

**Economic Commission for Europe**

Inland Transport Committee

**Working Party on the Transport of Dangerous Goods**

**Ninety-fifth session**

Geneva, 4-8 November 2013

Item 6(a) of the provisional agenda

**Proposals for amendments to Annexes A and B of ADR  
construction and approval of vehicles**

6 November 2013

**The use of CNG and LNG fuelled vehicles carrying  
dangerous goods - Presentation**

**Transmitted by the Netherlands**

**Informal Document  
presented to  
WP15 -Transport of Dangerous Goods  
6 November 2013  
United Nations  
Geneva**

**LNG: A SAFE FUEL FOR TRUCKS**



# Purpose: Advocate for a change in ADR regulations that prevent LNG vehicles from being ADR-certified

- ADR regulations provide an exemption related to the carriage of gases so long as the gas is used for propulsion or operating on-board equipment.  
*Annex A: 1.1.3.2 Exemptions related to the carriage of gases*  
*The provision laid down in ADR do not apply to the carriage of:*  
*Gases contained in the tanks of a vehicle, performing a transport operation and destined for its propulsion or for the operation of any of its equipment (e.g. refrigerating equipment)*
- On the other hand, another provision in the regulation related to fuel leaks specifies that the leaked fuel should drain to the ground. Unlike methane at ambient temperature, which is lighter than air, LNG (below -112) is heavier than air and upon release from a container eventually fully vaporises through heat transfer with the air and the surroundings.  
*Annex A: 9.2.4.3 **Fuel tanks** : The fuel tanks for supplying the engine of the vehicle shall meet the following requirements:*  
*In the event of **any leakage, the fuel shall drain to the ground** without coming into contact with hot parts of the vehicle or the load;*

# LNG Safety Characteristics

- **Natural gas liquefies at -163°C**
- **LNG is not flammable (due to its density). Only the vapor will ignite when the concentration is between 5% and 15% by volume in air.**
- **LNG is non-toxic, non-corrosive and does not contaminate soil or ground water.**
- **When spilled LNG, vaporizes creating a white cloud of condensed moisture.**
- **The vapor cloud is heavier than air until it reaches -112°C, then it disperses quickly (like methane in its normal gaseous state).**

Source: LNG Safety: Integrating Standards, Regulations, Best Practices & Compliance, Douglas Horne, Clean Vehicle Education Foundation at LNG is Hot Workshop, Clean Fuels Consulting, Brussels 2009.

# Global Overview on the Development of LNG Trucks

- Summary world market for LNG & trucks
- European LNG truck development
- Development of LNG truck market: North America
- LNG truck developments: China & Australia
- Fuel suppliers' vision of LNG for trucks

# Current Global View: HDV NGVs

REGION	TOTAL NGVs	MD/HD BUSES	MD/HD TRUCKS	% MD/HDV TRUCKS of TOTAL NGVs
ASIA	9,733,192	390,849	155,207	1.6%
EURASIA	336,862	32,200	52,760	15.7%
AFRICA	188,220	1,463	85	0.45%
EUROPE*	1,735,115 (1,347,115)	278,472 (45,684)	193,759 (57,966)	11.2% (4.3%)
S & CENTRAL AMERICA	4,608,799	13,920	9,660	0.21%
NORTH AMERICA	131,036	13,230	~15,550 <sup>(1)</sup> (~4000 L-NGVs)	11.8%
WORLDWIDE	16,424,603	697,596	361,748	2.2%

**\*UKRAINE**

**388,000**

**232,788**

**135,793**

**35%**

Source: Gas Vehicle Reports, Aug/September 2012/13, NGVAmerica  
 (1) US/Canada NGV Market Analysis (segmentation), Tiax/ANGA,2010

# International Standards & Regulations are Being Developed for L-NGVs

## United Nations Regulations

- Amendments to R.110 for L-NGV components & installation (awaiting approval by WP29)
- Dual-fuel trucks (including LNG) R.49
- Fuel station signage agreed at UN (WP1)

