


take a closer look

Powering Your Operations with Natural Gas

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Dallas | May 17th | 2012



The Shared Strategic Incentive

Our Industry

- Maintaining industry leading cost structures
- Creating demand through business transformation
- Accelerating social currency and license to operate


Our Strategy

A six faceted approach to accelerate value creation:

- Provide comprehensive disclosure of reserves and resources
- Accelerate pace of development
- Advance resource play hub design and development
- Increase exposure to oil and natural gas liquids
- Attract third party investments in undeveloped reserves and resources
- **Grow the market for North American natural gas**



Having built a high-quality resource base, the greatest value creating proposition for our shareholders is to now deliver a sustainably higher growth rate and to do it at the lowest possible cost.



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The ANGA Collaboration

2



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America's Natural Gas Alliance

NGVe Committee



anga
America's
Natural Gas
Alliance

America's Natural Gas Alliance exists to promote the economic, environmental and national security benefits of greater use of clean, abundant, domestic natural gas.

- Working to advance the market adoption of natural gas vehicles in North America
- Advancing the natural gas industry's understanding and use of natural gas in our operations
 - Implementing light duty vehicles in our fleet
 - Developing opportunities to use natural gas in our operations – drilling and pressure pumping services
 - Encouraging adoption by our supply chain

3

The Membership of ANGA

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America's Natural Gas Alliance (ANGA) exists to pursue a single mission:

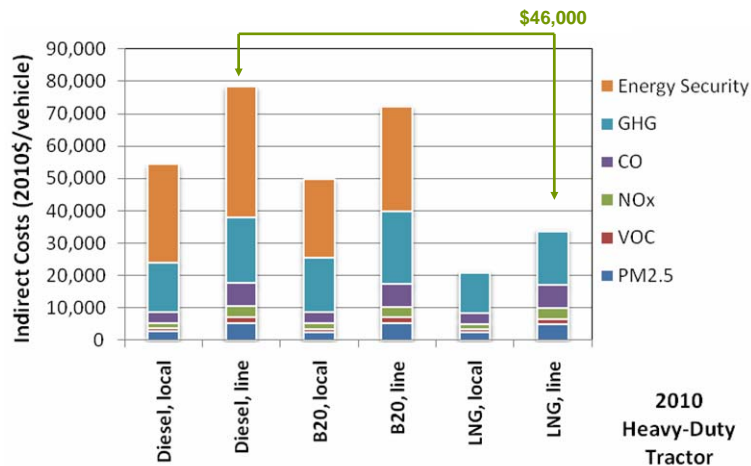
“to increase appreciations for the environmental, economic and national security benefits of clean, abundant, dependable and cost efficient American natural gas”



4 Source: www.anga.us as of 4/30/2012


NGV Marketing Analysis Report

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Source: ANGA NGV Marketing Analysis _ TIAX LLC

5




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Natural Gas University

The marketplace terminology

6



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Terminology – Natural Gas Sources

Field Gas	Typically gathered from existing in-field gathering lines and piped to location. Limited treating is done – liquid knockout.
Plant Gas	Treated gas from the gas plant is piped back to location or gas lift lines are used to supply gas. No treating is needed.
CNG	Compressed into storage vessels (tubes) and delivered to site via tube trailers. Stored at 3,600 psi.
LNG	Liquefied through refrigeration (-260 °F), stored as liquid in insulated vessels and transported to site via tractor/trailer.

7

Terminology – Natural Gas Engines

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Dedicated

Implies that only one fuel system is used. For natural gas dedicated engines, spark ignition is required for combustion.

Bi-Fuel

Incorporates two independent fuel systems and can run alternatively on either fuel, but only one at a time. Bi-fuel systems are used in light duty and medium duty vehicles with gasoline engines.

Dual Fuel

Incorporates two independent fuel systems and can run on both fuels simultaneously. The engine may also run on either or one fuel alone, typically employed on diesel engines.

8

Terminology – Natural Gas as a Fuel

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- Diesel - volumetric energy content or heating value of Diesel #2 is approximately 129,500 British thermal units (Btu) of energy per gallon (34,210 Btu/liter).

