



# Policy & Deployment Drivers for Gaseous Fuels

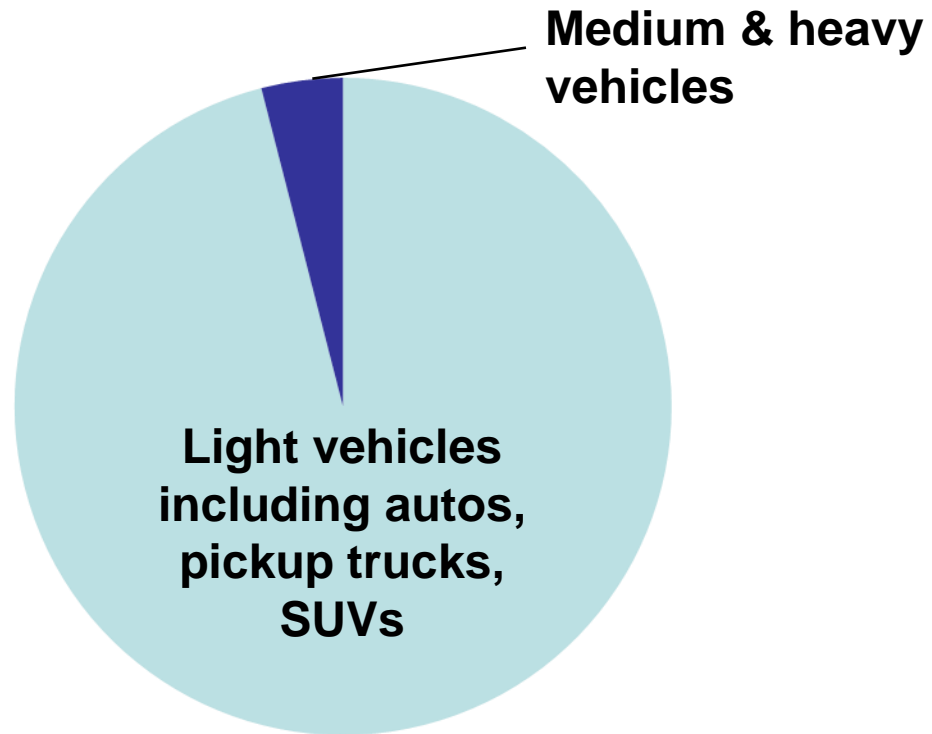
Transportation Technologies & Fuels Forum  
Arlington, VA – June 8, 2011