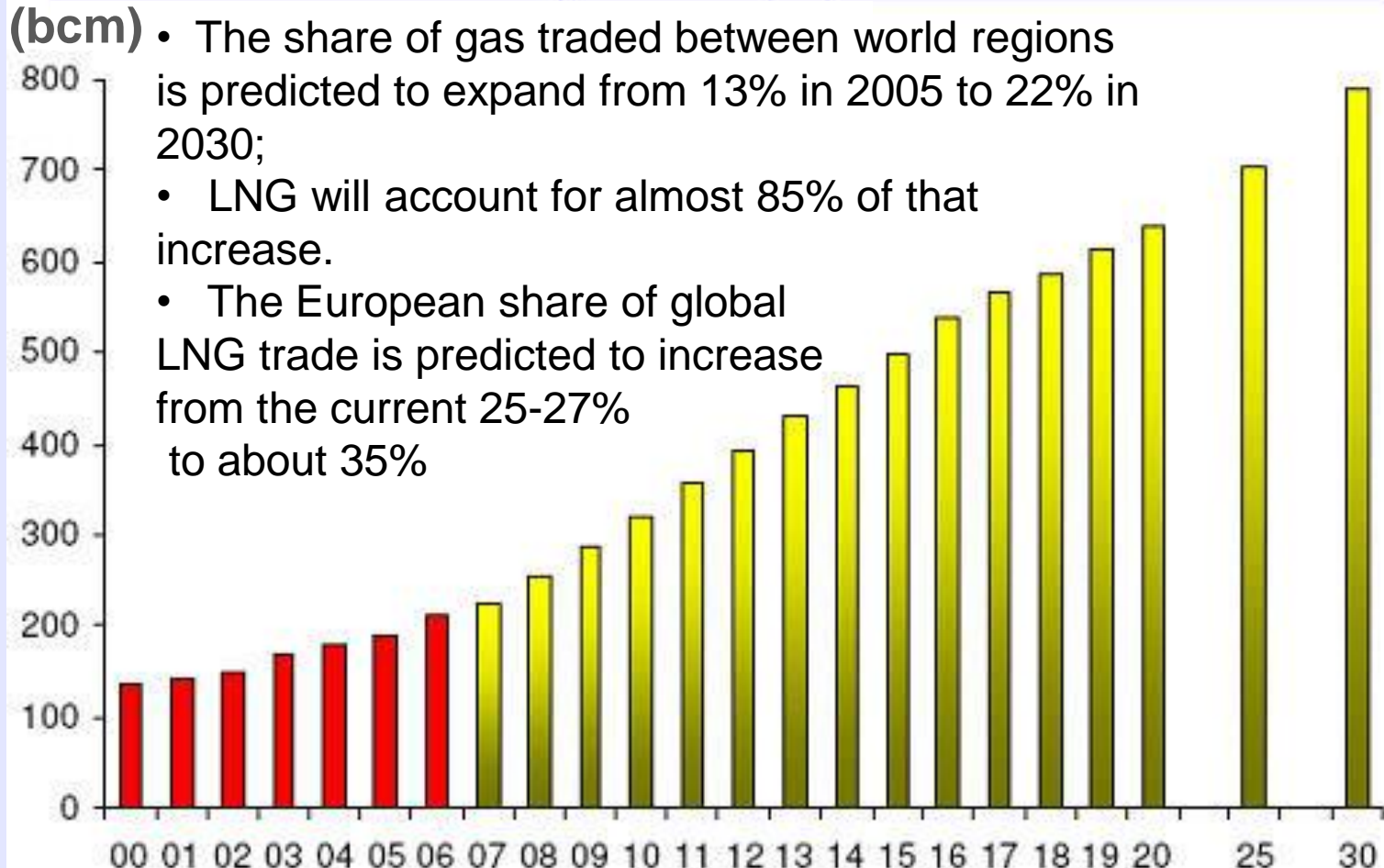


## ISO Standards Development is on-going

- Fueling stations and storage require harmonized global regulations, current national standards are insufficient. *(ISO standards underway)*
- Tanks for on-board storage *(ISO 1299/2012 standard completed)*
- Harmonized fuel connector/receptacle needed *(ISO standard underway)*

