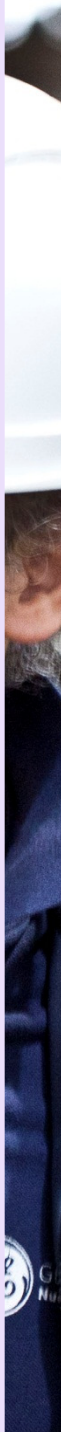
GE Oil & Gas

Frank van Dijk
22-Oct-2013

GE imagination at work



GE Oil & Gas

is a world leader in advanced technologies and services with 43,000 employees in more than 100 countries supporting customers across the industry — from extraction to transportation to end use. Our unrelenting commitment to the environment, health and safety, quality and integrity defines us: it's The Way We Work.

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The GE Oil & Gas business

Operating in **100+** countries **43,000** employees Revenue '12: **~$18.2B**

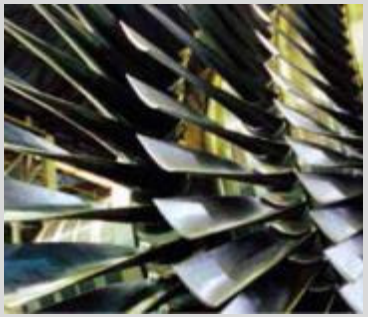
Subsea Systems

Drilling & Surface

Lufkin

Measurement & Control

Turbomachinery



Global Services

PII

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Building on a strong foundation …

(Orders $ in billions)

… GE Oil & Gas today

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SOLUTIONS FOR SMALL SCALE LNG

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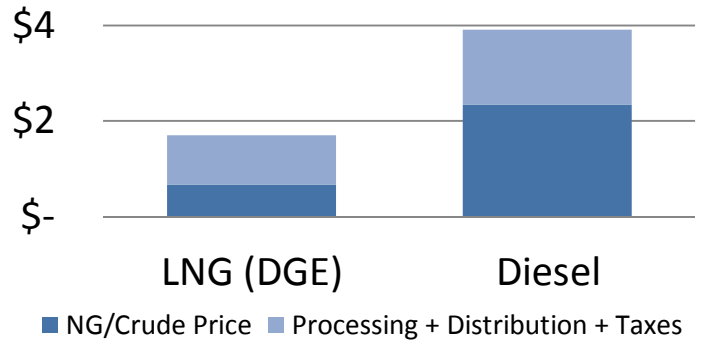
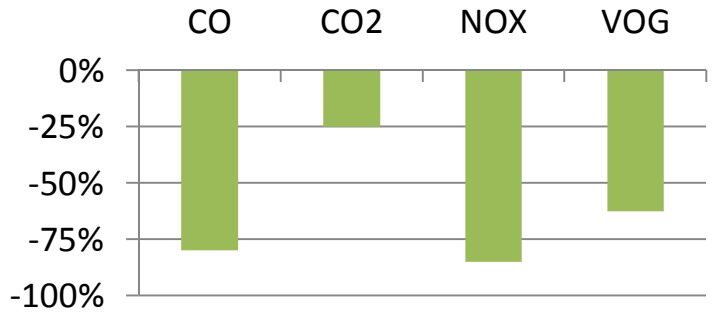
LNG-fueled transportation today

Opportunities

LNG vs Diesel Prices[1, 2, 3]



NG vs Diesel Emissions Reduction*



Adoption challenges

For vehicle owners

- High conversion costs
- Nascent LNG fueling network

For LNG station operators

- High CapEx/OpEx
- Location based adoption risk
- Logistics cost & complexity

Sources: [1]IHS CERA – Apr '12, [2] Credit Suisse: The Shale Revolution – Dec '12, [3] EIA.gov data – Feb '13, data, [4] NGVA –'13

