Natural Gas Vehicle Technologies for Light, Medium, Heavy and High Horsepower Applications
Forward Looking Statements

- This presentation contains forward-looking statements that are based on the beliefs of Westport’s management and reflect Westport’s current expectations. Investors are cautioned that all forward-looking statements involve risks and uncertainties that could cause actual results to differ materially from those expressed in these forward-looking statements, including, without limitation, Westport’s ability to develop viable fuel systems; Westport’s ability to provide the capital required for research, product development, operations, and marketing; product development, production and commercial launch delays; changing environmental regulations; Westport’s ability to attract and retain key personal and business partners; competition from conventional diesel fuelled engines; and Westport’s ability to protect its intellectual property. These factors should be considered carefully and investors should not rely on any forward-looking statements. Investors are encouraged to review Management’s Discussion and Analysis and the Risk Factors section in Westport’s most recently filed Annual Information Form and filings with securities regulators for a more complete discussion of factors that could affect Westport’s future performance. We undertake no obligation to update or revise any forward-looking statements, whether as a result of new information, future events or otherwise, except as required by law.

- All figures are in U.S. dollars unless otherwise stated.
Westport Engineers Advanced Natural Gas Engines

**Market Focus**
Transformation from petroleum-fuelled to alternative-fuelled engines.

**Position**
The global leader in gaseous fuel engineering and technology.

**Strategy**
Leverage IP to penetrate markets through relationships with market-leading OEMs.
Global Operations

Total Global Employees: 1,098

as of September 30, 2012
Through its market focus and position, Westport has moved from proof of concept to capture the global emergence of natural gas vehicles through a broad range of transport applications.
Westport is the Technology Leader

- Global patent portfolio pivotal to Westport’s market leading position with OEMs
- Worldwide, Westport and its affiliates have filed over 700 patent applications relating to over 180 inventions in:
  - engine technologies
  - fuel system components
  - control methods
  - vehicle integration
  - other related technologies
- Established strong development lead times and barriers to entry with over $390M in R&D and commercialization since 1995

![Top 10 Companies with Natural Gas Engine Related Patents*](chart)

*Based on the patent search results of publicly available data within the International Patent Classification F02, meeting the search term criteria: one of ("engine" or "combustion" or "injector" or "injection valve") and ("natural gas" or "methane" or "gaseous fuel") and not ("fuel cell" or "turbine"). This chart includes issued or granted patents from: Australia, Brazil, Canada, China, European Patent Office Grants, France, Germany, India, Italy, Japan, Poland, Russia, Spain, UK, USA, USSR, and pending published patent applications from: the European Patent Office, USA, and the World Intellectual Property Office.
Natural Gas Vehicles? Many Questions!

Which Engine Technology?
- Spark-Ignited
- Dual-Fuel
- HPDI

Which Fuel?
- CNG
- LNG
- Biomethane

For which Applications?

Which Supplier?
- OEM Solution
- Retrofit Solution
# Westport Natural Gas Engine Technologies

<table>
<thead>
<tr>
<th>Spark-Ignited</th>
<th>Dual-Fuel (Fumigation)</th>
<th>High Pressure Direct Injection (HPDI)</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="Spark-Ignited Diagram" /></td>
<td><img src="image2.png" alt="Dual-Fuel (Fumigation) Diagram" /></td>
<td><img src="image3.png" alt="High Pressure Direct Injection (HPDI) Diagram" /></td>
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## How it works

- Gas & air pre-mixed at low pressure
- Ignition from spark plug
- Reduced compression ratio to avoid knock
- Bi-fuel (automotive) or dedicated (trucking)
- Simple EGR and catalyst
- Otto cycle

- Gas and air pre-mixed at low pressure
- Diesel injection for ignition
- Diesel/gas mixture adjusted based on knock sensor
- Otto cycle
- Can revert to diesel fuel only

- High pressure gas injected directly into combustion chamber
- Compression Ignition from diesel pilot
- Diesel cycle

