Freightliner Natural Gas Market and Product Update

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Freightliner Trucks
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Drivers and Barriers
What’s influencing Natural Gas?

**DRIVERS**

- Improving operating economics vs. diesel
- Increasing diesel fuel costs driving quick NG payback
- Reduced after-treatment complexities
- Reduced GHG emissions (up to 23%)
- Environmental initiatives of government
- Muni specs requiring “Cleanest Technology Available”
- Noise reduction - 5-12 dba reduction vs. diesel
- Domestic Fuel/Energy Security
- Resources available: 100 year supply
- Renewable Fuel

**BARRIERS**

- Insufficient infrastructure
- Wait for federal funding
- Right application: Right engine for right segment, like TBB small NG engine or CAS bigger engine
- Purchase price
- Cost for employee training (drivers, shop)
- Resale value/No resale market
- Insecurity about new technology

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**Table:**

<table>
<thead>
<tr>
<th>Fuel Econ</th>
<th>Diesel Model</th>
<th>NG Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6</td>
<td>5.4</td>
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<tr>
<td>Ann Mileage</td>
<td>80,000.00</td>
<td>80,000.00</td>
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<tr>
<td>Fuel Price</td>
<td>$ 3.83</td>
<td>$ 1.80</td>
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<tr>
<td>Gall Per Yr</td>
<td>13,333.33</td>
<td>14,184.81</td>
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<tr>
<td>$ in Fuel</td>
<td>$ 51,990.07</td>
<td>$ 20,000.07</td>
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<tr>
<td>Annual Fuel Savings</td>
<td>$ 24,800.08</td>
<td>$ 1,641.82</td>
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</tbody>
</table>
M2 112 NGs Delivered / Customer Experience

**Vehicles delivered:**

- Sterling SB 113 LNG port tractors: 328
- Freightliner M2 112 trucks & tractors: 725
- 1053 Freightliner/Sterling units produced/delivered, including:
  - LNG & CNG port tractors
  - LNG & CNG food delivery tractors
  - CNG regional haul tractors
  - CNG Refuse tractors
  - CNG Sewer trucks
  - CNG Gas Utility trucks
  - CNG Municipal Gov’t trucks
- 240 on order, quotes out on 500 more
- Over 1000 units have been delivered
**Freightliner M2 Specifications**

- **Model:** M2
- **Bumper to Back-of-Cab:** 112"
- **Wheelbase:** ANY
- **Engine:** Cummins Westport ISL Gas
- **Horsepower:** 320 HP
- **Torque:** 1,000 lb/ft @ 1,300 RPM
- **Transmission:** Allison 3000 or 3500; HS or RDS Automatic

**Fuel Tanks:** 119 (64) & 150 (84) Gallon LNG
- 60 and 75 DGE CNG
Customer Profile – Natural Gas

Who is buying?

- Total fleet size – typically 50 -250 units
- Willing to try between 2 and 5 natural gas units
- NOT installing fuel on site (yet)
- Need retail fuel station with 3600 psi / 5 GPM MINIMUM
- NOT going to drive 50 miles round trip to fuel
  - Assuming fuel not available on planned route
- NOT going to modify shops (yet)

When natural gas project proves it can work in customers’ operations:

- More natural gas vehicles will be ordered
- Customers may consider fuel station on site
Lessons Learned: The Buying Cycle

Customer Purchase Process – Natural Gas

- Research the Business Case

  - Will products work for my application?
  - Will there be compromises to Weight/length?
  - Funding availability
  - Financing
  - Warranties
  - Insurance
  - Driver reactions
  - Service Shop Modifications
  - Fuel readily available at competitive cost & flow?
    - ☑️ 10% YES – LET’S PROCEED!
    - ☠️ 90% NO – WALK AWAY AT THIS POINT
Warranty and Maintenance

- Base Warranty: 2 Year/250,000
- B-50 life is 500,000 Miles
- Maintenance Free Aftertreatment System
  - Three-way passive catalyst
  - No regeneration or ash cleaning