# Transportation Characterization

- 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

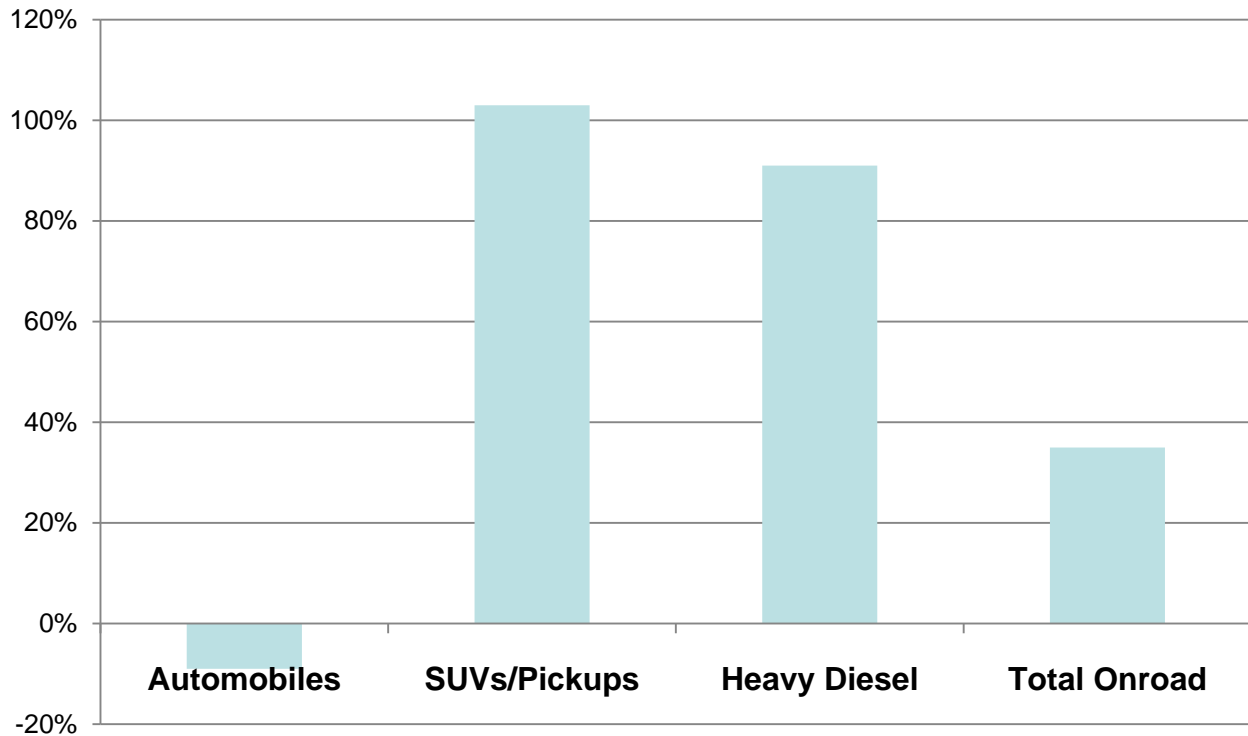


# Vehicle Population



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

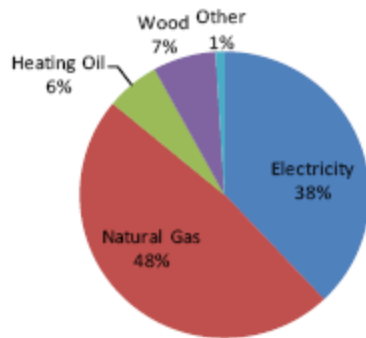
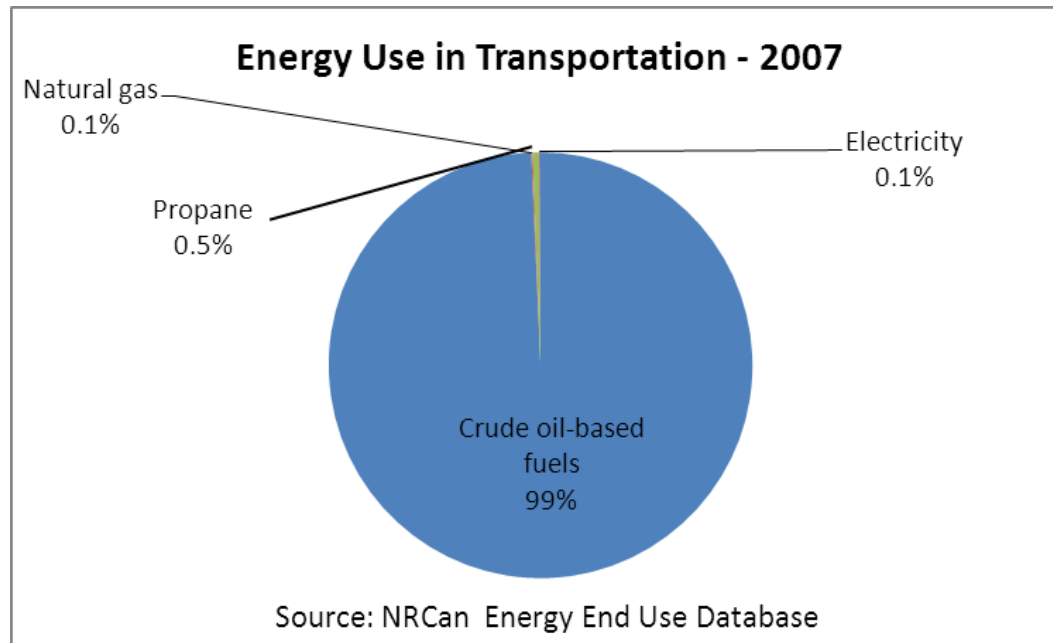
# GHG Emissions 2000-2009



