a Market

- Significant energy demand that comprises about 29% of secondary energy use in Canada
- Disproportionate share of energy used by medium and heavy vehicles:
  - 4% of on-road vehicles use 28% of energy
- Growth in energy demand since 1990
  - Passenger + 18%
  - Freight + 71%
- Changing landscape
  - New regulations – carbon; fuel efficiency
  - Renewable fuel standards
  - Emerging technologies



# Merits of Natural Gas Use

- Diversifies energy use in a sector of economy that remains 99% reliant on single energy source
- Reduces carbon by 20-25% on well-to-wheels basis (*Natural Resources Canada modelling*)
- Enhances fleet competitiveness through use of lower fuel cost
- Provides economic benefits for Canada in the fuel, vehicle, and station supply chain
- Infrastructure investments can be leveraged with future use of renewable natural gas for near zero carbon emissions



# Natural Gas – Current Status

- < 1 Bcf/year or 0.1% of energy used in Canadian transportation sector is natural gas
- Vehicles & stations
  - 12,000 natural gas vehicles
  - 70 public stations, 15 private stations
  - 350 vehicle refuelling appliances
- All CNG vehicles; no LNG vehicles
- Continued challenges for public refuelling stations due to decreasing fuel volumes
- Early use of natural gas for transportation may limit thinking regarding current relevance



# Natural Gas – Into the Mainstream

- Transportation needs cost effective, lower carbon options – role for natural gas
- There is no one size fits all in transportation
- Convergence of factors for natural gas as a transportation fuel:
  - Abundance of domestic resource
  - Affordability of fuel - dispensed CNG/LNG is 30-35% less expensive than diesel fuel
  - Maturity of vehicle technologies
  - Increased availability of factory-built vehicles
  - Emergence of carbon-based regulations