## Westport products

- Westport Automotive
- Cummins Westport
- Weichai Westport
- EPA 10 & Euro VI Capable

- Emer Westport
- Euro V Capable

- Westport Trucking & Off-Road
- EPA 10 & Euro VI Capable
# Natural Gas Engine Technology Compared to Diesel

<table>
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<th>Spark Ignited</th>
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<tr>
<td><strong>Combustion Cycle</strong></td>
<td>Otto</td>
<td>Diesel/Otto</td>
<td>Diesel</td>
</tr>
<tr>
<td><strong>Ignition</strong></td>
<td>Spark Plug</td>
<td>Diesel Injection</td>
<td>Micropilot</td>
</tr>
<tr>
<td><strong>Fuel cost/mile</strong></td>
<td>Better</td>
<td>Better (variable substitution)</td>
<td>BEST</td>
</tr>
<tr>
<td><strong>Emissions</strong></td>
<td>BEST</td>
<td>Same</td>
<td>Same or Better</td>
</tr>
<tr>
<td><strong>GHG</strong></td>
<td>Better</td>
<td>CH4 Cat</td>
<td>BEST</td>
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<tr>
<td><strong>Power Density</strong></td>
<td>Lower</td>
<td>Same or Lower</td>
<td>Same</td>
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<tr>
<td><strong>Power/Torque</strong></td>
<td>Same</td>
<td>Same or Lower</td>
<td>Same</td>
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<tr>
<td><strong>Efficiency</strong></td>
<td>Lower</td>
<td>Same or Lower</td>
<td>Similar or Same*</td>
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<tr>
<td><strong>Noise</strong></td>
<td>BEST</td>
<td>Same</td>
<td>Same</td>
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<tr>
<td><strong>Aftertreatment</strong></td>
<td>BEST</td>
<td>CH4 Cat</td>
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<td><strong>Fuel Flexibility</strong></td>
<td>CNG/LNG</td>
<td>BEST CNG/LNG/Diesel</td>
<td>LNG-limp mode on diesel</td>
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*B Based on design focus
Automotive Components & Complete Solutions - Spark Technology

- **off-engine components**
- **on-engine components**
- **complete industrial engines**

**complete systems designed to specific OEM platforms**

Westport
Historical Success:
Urban Return-to-Base Fleets

**BUS**
- North America: 20% Market Share
- Market size 5,000 buses/Yr
- 20 Years
- Compressed Natural Gas

**REFUSE**
- North America: 50% Market Share
- Market size 5,000/Yr
- 10 Years
- Compressed Natural Gas
Cummins Westport Joint Venture - Spark Technology

- 50:50 JV established in 2001
- Renewed agreements 2004 and 2012
- Delivered over 35,000 engines
- Industry leading OEM availability

Key recent growth driver:
- refuse trucks in North America – approaching 50% natural gas market penetration
- Medium and heavy truck applications

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CWI Engines in North America by Segment (cumulative through Q3 2012)

- Truck
- Refuse
- Coach/Shuttle/Specialty
- School Bus
- Transit

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Westport Dual Fuel System

1: Intake
The gas is injected into the intake manifold close to intake valve. The mixture of air + gas enters the cylinder thanks to the air-stream.

2:Compression
The mixture of air + gas is compressed into the cylinder. Pressure and temperature of air + gas mix rise. The diesel fuel pilot is injected.

3:Ignition
The diesel fuel ignites. The burning diesel fuel ignites the gas. Temperature and pressure quickly rise into the cylinder, forcing the piston downwards.