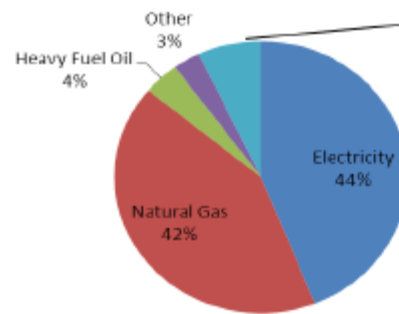
- Emissions growth from onroad sources nearly 2 x average growth across economy



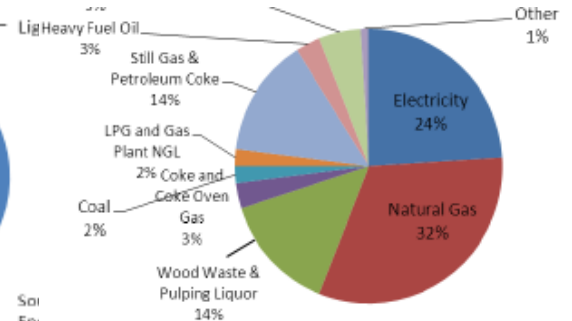
# Diversification in Energy Use



**Residential**



**Commercial**

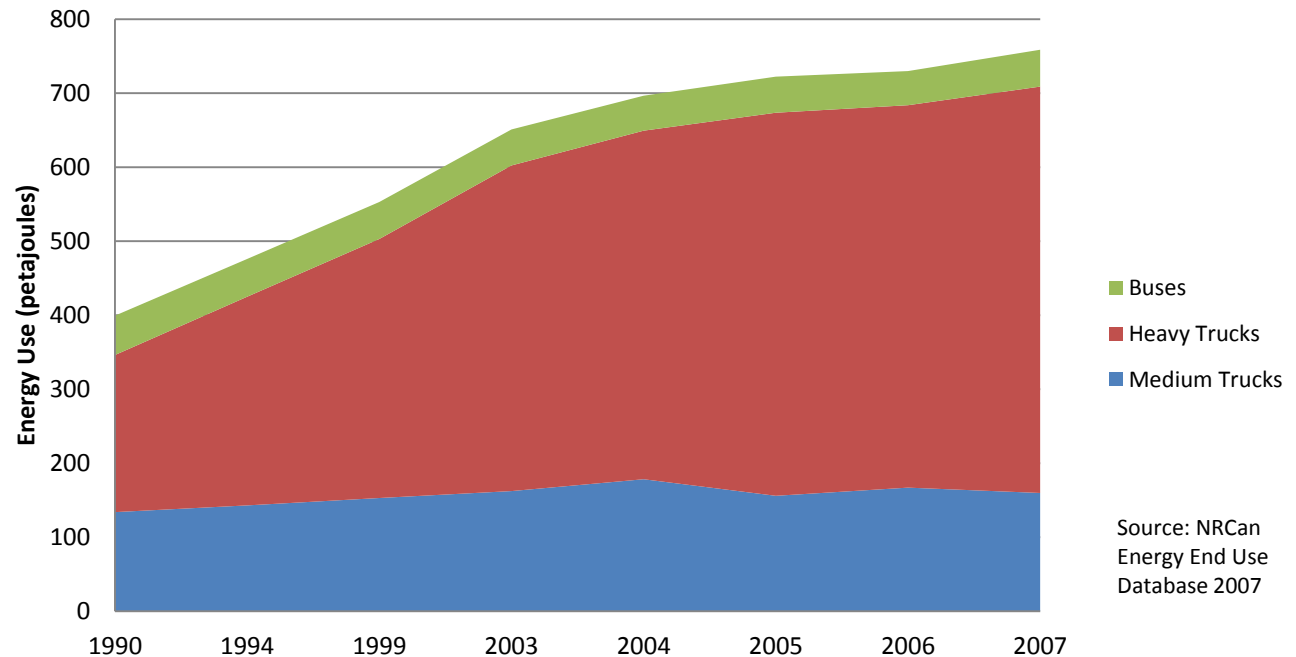


**Industrial**

# HDV Energy Demand Growth



Energy Use by Vehicle Category



Source: NRCan  
Energy End Use  
Database 2007

- Estimated 70% increase in energy demand since 1990 for HDVs

# Government Role & Policy Drivers

- May be a role for government if:
  - There a market failure, so benefits are not being captured
  - There externalities that are in the public interest
  - The perceived risk too great for early adopters
- Two related levels of drivers:
  1. Policy response drivers
  2. Deployment drivers



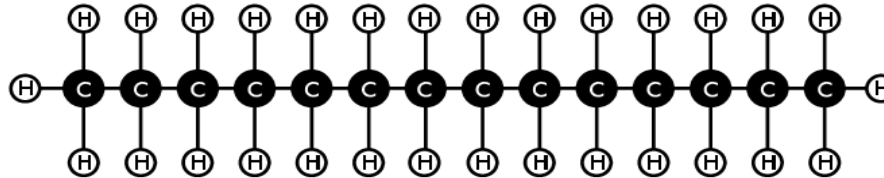
# Policy Driver #1 - Environment

- Gaseous fuels can lower the carbon intensity of transportation sector



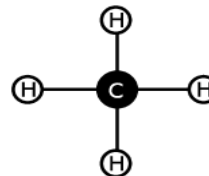
**Diesel C<sub>14</sub> H<sub>30</sub>**