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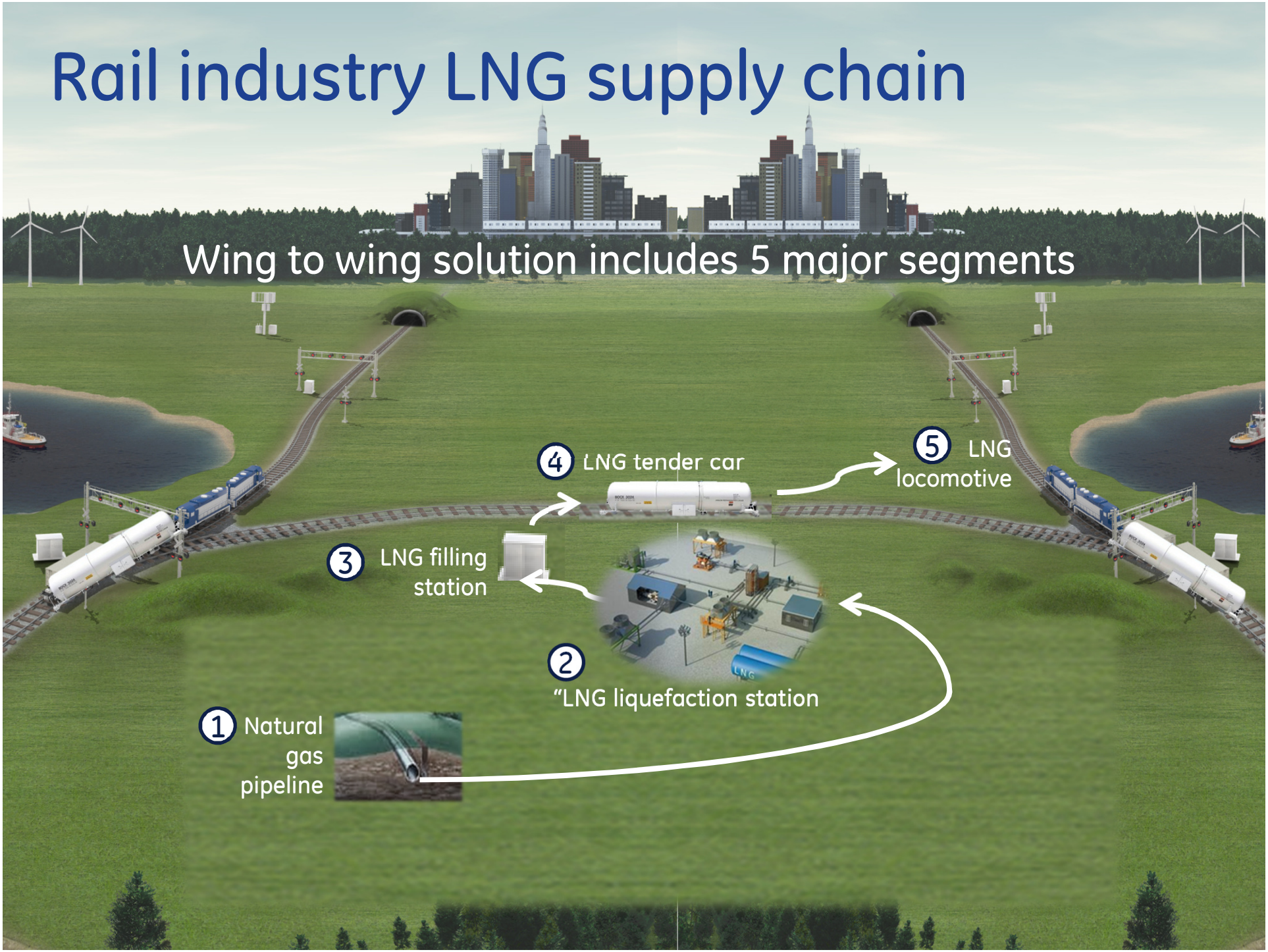
Rail industry LNG supply chain



