Standardization for LNG for Road Filling Stations and Trucks

Company presentation
Market experience and perspectives

Tallinn, May 16th 2018

www.cryogas.pl
Company profile

✓ Distribution and sales of the liquefied natural gas – LNG. Natural gas supplies by grids.
✓ Construction of LNG consumption facilities in Poland and in the Baltic States.
✓ More than 30% of the Polish LNG consumption market share within five years of operations.
✓ Several LNG regasification systems for industrial consumers.
✓ LNG marketing as motor fuel – trucks, garbage trucks, buses.
✓ Fleet of cryogenic semi-trailers for LNG transport.
✓ Official supplier of LNG bunkering for vessels in the Port of Gdansk and the Port of Gdynia.
✓ Team leading Polish specialists in LNG market.
Company movie presentation

Click picture to watch movie on YouTube
Directions of LNG deliveries

**LNG liquefaction plants**
- Kaliningrad, Russia
- Pskov, Russia
- Kingisepp, Russia
- Odolanów, Poland

**LNG sea terminals**
- Rotterdam, Netherlands
- Zeebrugge, Belgium
- Świnoujście, Poland
- Klaipeda, Lithuania
- Vysotsk, Russia
Purposes of Cryogas LNG deliveries

Natural gas vehicles
- Reduction of fuel cost.
- Lower CO₂ and NOₓ emission.
- Lower noise emission.

LNG/CNG for city buses, garbage trucks, transport companies.

Bunkering
- Reduction of fuel cost.
- Lower exhaust gases emission.
- Fulfil present and future SECA standards.

LNG for seaway vessels.
LNG for inland waterway vessels.

Industry
- Heat production.
- Process steam production.
- High efficient cogeneration (CHP).

Industry customers without access to natural gas grids network.
Cryogas as the LNG supplier for trucks

LNG road tests for transport companies
Activity: Long distance tests of LNG trucks
Start: June 2015
Fleet:
- IKEA Distribution North Europe
- Unilever Poland
Status: Cryogas provides LNG supplies and infrastructure.

First LNG station for municipal services
Activity: Design & construction of LNG/LCNG station
Start: September 2015
Fleet: Municipal garbage trucks
Status: Refuelling of Light and Heavy Garbage trucks owned by municipal company (PGK Śrem). Station is open 24/7 to the public.

First motorway LNG/CNG station
Activity: Design & construction of LNG/LCNG station
Start: January 2018
Fleet: HD trucks, LDVs
Status: Station at design stage. Project in cooperation with local petrol company (UNIWAR).
# Real road tests of Iveco Stralis LNG

<table>
<thead>
<tr>
<th></th>
<th>IKEA</th>
<th>Unilever</th>
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<tbody>
<tr>
<td><strong>LNG Vehicle</strong></td>
<td>Iveco Stralis 330 Natural Power</td>
<td>Iveco Stralis NP400</td>
</tr>
<tr>
<td><strong>Consumption / 100 km</strong></td>
<td>25,0 kg LNG vs 30,0 L Diesel</td>
<td>23,6 kg LNG vs 27,7 L Diesel</td>
</tr>
<tr>
<td><strong>CO2 – LNG vs Diesel</strong></td>
<td>-7%</td>
<td>-11%</td>
</tr>
<tr>
<td><strong>Benefits</strong></td>
<td>Similar use to Diesel truck, significant noise reduction.</td>
<td>Comfortable cabine, similiar use to Diesel truck.</td>
</tr>
<tr>
<td><strong>Challenges</strong></td>
<td>Not enough power, limited range (750 km), limited availability of the stations.</td>
<td>Lack of experience in LNG usage, limited avidability of the stations, no standard fuel cards.</td>
</tr>
<tr>
<td><strong>Further details</strong></td>
<td>On-line report <a href="#">here</a></td>
<td>On-line report <a href="#">here</a></td>
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On the way to HD mobility powered by LNG

Accessible solutions

LNG vehicles
- Mono-fuel 400-460 HP engines.
- Dual-fuel 420-460 HP engines.
- Automatic transmission.
- Refuelling autonomy – 1,600 km.
- NGVs with ADR certification.

LNG refuelling
- Single LNG stations.
- Limited access to LNG blue corridors (semi, Island implementations').

Technology
- Single technology suppliers.
- High-priced equipment.