Complex Hydro Carbon

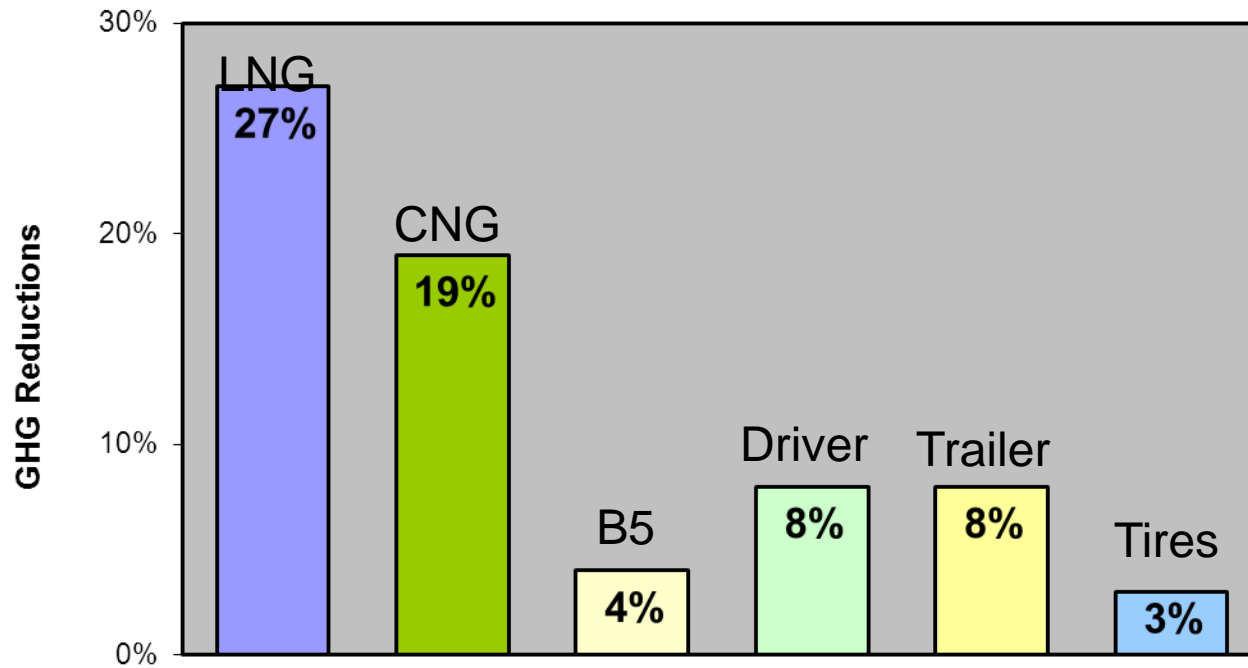


**Methane CH<sub>4</sub>**

Simplest Hydro Carbon



# Policy Driver #1 - Environment



Natural gas typically reduces well-to-wheels GHG emissions by 20-25%

Fuel switching can complement other strategies

# Policy Driver #1 - Environment

- CAC benefits can also be achieved with gaseous fuels
- Tightening regulatory standards create opportunity in marine sector
- HCNG also beneficial for onroad use



# Policy Driver #2 - Diversification

- Inherent vulnerability given high degree of reliance on a single energy source
  - US – energy security issue
  - Canada – regional vulnerabilities
- Natural gas supply outlook has significantly improved – estimated more than 100 years of resource
- Integrated North American market for natural gas – shielded from full impact of global economic shifts