1 gallon of diesel ≈ 1.7 LNG-g

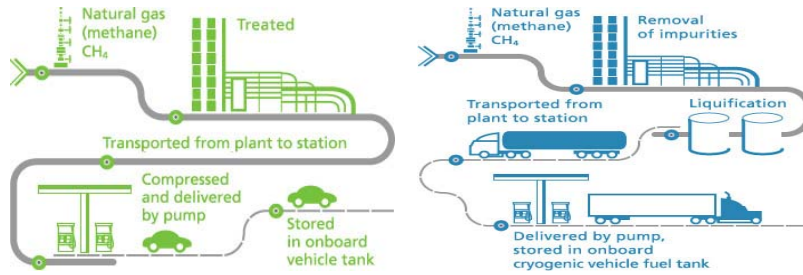
- Natural gas volumetric energy content can range from 900 to 1,400 Btu per standard cubic foot, depending on gas composition.
- Comparison
 - If natural gas has an average 1,000 Btu, then it would take 129.5 Scf to equal the same energy content as a gallon of diesel, diesel gallon equivalent (DGE).
 - Gas volumes are typically measured in **one-thousand** standard cubic feet or Mcf

1 Mcf ≈ 7.72 DGE

9

The Recipe for CNG & LNG

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Demand
Storage
Infrastructure

10

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Natural Gas as a Fuel

The value proposition and success approaches

11

What Makes LNG Viable?

Illustrative Full Cycle Cost Components – LNG vs. Diesel

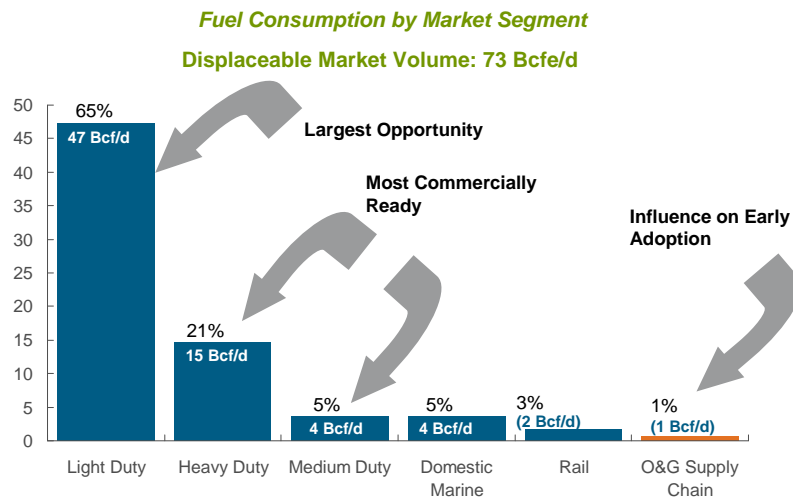


- LNG offers 20% to 40% savings depending on region*
- LNG feed stock price is one third of diesel*
- LNG per unit margin can provide at least a \$4.00/mcf uplift in value to feedstock*

*\$5.00/MMBtu Gas and \$100/bbl oil, blended Canada/U.S. analysis

U.S. and Canada Natural Gas Use Opportunity

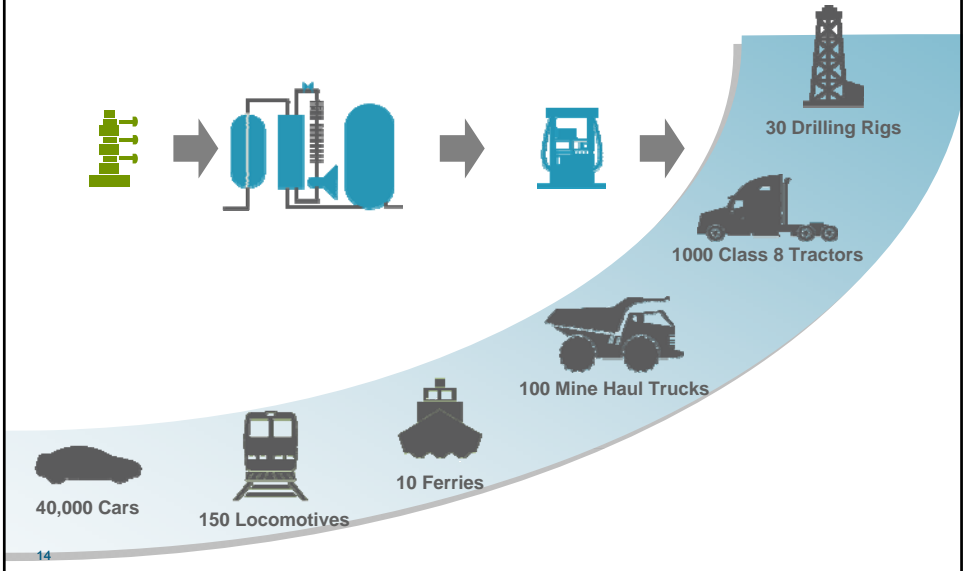
Transportation Sector Displacement



Displacement opportunities exclude Air, International Shipping, Military, Pipeline Fuel
Source: Data and forecast from EIA, Encana