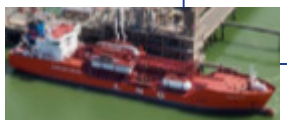
LNG infrastructure for marine

Gas Source

Pipeline Gas

Large LNG terminal

LNG Container



Marine Transport

@Port

Road Transport

TTS Bunkering

Small-Scale LNG

LNG Station

LNG Storage

L/CNG Station

Power Station

STS Bunkering

Users

Marine fleets
- Ro-Ro
- Lo-Lo
- Ro-Pax

Industrial fleets
- Rail
- Heavy duty
- Medium duty

Personal NGV/Fleets
- Light/medium duty

Distributed Power
- Emerging markets
- Remote power
- Peaking
- Marine fleets

GE Offerings

Micro LNG
Salof MMLS

LNG In A Box
CNG In A Box

Gas Engines
Drill Motors
Gas Turbines

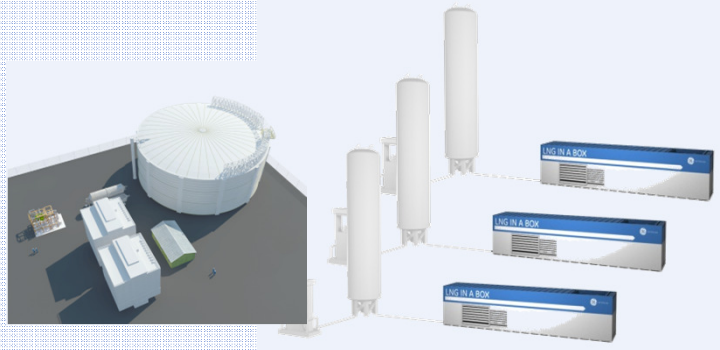
imagination at work

Transforming LNG fueling infrastructure model

Traditional Large LNG

- Up to 72 months
- Custom, project-based
- Capital intensive
- High logistics complexity & cost

LNG for Transportation



- 6-24 months
- Modular & standard, product-based
- Reduced CapEx & OpEx
- Simplified logistics, on-site production

Breaking down traditional, complex LNG plants into modular, rapidly deployable solutions

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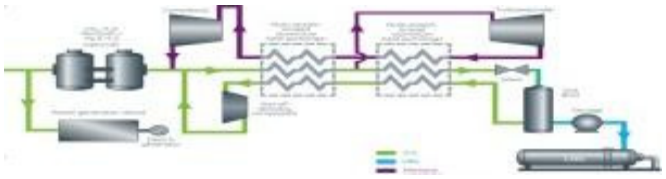
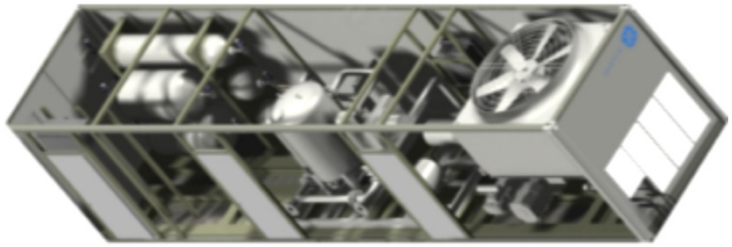
Small LNG solutions

1 Tonne of LNG = 1,380 m3) of Natural Gas = approx. 52 mm BTU
1 Ktpa = 1 Kilo (1,000) tonne per annum
For full conversion table: http://www.platts.com/conversion-tables





2011

Micro LNG – Gen 1

- 30-90 Ktpa
- Liquefaction only
- Custom
- API
- EPC heavy
- Construct on site
- 24 months lead time

2012 - 2013

Micro LNG – Gen 2

- 30-150 Ktpa
- Turnkey solution
- Multiple standard packages
- Non API
- Factory tested skids, GC only
- Plug&play, light civil work
- Target 12-15 mo lead time

