

Agenda

- 1. North American context
- 2. Factory-built engines & vehicles
- 3. Energy density challenge
- 4. Canadian fleets using natural gas tractors
- 5. LNG & LNG fuel systems weight impacts
- 6. Weight allowance considerations
- 7. Ongoing technology improvements



North American Context (1)

- Natural gas has been used as a vehicle fuel in North America for more than 30 years
- In North America today:
 - Estimated 155,000 vehicles & 1,515 stations
 - < 1% of onroad vehicles are natural gas</p>
 - ➤ Natural gas = 1% of energy used in transportation
- For use as a vehicle fuel, natural gas must be:
 - Compressed to 3,600 psi = CNG
 - Liquefied at -162° Celsius = LNG

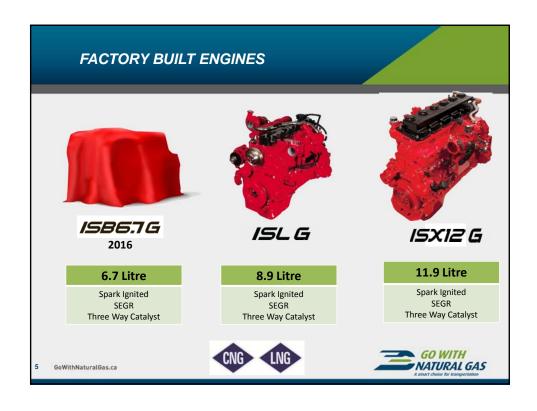
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North American Context (2)

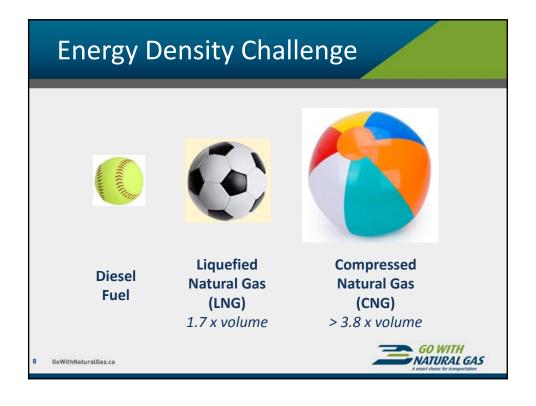
- Renewed natural gas vehicle interest driven by:
 - Supply outlook > 100 years at current demand
 - Lower emission fuel
 - Simpler technology with no DPF or SCR system required
 - Fuel cost savings compared to diesel
 - Ability to operate on renewable natural gas from waste sources for near zero emissions
 - > > 50 models of factory-built trucks, buses











LNG Highway Tractors in Canada



Robert Transport LNG Highway Tractor Boucherville, QC

- Total of 280 LNG highway tractors including:
 - Robert Transport 120 LNG tractors Montreal to Mississauga
 - Vedder Transport 50 LNG tractors in Abbotsford, BC
 - <u>Ferus</u> 21 LNG tractors in Grande Prairie, AB
 - Bison Transport 15 LNG tractors in Calgary, AB
 - <u>Loblaw</u> 5 LNG tractors in Mississauga, ON





LNG Highway Tractors in Canada





Minimax LNG Tractor Cornwall, Ont.

- Two saddle tanks for 120 DGE (450L) system;
- 90" frame rail needed 195" WB
- Quebec City to Cornwall



CNG Highway Tractors in Canada



ColdStar Solutions CNG Highway Tractors

Langford, BC

- Vancouver Island-based
- 10 Mack CNG tandem axle tractors out of fleet of 45
- Twin, 45 DGE tanks; 191" WB; 250 km return daily
- 80,000 lbs GVWR
- ~ 1,000 lbs (450kg) more than comparable diesel truck
- 335 diesel litre equivalent



Ongoing Technology Improvements

- ▶160 DGE (up from 155 DGE) and weighs 500 lbs. less than the previous model (3,000 lbs full/ 1,400 kg)
- ➤ four cylinders (Type 4) for a total weight of 3,000 pounds and requiring 31 1/4" of frame rail
- Carbon-fibre tanks 70% lighter than steel
- stand-alone system or packaged with up to 126 DGE side-mounted systems for a total of 286 DGE
- > 3,000 lbs (BTC)+ 2,000 lbs (frame rail) = 5,000 lbs CNG system

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Weight Allowance Considerations



Saddle Creek CNG Highway Tractor (155 DGE BTC) Florida

- Weight allowance increase to 1,000 kg would cover most configurations
- Removes barrier for natural gas use for certain types of fleets
 - British Columbia allowance of 1,500 kg on heavy haul routes



US Weight Allowance Considerations

➤ The Natural Gas Long Haul Truck Competitiveness Act

➤ Bypartisan bill introduced in late July, would let the Department of Transportation permit natural gas trucks to exceed the 80,000-pound Interstate limit by the additional weight of their tank and fueling system.



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