# World Forecast LNG Trade Through to 2030

Forecast LNG Trade Through to 2030 (bcm)





# Expansion of LNG terminals provide new opportunities for L-NGV fuelling stations in different countries



# European OEM LNG Trucks

- IVECO  
Stralis LNG



- Mercedes  
Econic LNG



- Scania  
P310 LNG



- Volvo  
FM MethanDiesel



# European LNG Truck Fleets

## Rolande

- Rolande (NL/F/D) supermarket distribution (12 Iveco Stralis trucks)
- 6 L-CNG stations NL
- Fuel costs savings over diesel = €8,600 to €15,000 per vehicle per year (over 7 years)

Source: Rolande 2012





# European LNG Truck Fleets

## Simon Loos (NL)

- 30 Mercedes LNG trucks deployed in 2012
- Pollution reduction:
  - CO2 -30%
  - Particulates -85%
  - Noise -30%
- 600-700 km range
- Fuel consumption = diesel



# CHIVE LNG REFUELLING NETWORK: Some stations are inactive due to current LNG fleet demand (2013)



Lesmahagow



Tebay



Londonderry



Carlisle



Castleford



Wolverhampton



Lymm



Bristol



Ilkeston



Flamstead



Shepshed

# Barcelona LNG Garbage Trucks

- With five terminals currently in operation, Spain is the largest LNG market in Europe. (World's third-largest LNG importer after Japan and South Korea.)
- LNG makes up around 70% of Spanish natural gas supplies.
- For over 8 years LNG has been used as a transport fuel in Barcelona.
- Barcelona's LNG garbage trucks belong to CESPAA and are hired by Barcelona city council.



Chassis is made by MAN and Ros-Roca, Indox, Messer and Gas Natural have assisted the project.



# LNG for Heavy Duty Vehicles (USA)

- 150 LNG fuelling stations (42 public)
- 4,000+ L-NGVs
  - Freightliner
  - Kenworth
  - Peterbilt
  - Autocar
  - Capacity
  - Navistar?
  - Volvo?