# Policy Driver #2 - Diversification



ANNUAL NG TRUCK SALES AS % OF TOTAL SALES	TOTAL NG VEHICLES OVER 10 YEARS	ENERGY USE (THOUSANDS DLE)	ENERGY USE (Bcf)	ANNUAL GHG BENEFIT (Mt CO <sub>2</sub> e)
1%	3,599	238,668	8.2	0.1997
3%	10,796	716,003	24.5	0.5992
5%	17,994	1,193,338	40.8	0.9986
7%	25,191	1,670,673	57.2	1.3981
10%	35,987	2,386,676	81.7	1.9973
15%	53,981	3,580,014	122.5	2.9959

- Target vehicle replacement cycle
- Estimated 5% of HDVs on the road are replaced every year

# Policy Driver #3 - Sustainability

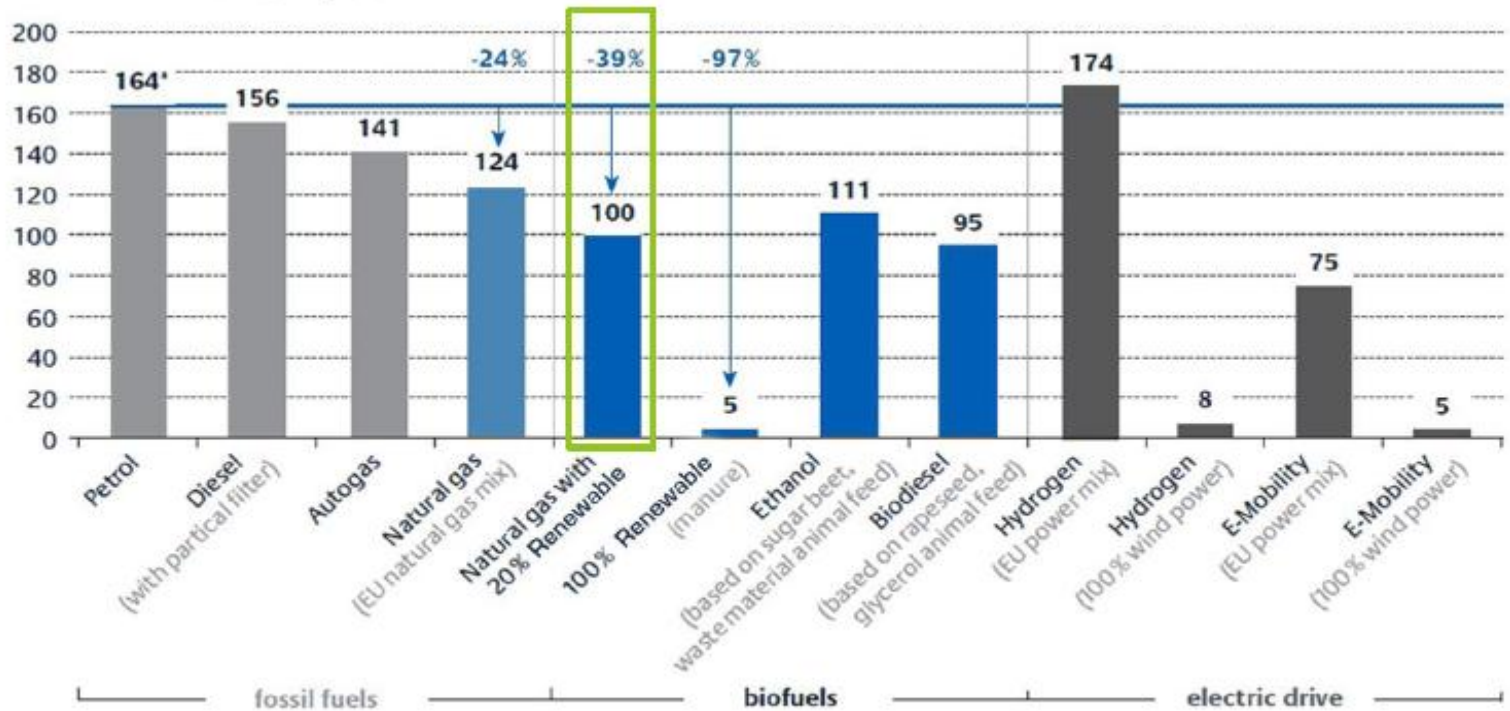
- Long term objective zero or near zero emission options for transportation
- Flexibility of gaseous fuels to partner creates opportunity for biomethane (renewable natural gas - RNG)
- Canada's natural gas distribution industry recently published a technical guideline for grid injection of RNG
- City of Toronto digester gas to refuse truck fuel project
- Companies starting to sell "green" gas