State support
- Single projects support, discussions for the EU Directive implementation ‘Clean Energy for Transport’.

Missing points

Retrofitting to Dual Fuel NG.
- Construction vehicles – poor offer.
- Diversified products portfolio.

Complex technical regulations.
- Wide access to stations (‘Blue Corridors’).

Competition between suppliers.
- Investment cost reduction.

New eco zones.
- Preferences in road tariffs & excise.
Cryogas M&T Poland Solution
for trucks powered by LNG

- LNG price - parity to Diesel indexed price.
- Price components:
  - ✓ Cost of natural gas;
  - ✓ Excise and road tax;
  - ✓ Tenancy fee for LNG station.
- Possible price reduction - Increased contract’s period/volume.
- Each LNG station is tailor-made solution.
- 24h/7 days Cryogas control of the station.
- Cryogas is responsible of all aspects in reflect to:
  - ✓ LNG supplies and refuelling;
  - ✓ LNG station design, construction and maintenance.
LNG refuelling station - scheme

1. **Cryogenic semi-trailer.** Maintains a low temperature of liquefied gas during transportation.
2. **Cryogenic tanks.** Used to store gas in liquefied form.
3. **Cryogenic pump** transfers the fuel to the LNG dispenser.
4. **LNG dispenser** measures the amount of fuel taken, and then an LNG vehicle – truck, bus or other heavy vehicle – is fuelled by using a standardized nozzle.
LNG stations – possible applications

<table>
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<tr>
<th>Fixed station</th>
<th>SKID station (movable)</th>
<th>Container station (mobile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully area arrangement</td>
<td>Station area arrangement</td>
<td>Area adjustment</td>
</tr>
<tr>
<td>Vertical LNG tank</td>
<td></td>
<td>Horizontal LNG tank</td>
</tr>
<tr>
<td>50 HD trucks &amp; more</td>
<td></td>
<td>Up-to 50 HD trucks/day</td>
</tr>
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</table>

**Location requirements**
For setting the LNG station is required area ready for HD trucks handling (LNG supplies) and access to 20 kW electricity.

**Fast and efficient LNG refuelling is accessible for all types of LNG stations (container type as well).**
For HD truck with double tanks it’s consume max. 10 minutes.

*Source: Producers, Cryogas*
LNG refuelling stations for vehicles

Photo. LNG refuelling infrastructure in Olsztyn and Šrem, set by Cryogas M&T Poland

Activity: Design and construction of LNG stations for vehicles refuelling
Commissioning: November 2014 – Olsztyn; September 2015 – Šrem
Comprehensive investment process of building LNG filling station:
1. Executing a complete construction design.
2. Obtaining required permits.
3. Assigning construction managers and inspectors.
4. Executing construction and sanitation works.
5. The official technical authorization of constructed station.
LNG bunkering solution
offered by Cryogas M&T Poland

Experience and perspectives

• **Poland. LNG Truck-to-Ship bunkering**
  ✓ Gdańsk/Gdynia. Cryogas is the official LNG bunkering supplier. Participation in working group for safety and technical operational instructions.
  ✓ Service/regulations extension for other Polish ports.

• **Baltic States. First steps already made**
  ✓ First LNG supplies for vessels operator (Truck-to-Ship deliveries).
  ✓ Activities for expanding truck-to-ship bunkering.
LNG satellite stations for industry

- **Lower cost of heat/process steam production**
  Low fuel price. Saving guarantee based on the market fuel prices. Higher combustion efficiency. Reduced maintenance and operating costs of boiler.

- **Environmental friendly fuel**
  Reduction in CO2 emission and elimination of particle matters emission.

- **Payment for consumption, not for delivery**
  Metering by the flowmeter installed just before customer’s devices using LNG.

- **Multitude of applications**
  LNG can be used i.a. for high efficient CHP units.
LNG satellite station for industry - scheme

1. **Cryogenic semi-trailer** – maintains a low temperature of liquefied gas during transportation.
2. **Cryogenic tank** – set for storage of liquefied gas.
3. **Atmospheric vaporizers** – used to convert the LNG to gaseous form.
4. **Measuring & reduction station** – gas measurement and pressure reduction.
5. **Odorization** – addition of the characteristic smell to the gas.
6. **Facility boiler**.
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