Passenger Bus



Refuse Truck



Street Sweeper

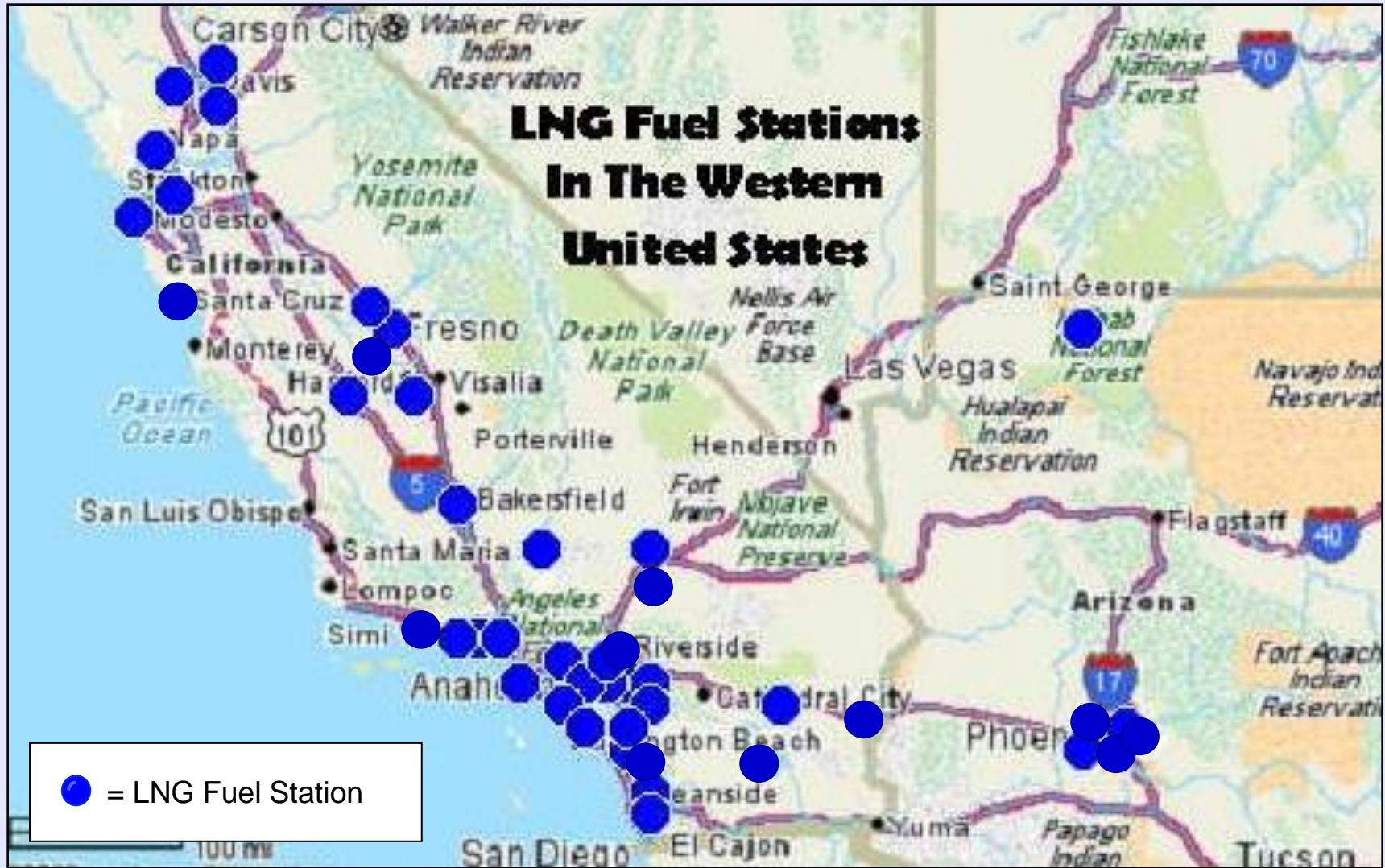
# Local, Regional HD NGV Trucks



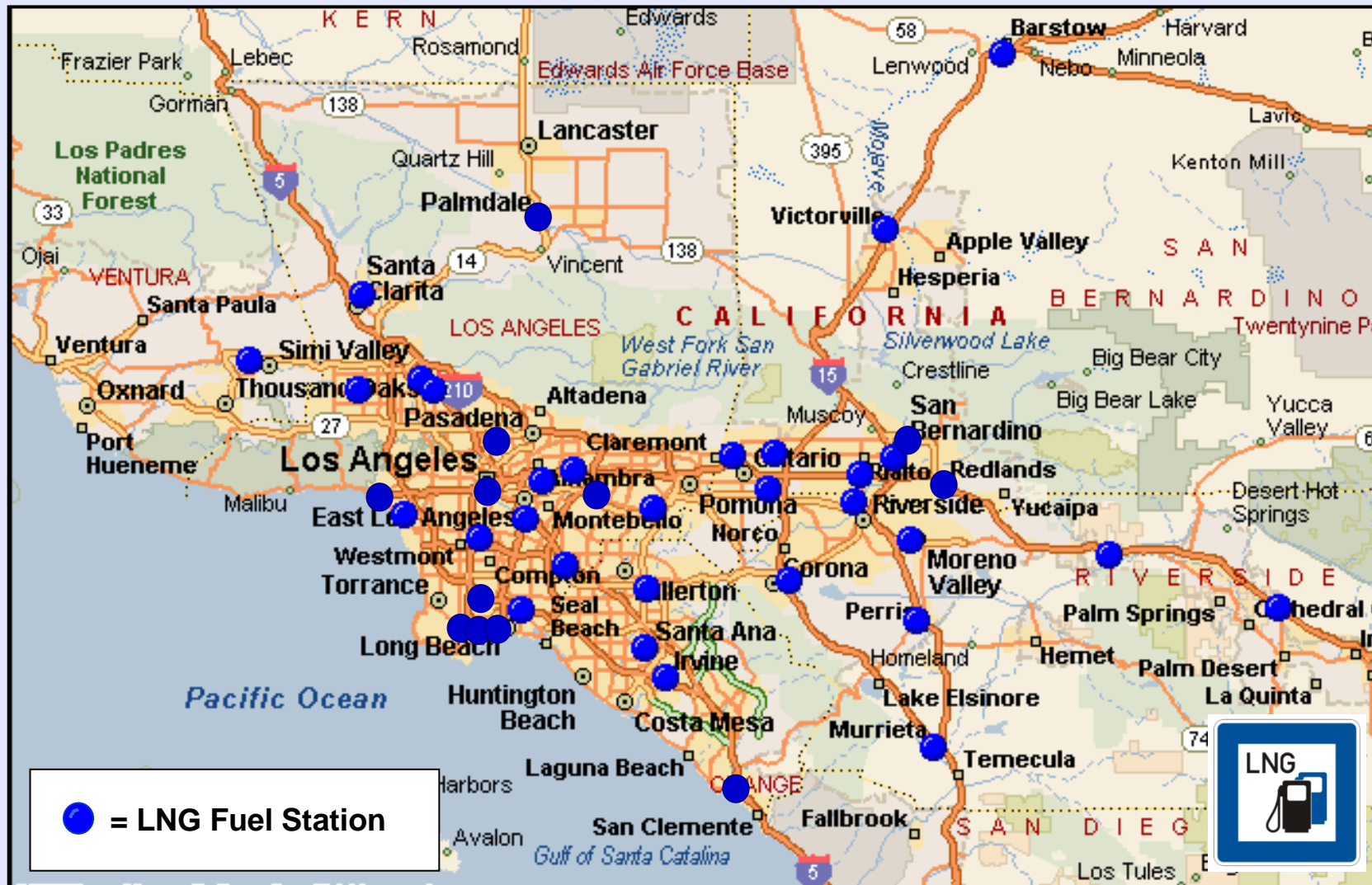
**NGVAMERICA**  
Natural Gas Vehicles for America