# Policy Driver #3 - Sustainability



WTW GHG emissions in g CO<sub>2</sub> eq./ km

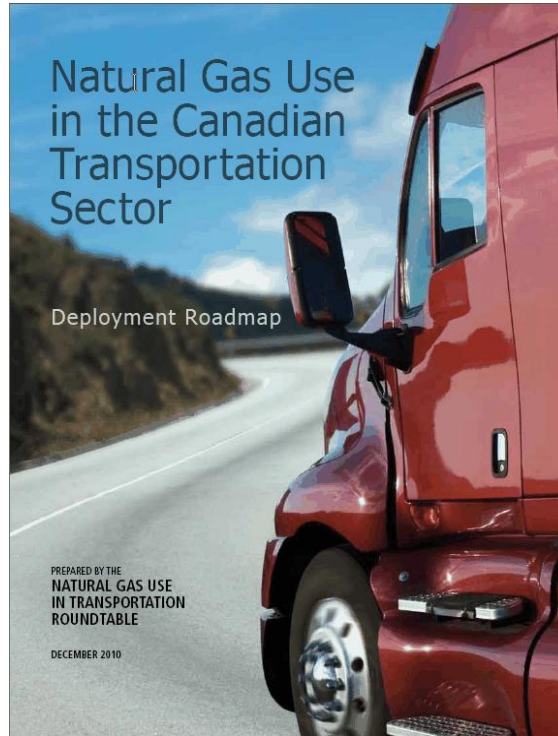


\* reference vehicle: gasoline engine (induction engine), consumption 71 per 100 km

Source: DENA – German Energy Agency

Investments in fossil natural gas at fleet and station level can be leveraged for renewable natural gas use

# Deployment Focus is Critical



- Sound policy rationale is foundation, but a focus on technology only is not enough
- Any public or private sector investment needs to consider deployment

Understanding end user needs is basis for being able to identify deployment drivers