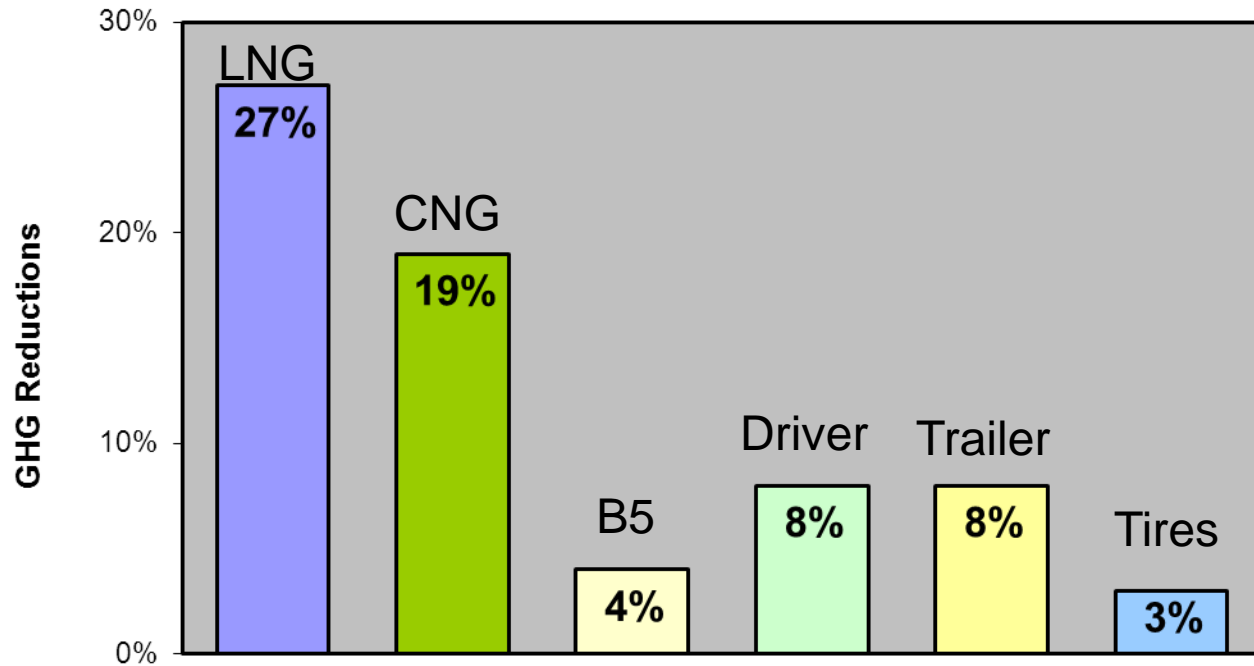


# Factory-Built Vehicles



Bus (School)	Bus (Transit / Shuttle)	Bus (Inter-city)	Dump	Paver / Utility	Refuse	Stake Bed or Cube	Street Sweeper	Tanker (Long Haul)	Tanker (Short Haul)	Vacuum / Sewer	Yard Spreader

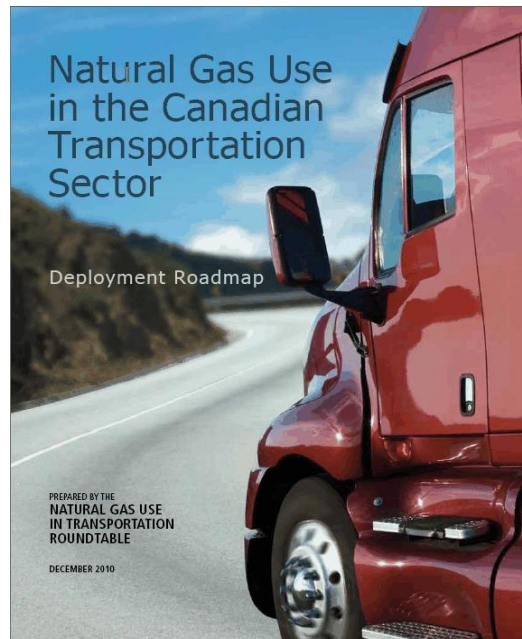
# Options for Class 8 Trucks



- Range of options available to reduce GHGs
- Magnitude of benefit suggests a role for natural gas in a carbon-constrained future

# Deployment Roadmap

- March–Sept 2010 under direction of Deputy Minister of Natural Resources Canada
- Diverse stakeholders, consensus approach to identifying optimal uses of natural gas in transportation

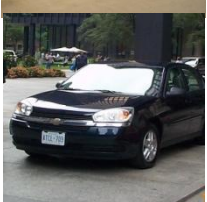


- Focus of recommendations:
  - Medium & heavy trucks & buses
  - Regional corridors
  - Return-to-base fleets
- Report available at [www.alternativefuels.gc.ca](http://www.alternativefuels.gc.ca)



# Business Case Findings

- Strong internal rates of return for right type, scale of fleet
- Top ranking applications
  1. LNG highway tractor fleet
  2. LNG urban tractor fleet
  3. CNG transit bus fleet
  4. CNG refuse truck fleet
- All-in costs of ownership *including* infrastructure considered in analysis



# Implications of Findings

- Market not acting on potential returns
- Three key impediments
  1. Out-of-date and incomplete information
  2. Perceived performance risk with technology
  3. Incremental vehicle cost and concerns regarding financial risk
- Roadmap recommendations
  - Targeted education and outreach to fleets
  - Demonstrate technology to create confidence
  - De-risk adoption via temporary fiscal measures
  - Reduce vehicle costs via targeted R&D, scale
  - Build capacity to execute