LNG in a Box

- 6-30 Ktpa
- Turn key solution
- 1 standard box
- Non API
- Factory tested solutions
- Plug&play, pad prep only
- Target 3-6 mo lead time
- Equipment financing

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LNG In A Box™ system

1 LNG gallon = 75,000 Btu
1.68 Gallons of LNG = 1 Gallon of Diesel
(on energy equivalents)

Ideally suited for:

- Heavy-duty truck fueling stations
- Virtual pipeline
- Distributed power generation

Performance:

- 10,000-50,000 gallons per day LNG production
- Inlet gas: Pipeline
- Gas recovery: 80-82%
- Specific power 1.4 kWh/gal (1.3MJ/liter)

Features:

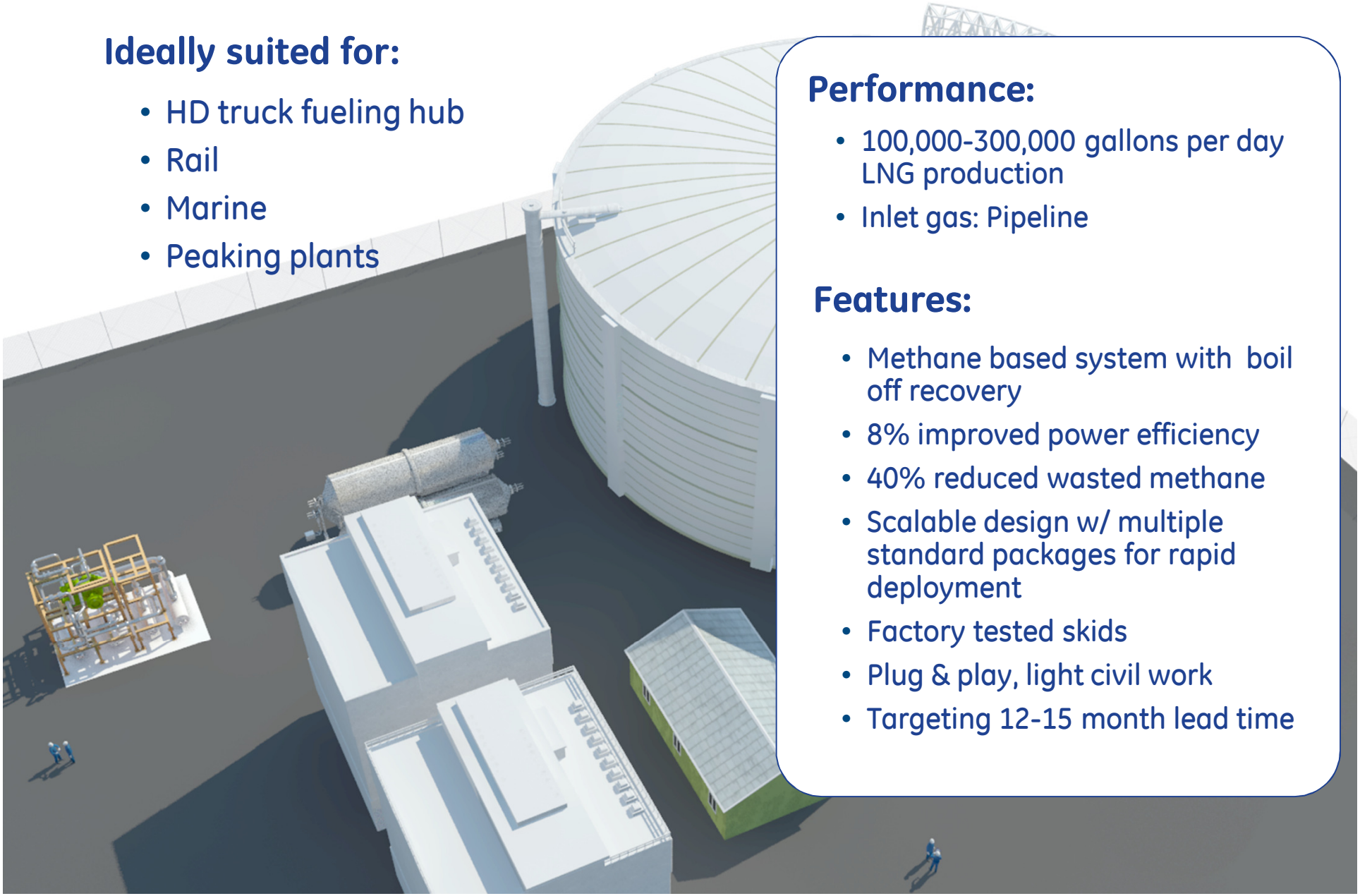
- Modular, rapidly (re)deployable design
- Simple methane cycle
- Minimal pad prep & quick installation
- 6-12 month lead time
- Highly automated operation
- Gas engine option available
- Equipment financing available