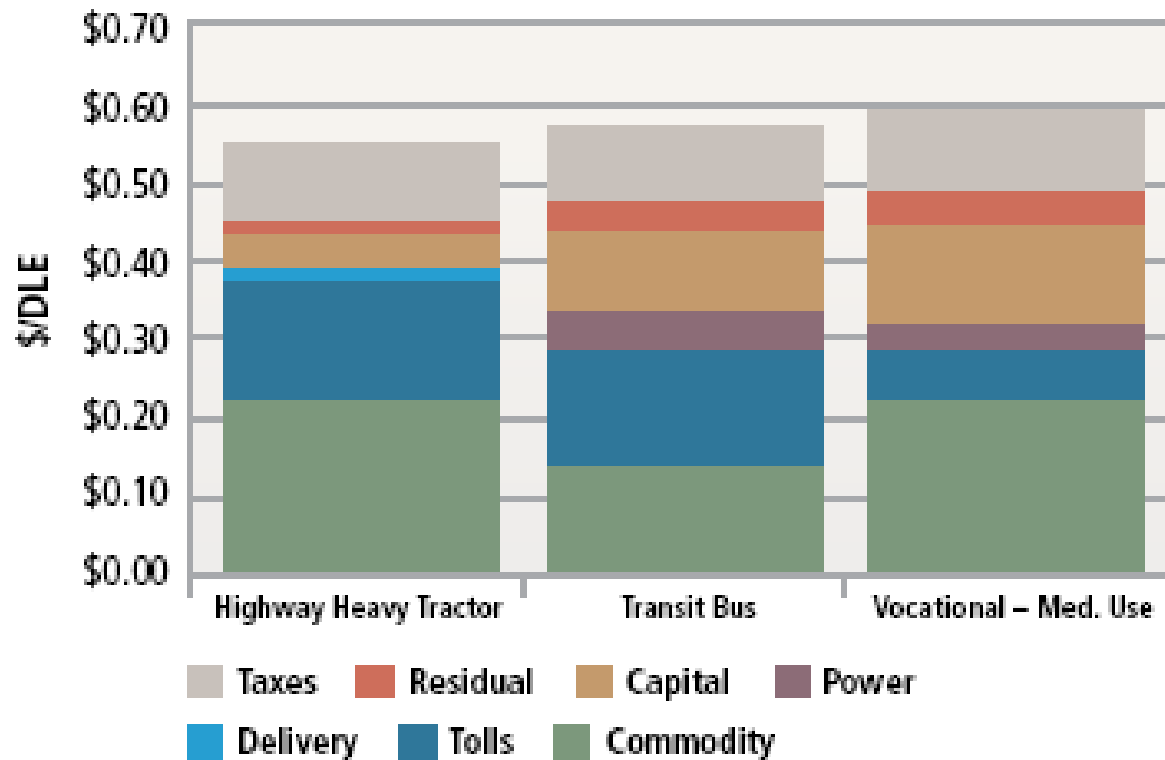
# Deployment #1 – Cost Effectiveness

- New entrant must not only meet or exceed status quo performance, but must also provide financial benefits for fleet
- Capital & operating costs must both be considered
- Natural gas typically 30% less expensive for right scale of return-to-base or regional HDV fleet
- Example - estimated \$8,000 annual per highway tractor fuel savings with LNG

# Deployment #1 – Cost Effectiveness

- All-in cost of ownership compared to diesel fleet determined via *Roadmap*

Components of Cost: NG Fuel at Private B.C. Stations (2013)





## Deployment #2 – Operational Benefits

- Greater receptivity to change in HDV fleets given impact of recent diesel emissions standards
- Spark-ignited natural gas engine has some operating advantages:
  - Simple three-way catalyst
  - No need for SCR aftertreatment
- Time fill overnight refuelling beneficial, particularly for refuse fleets

# Policy & Deployment Drivers

- Two interrelated levels of drivers:
  1. Policy drivers
  2. Deployment drivers
- Analysis of natural gas for HDVs indicated there was a strong policy rationale basis for intervention
- Strong deployment drivers for right scale and type of fleets
- Next step is to implement *Roadmap* recommendations with focus on sustainable deployment



# Thank You & Questions

Alicia Milner

President

Canadian Natural Gas Vehicle Alliance

350 Sparks Street, Suite 809

Ottawa, ON, K1R 7S8

Tel: (613) 564-0181

E-mail: [alicia.milner@cngva.org](mailto:alicia.milner@cngva.org)

Web: [www.cngva.org](http://www.cngva.org)