4:Exhaust
Burnt gases leave through exhaust valve.
Exclusive Westport HPDI Technology
EPA 10 Certified & Euro VI Capable

- **Liquefied Natural Gas (LNG)**
- High Pressure Direct Injector (HPDI) replaces the diesel injector
- This two-fuel HPDI injector delivers both diesel fuel and natural gas to the engine cylinder
- Diesel fuel provides ignition only, natural gas provides >90% of the power
- Diesel engine performance remains:
  - Same high power and torque
  - Same or similar efficiency
- ~20% GHG reduction with fossil LNG
**HPDI Injector Replaces the Diesel Injector**

- Common-rail style injector – two fuels through one injector
- Directly replaces diesel injector – no engine modifications
- Diesel used as ignition source, actuation fluid, lubricant, and coolant
Westport HPDI System

High-pressure accumulator → Fuel conditioning module → HPDI fuel injectors

LNG tank and pump module → Control unit

Off-Engine Fuel Storage & Delivery

On-Engine Fuel System

North America: 400 – 450 HP
New Market: Heavy Duty Trucks
Regional and Long Haul - LNG

Liquefied Natural Gas (LNG) opens the way for medium-long distance road transport
Market Forecast
North American Class 8 Natural Gas Trucks

5 year CAGR = 49%
North America
Growth in LNG Fueling Infrastructure

Source: Westport analysis January 2013, Clean Energy Fuels, Encana, Shell, and BLU, FortisBC, Gaz Metro
Europe LNG Fueling Infrastructure Developments

- Approx. 25-30 stations currently in operation
- Expected 15-20 additional stations in 2013-2014 including the ‘LNG Blue Corridor’ Project
- January 2013: European Commission proposes 400 km max. distance between LNG stations Europe-wide by 2020 (included in the Clean Power for Transport package)

Focus areas until 2014

Source: Westport analysis January 2013
Significant Off Road Opportunities

- Mine haul trucks
- Shale frac trucks & pumps
- Tugboats
- Locomotives
Westport and Caterpillar Announce Agreement to Develop Natural Gas Technology for Off-Road Equipment  June 5, 2012

The two companies are positioned to be the first to offer Westport™ HPDI technology in the high horsepower off-road market; initial focus on mining trucks and locomotives;

- Westport and Caterpillar co-developing natural gas fuel systems
- Westport to supply key natural gas fuel system components
- Product ready in about 5 years

Photos courtesy Caterpillar and EMD
## Conclusion

### Trends in NG Engine Technology

<table>
<thead>
<tr>
<th>Application</th>
<th>Displacement</th>
<th>kW/Cyl</th>
<th>Fuel / Year</th>
<th>Gas Technology</th>
<th>Fuel Choice</th>
<th>Current Uptake</th>
</tr>
</thead>
</table>
| Large Marine          | Up to 25,000 L | Up to 1000 | Up to 30 mil. L | ➢ Direct Injection  
➢ Dual Fuel                  | Fossil and/or Bio | ~100          |
| Off-Highway           | 20 to 150 L   | 150 to 275 | ~1,000,000 L | ➢ Direct Injection  
➢ Dual Fuel                  | LNG             | ~0            |
| • Rail/Marine         |              |        |             |                                  |                      |                |
| • Mine Truck          |              |        |             |                                  |                      |                |
| Heavy Duty            | 10 to 16 L    | 50 to 75 (350 hp) | ~100,000 L | ➢ Direct Injection  
➢ Dual Fuel  
➢ Spark Ignited      |                      | ~10,000   |
| • On-highway trucks   |              |        |             |                                  |                      |                |
| Medium Duty           | 5 to 9 L      | ~40 (<350 hp) | ~40,000 L   | ➢ Spark Ignited  
➢ Lean  
➢ Stoich + EGR  
➢ Dual Fuel      | CNG            | ~100,000   |
| • Buses               |              |        |             |                                  |                      |                |
| • Refuse              |              |        |             |                                  |                      |                |
| • MD Trucks           |              |        |             |                                  |                      |                |
| Light Duty            | Up to 7 L     | ~40    | ~5000 L     | ➢ Spark Ignited                  | CNG             | > 1,000,000   |
| • Pass. Cars          |              |        |             |                                  |                      |                |
| • LD Trucks           |              |        |             |                                  |                      |                |

Values are coarse estimates and information is based on Westport’s best knowledge.
Thank You

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