Bio/CNG off pipeline solutions and economics

TEN-T Days 2015, Riga, Latvia
Subject: Minimum requirements on alternative fuels infrastructure build up, to be implemented through Member States’ national policy frameworks, EU common technical specifications and Consumer information.

**Scope regarding CNG:**
- Appropriate number of CNG filling points in urban/suburban and other densely populated areas
- CNG filling point every 150 km along the TEN-T core network corridors

**Estimated Targets (Quantity):**
- Example of well developed LPG fueling infrastructure - 29 000 filling stations for 6 M LPG vehicles
- NGV industry target - 15M NGVs by 2025, i.e. ~16 000 CNG stations (Italian example: 900 NGVs per station)
- Expert Group of Future Transport fuels - 10% of urban conventional stations & 25% of on-highway stations

**Current CNG filling infrastructure status:** 3 200 CNG filling stations in EU

Overlooked factor for consumer acceptance of CNG – Quality (Convenient Location)
Leading EU CNG filling infrastructure countries

**GERMANY**

- **CNG filling stations infrastructure:**
  - No CNG stations on the highways and motorways*
  - In less densely populated areas the stations are not located in the most convenient places, as they are tied to existing gas distribution grid

- **Market Status:**
  - 920 CNG filling stations
  - 98,000 NGVs
  - Only ~110 NGVs per station

**ITALY**

- **CNG filling stations infrastructure:**
  - ~50 CNG stations located on the highways and motorways
  - Recent stations were deployed in the most optimal locations from the traffic-related point of view**

- **Market Status:**
  - 990 CNG filling stations
  - 885,000 NGVs
  - ~900 NGVs per station

*Michael Schuermann, Erdgas-mobil GmbH
**Flavio Mariani (NGV Europe)
***NGVA Europe (vehicle and station statistical data)

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Competitive Price + Convenient Location + Stability. Required combination for consumers to adopt CNG as mainstream alternative fuel.

**TEN-T Days 2015, Riga. Presentation “Bio/CNG off pipeline solutions and economics”**
For the deployment of appropriate CNG filling infrastructure (Quantity and Quality) off-grid CNG solutions will play an important role and will be the part of the market opportunity.
Off-grid CNG filling infrastructure (Virtual Pipeline)

Gas Source > Compression & Loading > Transportation > Unloading & Final Consumer

Gas Source: pipeline, biomethane plant, LNG vaporizer, synthetic gas

*Regulatory implications of new developments in the gas supply chain, Final Report 2014 (Submitted by Kantor)

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Off-grid LCNG filling infrastructure

1. Gas Source
   - Existing LNG import terminal
     - Unloading facility
     - LNG Storage
   - Existing liquefaction plant
     - LNG train
     - LNG Storage
   - Small scale liquefaction plant
     - Transmission system
     - Stranded gas reserves
     - LNG Storage
   - Gas Source
     - If existing LNG storage facilities are available, loading of LNG can be carried out there.
     - Otherwise, LNG is produced in a liquefaction plant, connected to the gas transmission system or directly to a gas field.

2. Compression & Loading
   - Intermediary storage
   - LNG truck
   - LNG barge
   - LNG loading terminal
   - TransportNG is carried out using specialized LNG trucks
   - Sea transportation of LNG is carried out using small scale LNG vessels

3. Transportation
   - LNG tank wagons
   - Transportation network

4. Unloading & Final Consumer
   - LNG filling station
   - LNG is unloaded at satellite plants that are connected:
     - To a local network supplying final consumers
     - Directly to the internal installations of final consumers (e.g. industries, residential blocks, CNG filling stations)

*LNG Source > Transportation > Unloading > Storing > Regasification*
(Source: LNG import terminal, existing liquefaction plant or small scale NG/Bio liquefaction plant)

*Regulatory implications of new developments in the gas supply chain, Final Report 2014 (Submitted by Kantor)*
GasLiner – Multifunctional CNG off-grid solution

REGULAR OFF-GRID CNG SUPPLY CHAIN
1. Gas Source
2. Compression & Loading
3. Transportation
4. Unloading & Final Consumer

GASLINER OFF-GRID CNG SUPPLY CHAIN

Gas Source > GasLiner > CNG Filling Station
Cuts the regular CNG supply chain. Brings down CapEx significantly. Decreases OpEx.

Presentation “Bio/CNG off pipeline solutions and economics”
TEN-T Days 2015, Riga.
GasLiner – Tested and Proven in Pilot Project

VIDEO AVAILABLE ON: WWW.GASLINER.COM
8 CNG filling points will be deployed along TEN-T core corridor. Remote CNG filling points ensures the convenient fueling locations for drivers.
Virtual pipeline CNG supply for remote CNG filling points.
Daily route = 4h. Filling time of each station storage = 30 min.
**Pilot Project: Estimated Economics**

### Regular CNG Supply Chain
- Gas Field
- Interstate Pipeline
- Distribution grid
- Compressor
- CNG Trailer
- Booster

### GasLiner CNG Supply Chain
- Gas Field
- Interstate Pipeline

Total off-grid CNG filling infrastructure cost per nm³ or kg along the TEN-T core corridors with GasLiner as virtual pipeline solution is **0,30 EUR/nm³ or 0,42 EUR/kg**.

#### CapEx:
- 0,19 EUR/nm³ or 0,266 EUR/kg
  - CapEx: 70 000 EUR/y (10y amortization, financed by dept)

#### OpEx:
- 0,11 EUR/nm³ or 0,154 EUR/kg
  - CapEx: 8 000 EUR/y (10y amortization, financed by dept)
  - OpEx: Electricity exp. 800 EUR/y (0,025 kwh/m³)
  - Staff exp.: 45 000 EUR/y (9 man h/day)
  - Maintenance exp.: 34 000 EUR/y (5% from CapEx/y)
  - The cost of fuel: 19 000 EUR/y (300 km/day, DF)
  - Cost of debt capital: ~15 000 EUR/y (4%)

#### Operator Net Margin:
- 9 000 EUR/y

#### Amount:
- 6400 nm³/day (15h compression, 8h transportation)

- 800 nm³/day (fully utilized)
Cost breakdown of GasLiner virtual pipeline (compression, transportation, unloading) and GasCharger CNG filling station module (storage and dispensing) per nm³ of CNG
Natural Gas cleans the air in the cities. Biomethane (renewable CH4) decarbonizes the Planet. Off-grid CNG supply chain allows to switch from Natural Gas to Biomethane overnight.

Compared to Diesel:
- No PM Emissions
- 60% reduction of NOx

Compared to Gasoline:

CO2 Emission Comparison:

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The minimal economic value required for consumer to switch to CNG is 30%.
The usage of Biomethane leaves consumer without sufficient value for switching the fuels.
Off-grid CNG vs Diesel (price comparison)

GAS SOURCE: BIOMETHANE PLANT (POLICY)

- Diesel: EUR 1.20
- BioMethane: EUR 0.440
- Virtual pipeline: EUR 0.190
- Filling Station Module: EUR 0.110
- Excise Tax: EUR 0.000
- VAT: EUR 0.000

Overall savings: -35%

*Latvian Biogas Association, Biogas plants with capacity >2 MW

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The kick-off should be supported by CapEx and Opex efficient, flexible, versatile and fast to deploy off-grid CNG solutions that works in small scale.
Thank you

CONTACT INFO:

Robert Strods/Co-Founder/
E-mail: robert@gasliner.com
www.gasliner.com