# LNG truck stations Western US



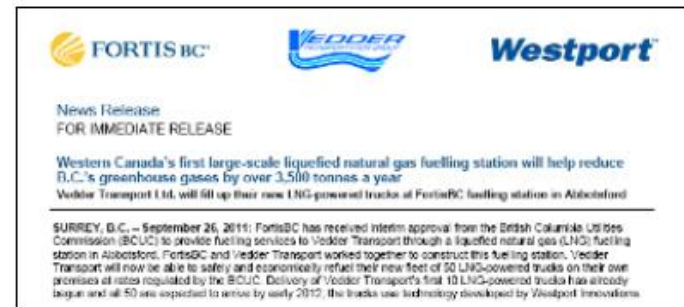
# 41 L-NGV Stations in Southern California



# N. American LNG Truck Case Studies

## Vedder Transport

- Largest fleet in British Columbia, Canada – high environmental commitment
- 50 new LNG tractors
- Hauling milk, food, forestry and waste products in dedicated service
- 3500 tonne annual GHGe reductions from implementation
- Cost reductions result in ~16 month payback
- 1 fuelling station – public access





# N. American LNG Truck Case Studies

## United Parcel Service

- Largest private fleet in USA – environment, energy security concerns
- 82 new LNG tractors – operating between Los Angeles, Las Vegas and Salt Lake City Distribution Centres
- 688 mile (1107 km) corridor with 3 fuel stations
- 4 fuelling stations
  - – public access
- ~5100 tonne annual GHGe reductions from implementation



# LNG for Port Applications

(Examples in Long Beach, California, USA)



# CHINA

22 LNG receiving terminals being built  
350 L-NGV Fuelling Stations; 13,300 L-NGVs\*



Slide adapted from GAS ADVISERS 3 Dec 2009

\*Vehicle data: Westport 2013 (US DOE-EIA)