### ISL G Truck

<table>
<thead>
<tr>
<th></th>
<th>Miles/Kilometers</th>
<th>Hours</th>
<th>Months</th>
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<tr>
<td>Oil and Filter*</td>
<td>15,000 Mi 24,000 KM</td>
<td>500</td>
<td>6</td>
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<tr>
<td>Fuel Filter</td>
<td>30,000 Mi 48,000 KM</td>
<td>1,000</td>
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</tr>
<tr>
<td>Coolant Filter</td>
<td>15,000 Mi 24,000 KM</td>
<td>500</td>
<td>6</td>
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<tr>
<td>Spark Plugs</td>
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<tr>
<td>Change Coolant</td>
<td>60,000 Mi 96,000 KM</td>
<td>2,000</td>
<td>24</td>
</tr>
<tr>
<td>Valve Adjustment</td>
<td>60,000 Mi 96,000 KM</td>
<td>2,000</td>
<td>24</td>
</tr>
</tbody>
</table>

- Intervals will reduce or increase based on average speeds/duty cycles.
- Default interval is the hours stated. Interval is whichever comes first – hours, miles or time.
Saddle tanks will be factory installed in 12 months
CNG Fuel Tanks

**Factory Installed** 60 and 75 Gallon CNG Tanks

Freightliner is the only “turnkey” NG OEM - all components factory installed & warranted!
# Natural Gas Fuel Packages and Capacity

## Comparison of CNG and LNG

<table>
<thead>
<tr>
<th></th>
<th>CNG</th>
<th>LNG</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fuel Packages</strong></td>
<td><img src="image" alt="CNG Fuel Package" /> OR <img src="image" alt="CNG Fuel Package" /></td>
<td><img src="image" alt="LNG Fuel Package" /> OR <img src="image" alt="LNG Fuel Package" /></td>
</tr>
<tr>
<td></td>
<td>60 &amp; 75 DGE CNG Fuel Capacity</td>
<td>119 gallon/65 DGE OR 147 gallon/86 DGE LNG Fuel Capacity</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td><img src="image" alt="CNG Fuel Capacity" /></td>
<td><img src="image" alt="LNG Fuel Capacity" /></td>
</tr>
<tr>
<td></td>
<td>41 DGE CNG Fuel Capacity</td>
<td>119 gallon/65 DGE LNG Fuel Capacity</td>
</tr>
</tbody>
</table>

LNG: Additional 24 DGE in similar packaging
Methane Detection

- Two Sensor System - mounted in cab, engine compartment
  - Visually and audibly warns driver of fuel leaks
    - Trace amount (no concern)
    - Significant amount (potential concern)

- Methane Detection installed on LNG and CNG vehicles

In overhead console
Natural Gas Fuel Types

**CNG**

**ADVANTAGES:**
- Lowest price
- Lowest emissions
- Extensive infrastructure already exists
- “Truck-Friendly” Technology

**CHALLENGES:**
- Storage requirements for CNG tanks
- Additional weight and OAL
- Range limits approximately 300 miles
- Existing technology limited to 9 Liter
- Performance of existing stations

**LNG**

**ADVANTAGES:**
- Lower price than diesel
- Lower emissions (compared to diesel)
- Fastest Fill
- LNG is lower weight than CNG; allows greater storage and distance (current max of 400 miles)
- Existing truck technology provides 9L or 15L; up to 450HP engine

**CHALLENGES:**
- Infrastructure only exists in Southern California; SLC; and Connecticut
- Venting; Performance Issues
- Higher production and distribution costs
- Truck cost for larger engine (15L)
HOW SAFE IS NATURAL GAS?

- Lighter than air, will not pool under vehicle
- TYPE III and IV Tanks, lightest weight
- 20 Year Tanks
- Heavily Regulated
- Drop/Crash Testing
- Bonfire Testing
- Dynamite Testing
- Pistol/Rifle Testing – Armor Piercing Bullets
- Hydraulic Crush Tests
- Google “CNG Tank Testing” – Numerous Web Sites and You Tube Videos

**SUMMARY:** NATURAL GAS IS AS SAFE, OR SAFER, THAN DIESEL AND GASOLINE
NG Fuel Location & Price Resources
Natural Gas Engine Technology

Stoichiometric EGR engine (Example ISL-G/ISX-G)

- Uses high EGR rates in combustion process in place of excess air (Lean Burn).
- End result is an oxygen free exhaust allowing use of a simple 3 way catalyst
- Simple Spark Ignition
- Fuel Neutral- LNG and CNG

Dual Fuel engine (Example ISX15L G)

- Uses diesel fuel as a pilot injection for Liquefied Natural Gas
- Due to the use of diesel fuel, exhaust requires emissions control devices (DPF, DOC, SCR)
- Heavy; High Complexity and Cost
- ONLY operates on LNG
NEW ISX12 G

Freightliner Cascadia: “Proof on Concept” debut May 2011 – SOP Q1 2013?