Micro LNG system

1 LNG gallon = 75,000 Btu
1.68 Gallons of LNG = 1 Gallon of Diesel
(on energy equivalents)

Ideally suited for:

- HD truck fueling hub
- Rail
- Marine
- Peaking plants



Performance:

- 100,000-300,000 gallons per day LNG production
- Inlet gas: Pipeline

Features:

- Methane based system with boil off recovery
- 8% improved power efficiency
- 40% reduced wasted methane
- Scalable design w/ multiple standard packages for rapid deployment
- Factory tested skids
- Plug & play, light civil work
- Targeting 12-15 month lead time

CNG In A Box™ system

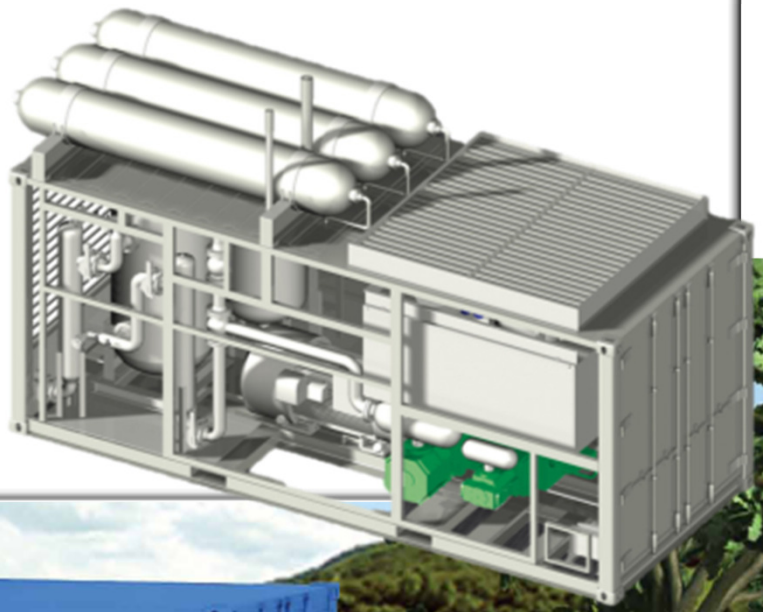
1 GGE* = 114,000 BTU/Gallon
1 GGE* = 3.587 m3 Compressed Natural Gas

Performance:

- 10,000-20,000 gallons per day gasoline equiv. (GGE*) production
- Inlet gas: Pipeline

Features:

- Portable, Modular design
- Minimal pad prep & quick installation
- 2-4 month lead time
- Highly automated operation
- Gas engine option available
- Equipment financing available