Promoting the Unique Value Proposition

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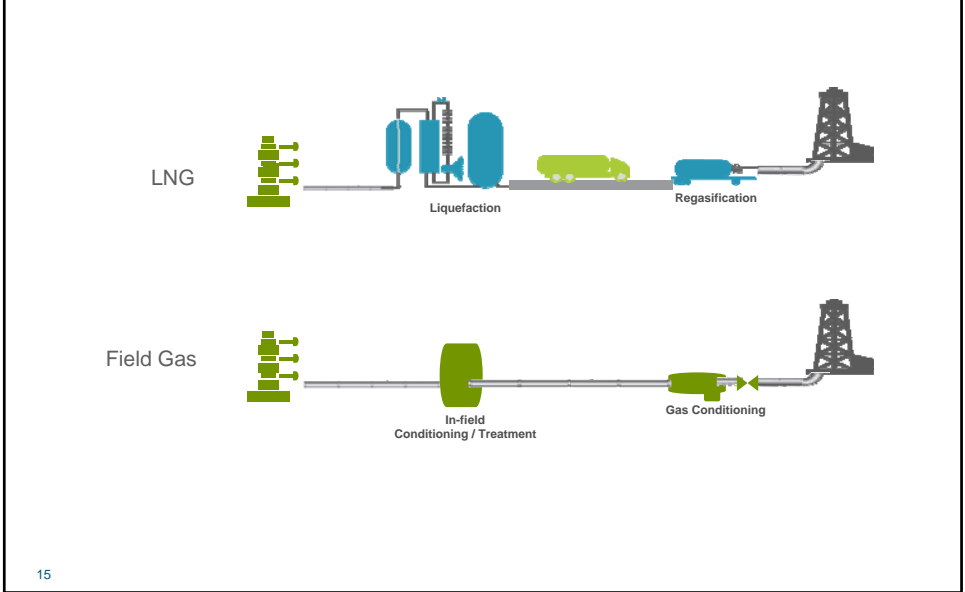


14

The Approaches to Transformation Success

Dedicated Natural Gas

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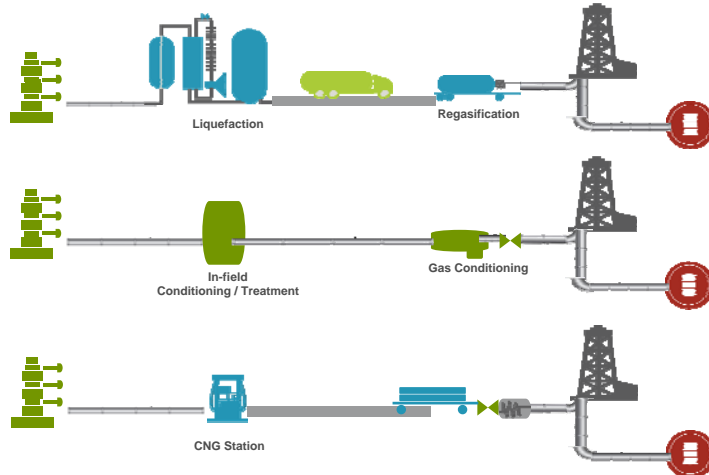


15

The Approaches to Transformation Success

Dual-Fuel Natural Gas

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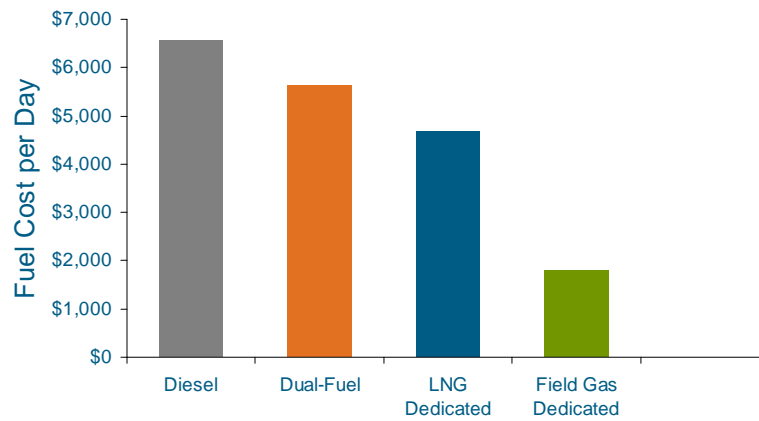