Target Markets

- Regional haul truck / tractor
- Vocational

Platform & Technology

- ISX 12 base engine
- Spark-ignition with cooled EGR & three way catalyst (TWC)
  - Same technology as ISL G
  - Operates on CNG or LNG
  - 400 HP/ 1350 Ft Lb Torque
  - Allison Automatic or Manual Transmissions
  - Test Vehicles Running Summer of 2011
Cummins Westport ISX 12-G Engine

- The ISX 12-G is built on the Cummins ISX12 platform and it uses the same components as its diesel counterpart but will operate exclusively on Natural Gas.
- Up to 400HP/1450Ft Lbs Torque
- ISX 12-G will be available early 2013
- Engine Brake will be an option
- The technology is the same as the ISL-G which is a three-way catalyst after treatment, which is packaged as a muffler and is maintenance free
- Manufactured at the Cummins Plant in Jamestown, NY
- Target Customer’s are Regional Haul truck/ Refuse and Vocational Applications
2012 Natural Gas Marketing Efforts

- **Trade Shows:**
  
  - World of Concrete – January
  
  - NTEA Work Truck Show – March
    
    - CNG presence in booth and Green Truck Ride & Drive
    
    - Green Truck Summit
  
  - MATS – March
  
  - BevOps – April
  
  - Waste Expo – May
  
  - ACT Expo – May

- **Collateral:**
  
  - 114SD CNG Sell Sheet
  
  - Cascadia 113 Day Cab CNG Sell Sheet
  
  - Updated Shaping Future Transportation Brochure
  
  - Comprehensive Freightliner Natural Gas Brochure

- **PR:**
  
  - Cascadia CNG/ISX12 G announcement/press release – MATS
  
  - Green truck leadership releases – ACT Expo
  
  - Cross country tour

- **Interactive:**
  
  - Updated natural gas page on Freightlinertrucks.com – individual product pages
  
  - Updated content in iPad FST app
  
  - Microsite for cross country tour – expanded to be comprehensive Freightliner green truck site (Freightlinergreen.com?)

- **Other**
  
  - Inclusion of natural gas product training module for sales certification
  
  - Regional events – summer 2012?
CNG Cross Country Tour Summary

- What: Drive Cascadia with ISX12 G from Long Beach, CA to Washington, DC
  - Dealer events
  - Microsite with blogs, photos, videos, social media
  - PR


- Where: Five (5) or Six (6) stops between Long Beach and Washington:
  - Phoenix
  - Albuquerque (?)
  - OKC
  - Little Rock
  - Nashville
  - Charlotte

- Why: Promote Cascadia with new 12 liter natural gas engine. Keep FTL in spotlight as natural gas leader. Show natural gas as a fuel, and FTL CNG product, as viable alternative to diesel
New Alternative Transportation to Give Americans Solutions Act (NAT GAS ACT) from 2011

- **H.R. 1380**
  - Introduced **Apr 6, 2011** - Currently **still** in the House
  - **Fuel Use:** 50 Cent/Gallon Tax Credit Extension
  - **Vehicle Purchase:** $32K to $64K Tax Credit
  - **Infrastructure:** Up to $100K Tax Credit per Station
  - **OEM Installation:** $4K per Vehicle
  - Reauthorize $30M annual for NG R&D/demonstration at the US DOE
  - Experts Predict Passage with Cost Reductions

- **S. 1863**
  - Similar to H.R. 1380, except for following aspects:
    - **No Fuel Use 50 Cent/Gallon Tax Credit Extension**
    - **Surcharge on natural gas** used in subsidized vehicles which ramps up in a 10-year period from 0 to 12.5 cent/gallon
  - Introduced **Nov 15, 2011** - Currently in the House

- President Obama talks Natural Gas during the 2012 state of the union address & UPS Vegas
- Toured the Freightliner Mount Holly Plant March 7, 2012