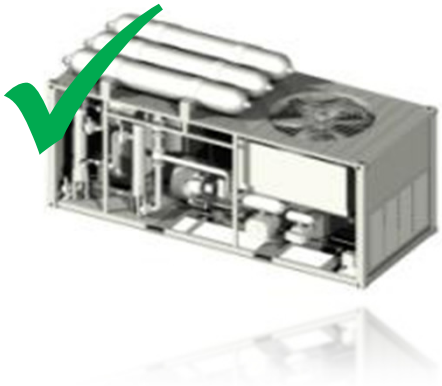


Ideally suited for:

- Cars, trucks, buses fueling stations
- Rig-site gas distribution, flare capture
- Storage, remote sites

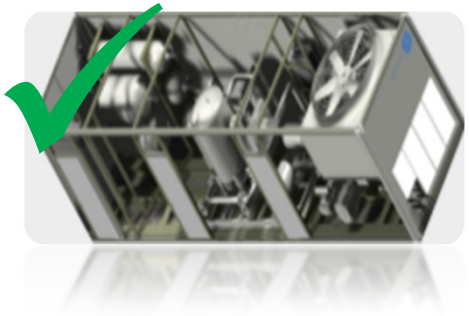
CNG Portfolio

1 GGE* = 114,000 BTU/Gallon
1 GGE* = 3.587 m3 Compressed Natural Gas



CNG In A Box - 400

- 10,000 gasoline gallons per day … 7.5 GGE / min
- Cars, trucks, buses
- Launched in Mar ‘12 … first unit delivered Sep ‘12



CNG In A Box High-Flow

- 20,000 gasoline gallons per day … 15 GGE / min
- Rig-site gas distribution, large trucks, flare capture
- Launched in Sep ‘12 … first unit delivered Mar ‘13

CNG In A Box Stand-alone

- 10-20,000 gasoline gallons per day … gas-engine driven
- Storage, remote sites
- Under development

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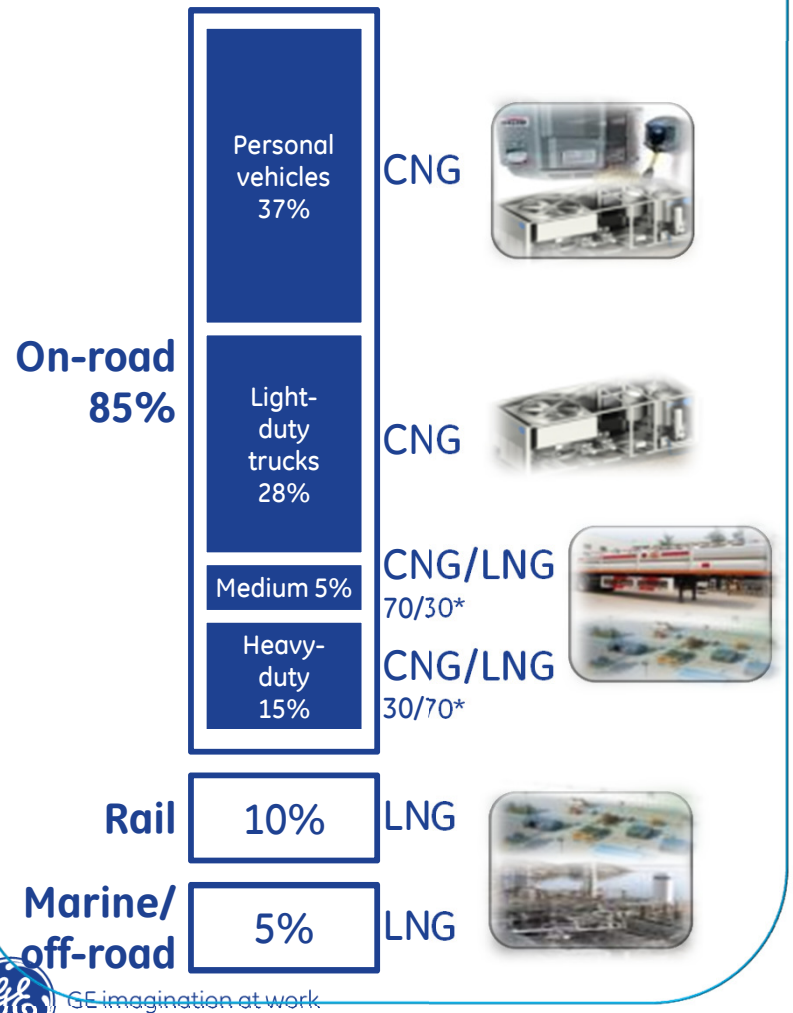
Gas Monetization… CNG/LNG