16

Potential Costs Opportunities

Illustrative Example of Approaches

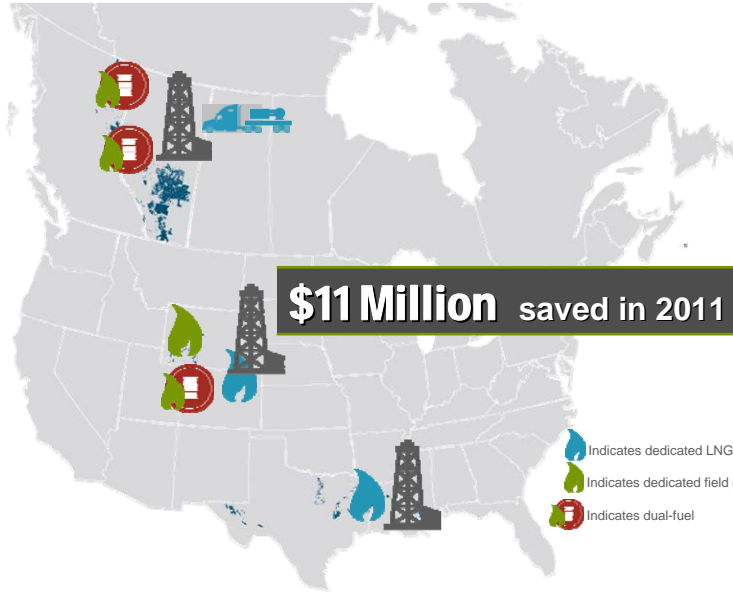
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17

The Drilling Rig Design of Experiments 2011 Focal Points

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20

Natural Gas for Drilling Rigs

A Case Study: Using LNG Fuel for Rig Power in MCBU

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21

Encana's Rig Gasification

Why We Are Motivated

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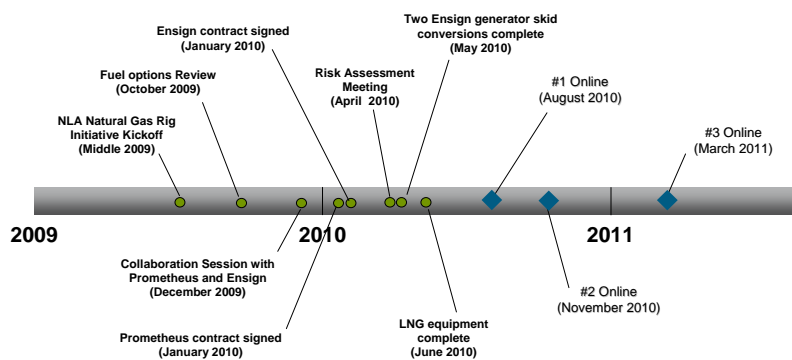
- **Driving Change**
- Strategic Alignment
 - Abundant supply of fuel
 - Leading by example
- Clean – Emissions Reduction
- Domestically Produced, Locally Consumed
- Technology Advancement Stewardship
- Cost Savings

22

Idea Becomes Reality

About One Year in the Making

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23



LNG Fuel System

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24

Deployment – Bundrick Pad in NLA

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- Safety
 - Risk assessment
 - Location and isolation
 - Training
 - Design
- Operation
 - Seamless transition from diesel, no interrupts
 - Average 4 day supply of fuel with 2 tanks



25



Results

- 21 wells, ~350,000 feet drilled
- 1.7 million gallons of diesel displaced (40,625 bbls)
- \$1,200 to \$1,500 per day saved for dedicated LNG
- Demonstrated feasibility of LNG as a fuel
- Transfers to other producers
- No downtime due to fuel

26



Insights & Opportunities

- Perception and education
 - Address fear of unknown with crews
 - Involve local emergency responders
- Logistics
 - More critical managing fuel supply from the rig
 - Must anticipate impacts from severe weather
- Location design
 - LNG skid needs to be incorporated in the location standard
- Engine management
 - 2 engines at lower loads is not better than 1 engine at peak load

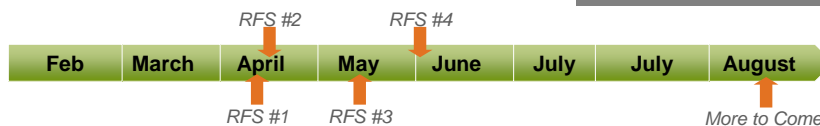
27

Encana NGE LNG Regasification Solutions

New in 2012

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- All-weather design
- Fully integrated safety system
- Active pressure management
- Remote monitoring
- 13,000 gallons storage
- 31,500 scfh vaporization rate (~9,225 LNG/day)
- Requires 177 kW power and instrument air
- 120 psi MAWP



28

Emerging Technology and Other Options

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- Field Gas
 - Ultimate in operating cost savings.
 - Used 250-450 Mcf per day.
 - More components between fuel source and engines as compared to LNG set-up



29

Emerging Technology and Other Options

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- Two recent announcements by major manufacturers
 - Cat – Dynamic Gas Blending
 - Cummins – High Horsepower Dual Fuel
- General Specs
 - Expect 1st Half 2013 availability
 - Up to 70% replacement of diesel with gas
 - Bolt-on component installation
 - New engines and retrofits
 - Accepts up to 55% inerts (CAT Only)

30

Thank You

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