# Currently 10 Operational LNG Refueling Stations with 4 More Planned, All on Major Trucking Routes.



Evol LNG storage



Source: EVOL LNG May 2009

# **LNG FOR TRUCKS**

## **The fuel suppliers' views....**

**Also as fleet operators of  
trucks & ships**



# Shell Vision LNG Vehicles Road & Marine Transport

Shell  
**LNG**  
TOMORROW'S FUEL TODAY

LNG in Transport from vision into reality  
Lauran Wetemans – GM, DLNG



# Shell Vision for LNG Trucks in N. America: \$100m investment in LNG & L-CNG fuelling stations

## GREEN CORRIDOR - CANADA



- Canadian Green Corridor, 1500 km Vancouver – Calgary - Edmonton
- Shell Flying J Network
- Sites opening end 2012



# Shell Vision... Europe

- Focus on Marine & Road
- North West Europe
- Including Addressing Own Demand
  - 2 barges with ISB on Rhine

“Shell owns 1,800+ vessels & target 25% to be using LNG by 2025.” (Poli-techs, March 2013, Brussels)

**GATE**



**GASNOR**



**ROAD**

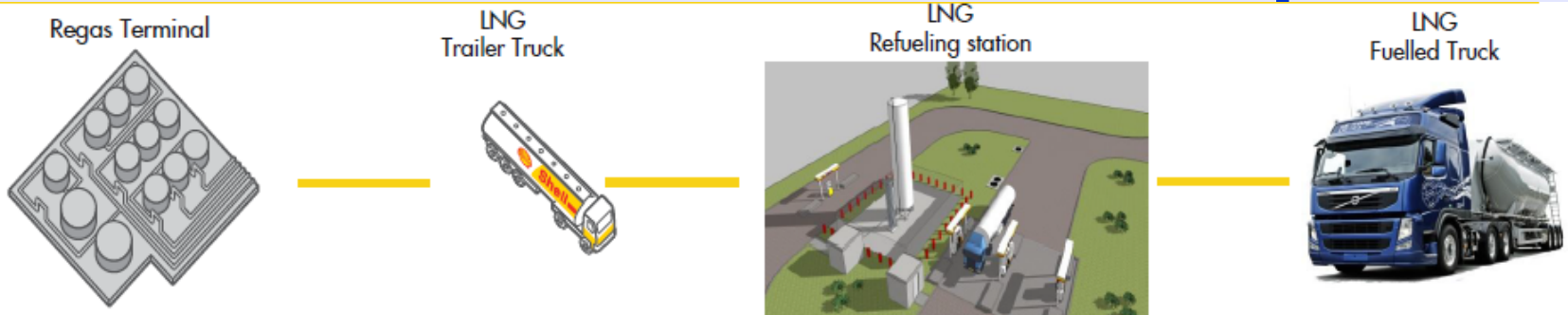


**INLAND WATERWAYS**





# Shell view of LNG for Transport



## CRITICAL SUCCESS FACTORS

### Conversion Cost

- LNG refueling station will be 3-5 times more expensive than current diesel station
- Increased availability of LNG fuelled trucks at a lower cost
- Cost reduction across the supply chain

### PRICING

- Governed to lower your total costs of ownership
- Enabling to provide customers a high quality fuel at discounted diesel prices

### REFUELING NETWORK

- Network Plan for LNG sites on existing Truck network
- Align with customer priorities

# Linde is a leader supplier of LNG and LNG fuel stations

Linde North America has purchased 23 LNG trucks for own distribution fleet



- **Peterbilt and Kenworth LNG trucks** with LNG fuel system and 8.9L NG engine
  - Cummins West Port ISLG Engine
  - 350 HP
- Trucks deployed in **Southern California, Texas and Midwest**
- Lower weight, spark ignited units has even **improved pay-load**



**Take-out: Good driver experience and economics in line with expectations. Linde always operating weight restricted which is limiting areas were low horse power engines can be used.**

# Linde view of what's required for LNG to penetrate the heavy truck market

- Codes & standards need to come in place, beyond local ones
- Industry must put „Safety first“
- Gas quality requirements needs to be sorted out (not that easy)
- Never accept solutions allowing methane to free air to be adopted
- Hen & egg situation can be solved
- LNG and CNG goes hand-in-hand and LNG is not a viable option for every heavy vehicle!
- Biomethane likely to play significant role on many markets as transport fuel and EU wide regulations on certificate trading needed
- All stakeholders need to work close together to align expectations and set priorities during early market phase

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