NA transportation fuel share
by vehicle type



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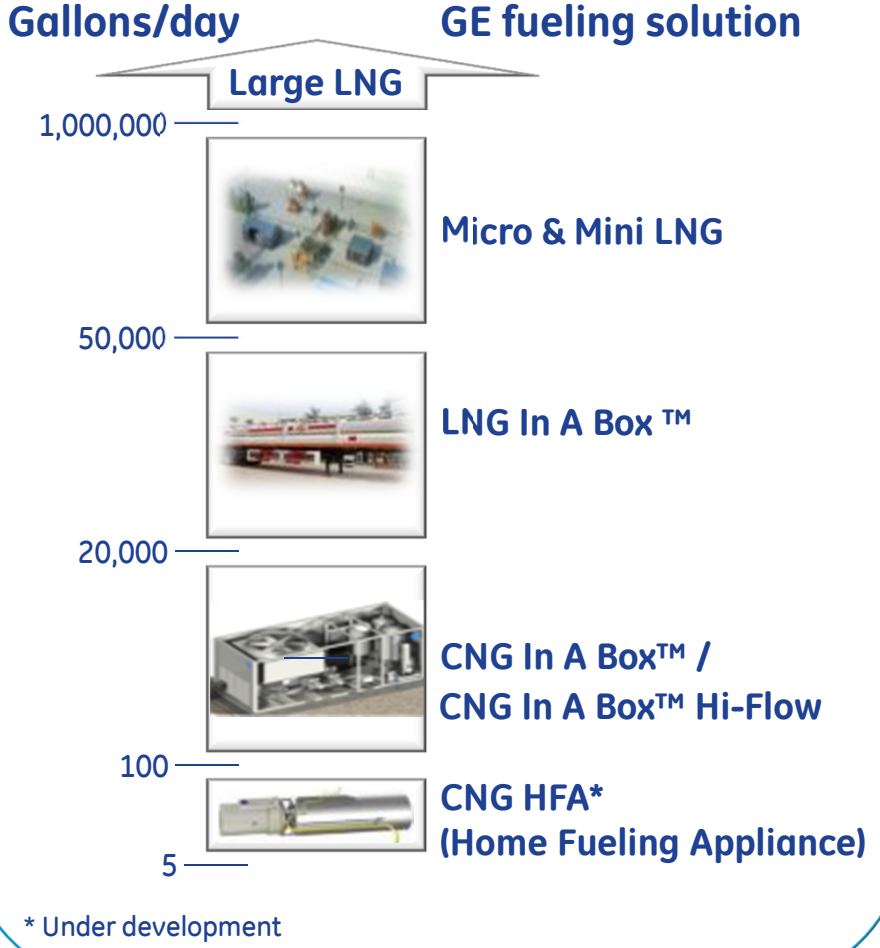
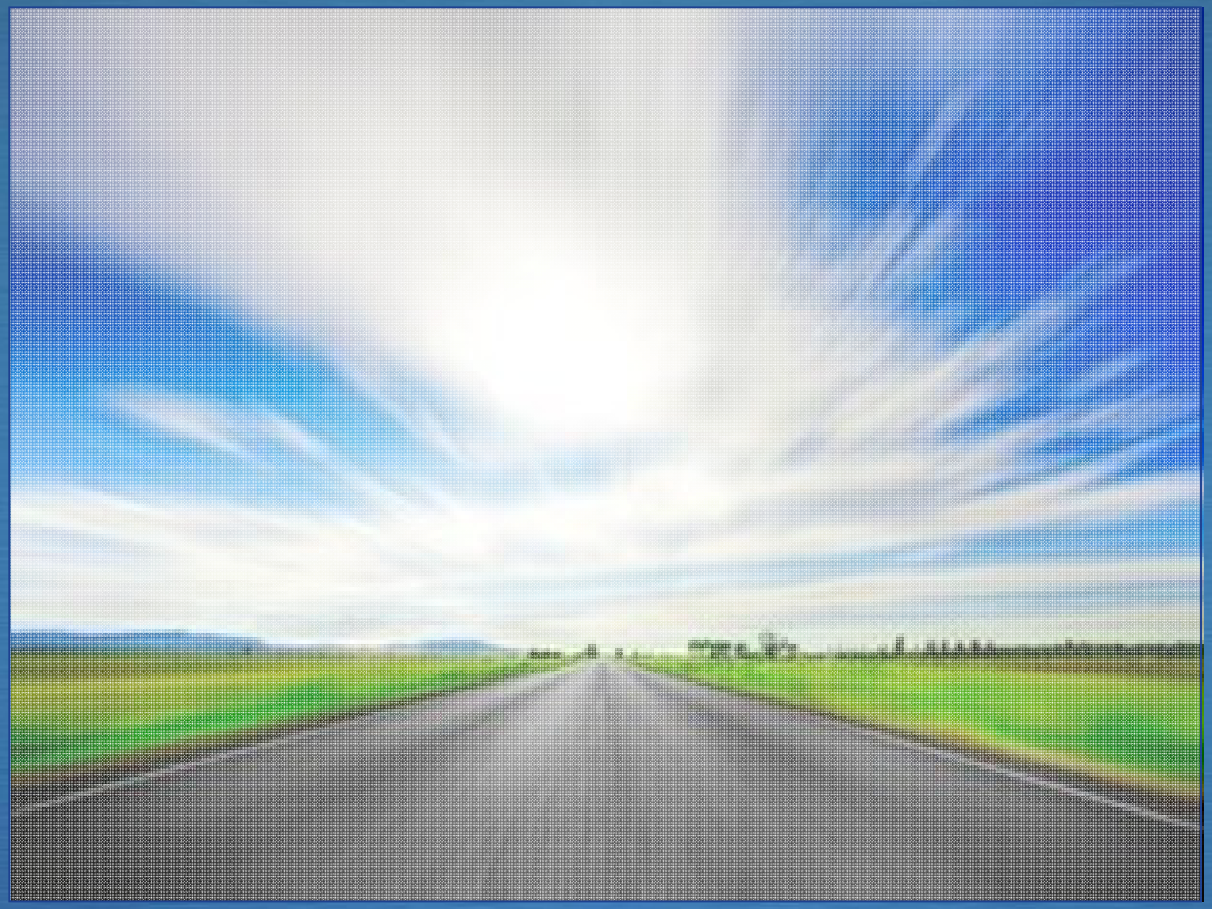
Source: 2007 EIA: Transportation Energy Data Book
*2017 estimate by Frost & Sullivan **N8CF-18. Medium is average of Class 6 & 7 trucks, Heavy duty is Class 8 trucks**
**NTI/BD under exploration

GE Gas Monetization Solutions



* Under development



Summary and conclusions

Small LNG … key points

- Strong heritage and experience in large scale LNG
- In-house financial solutions to facilitate different business models
- Integrated LNG solutions for wide production capacity range
- Complete life cycle solution utilizing best-in-class GE capabilities
- Product structure … Single design for multiple plants
- Modular design … Plug & play
- Flexible … can de redeployed or scaled up/down if needed

Bringing GE-proven LNG experience
to rapidly deployable, small-scale solutions

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