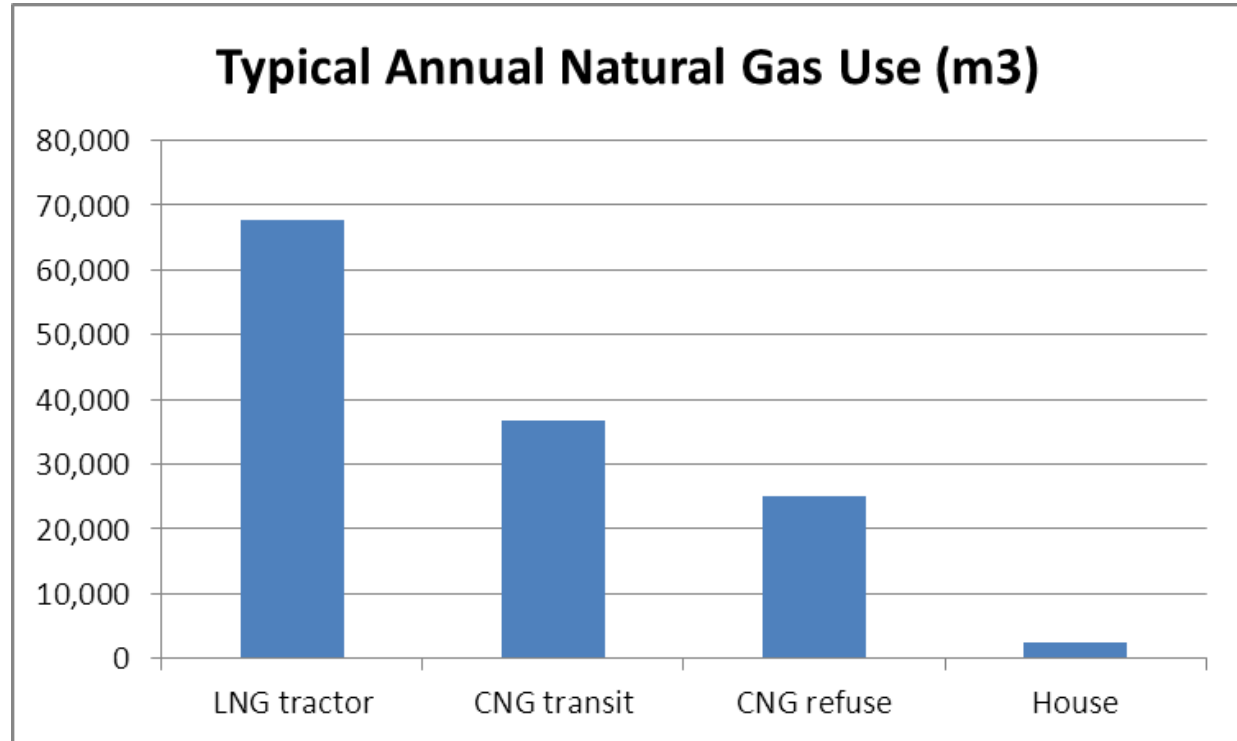


# Canadian Market Update

- 3 major projects recently announced
  - Robert Trucking – 180 LNG tractors with stations in Montreal, Mississauga, Quebec
  - Vedder Transport – 50 LNG tractors in Abbotsford, BC
  - Waste Management – 20 CNG refuse collection trucks in Lower Mainland, BC
- Lowering vehicle acquisition cost triggered decision in each case
- Fleets interested provided barriers can be addressed



# From Projects to Market Adoption



- Focus on high mileage corridor and return-to-base fleets
- Intersect vehicle replacement cycle

# Market Potential

- Total transportation 2,464 Bcf in 2008
- Medium/heavy ten year scenarios

NG Penetration of New Truck Sales	# of NG Vehicles	NG Usage/Year
1%	3,600	8.2 Bcf
5%	10,800	40.8 Bcf
10%	36,000	81.7 Bcf

- Infrastructure that is anchored by medium/heavy vehicle volumes can be used for other regional fleets



# Next Steps to the Market

- *Deployment Roadmap* good first step
- Need a coordinated, focused effort to get natural gas into mainstream
- Engagement of industry, government (federal, provincial), other stakeholders essential
- Benefits for fleets and benefits in fuel, vehicle, and station supply chain, but will take effort to achieve





# Thank You & Questions

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