From GasHighWay to LNG Blue Corridors
The new dimension of NGVs development

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In order to overcome these barriers, a European project called **GasHighWay** has been established, aiming at promoting the uptake of gaseous vehicle fuels, namely biomethane and CNG, …and especially the realization of a comprehensive network of filling stations for these fuels spanning Europe from the north, Finland and Sweden, to the south, Italy, …in other words: the GasHighWay.
7 Conclusions

• The role of legislation is essential
• Continuous communication to key decision makers and local authorities is needed
• The public opinion of gas vehicles as well as the majority of the facts regarding gaseous fuels are very positive
• The interest for gas vehicles is closely connected to the price for diesel and gasoline
• The positive practical examples of dual fuel technology have increased the interest towards NG/biomethane
• LNG in heavy duty vehicles and in shipping is increasing the use of methane
• In order to start a project for biogas upgrading and utilization as vehicle fuel, it is best to form a partnership along the whole value chain.
1.6 million NGVs in Europe at the end of 2011 (500,000 at the end of 2003)

Iceland 240 LD 20 HD
Norway 320 LD 500 HD
Sweden 37,700 LD 2,330 HD
Finland 900 LD 100 HD
Latvia 20 LD
Lithuania 80 LD 110 HD
Poland 1,800 LD 290 HD
Germany 94,600 LD 1,650 HD
Czech Republic (CZ) 3,100 LD 400 HD
Russia 55,000 LD 31,000 HD
Latvia 20 LD
Lithuania 80 LD 110 HD
Poland 1,800 LD 290 HD
Germany 94,600 LD 1,650 HD
Czech Republic (CZ) 3,100 LD 400 HD
Russia 55,000 LD 31,000 HD

1,470,800 cars, 46,100 buses, 50,800 trucks and 800 other NGVs
4020 filling stations
6.7 billion Nm3 (5.5 Mtoe)
52 % consumed in HD vehicles

Brussels, 1st March 2012
NGVs World Market growth. 1991 to 2020

Europe: 16% growth (2006-2011)

World: 65 M NGVs in 2020!

Source: www.ngvaeurope.eu
Eurogas Roadmap 2050 (13th Oct. 2011)
9% market share passenger, 33% freight

Final energy consumption - Transport

North American forecast: 37%
CNG urban trucks and buses in Europe

70,000 urban buses give service in the main European cities
9,000 (13%) are CNG.
(Italy, France, Germany, Spain, Sweden, Greece, Portugal, Netherlands)

20,000 garbage trucks in service in Europe
3,000 (15%) are CNG.
(France, Spain, Italy, Greece)
<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Present fuel</th>
<th>LPG</th>
<th>Liquid bio fuels</th>
<th>Full electric</th>
<th>Hybrids (energy recuperation)</th>
<th>Bio-natural gas (CNG &amp; LNG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three wheelers</td>
<td>Petrol</td>
<td>Yes (mostly converted)</td>
<td>Yes (%)</td>
<td>No</td>
<td>No</td>
<td>Yes (CNG)</td>
</tr>
<tr>
<td>Cars</td>
<td>Petrol &amp; diesel</td>
<td>Yes (mostly converted)</td>
<td>Yes (%)</td>
<td>Yes (city cars)</td>
<td>Yes</td>
<td>Yes (CNG)</td>
</tr>
<tr>
<td>Vans &amp; delivery trucks</td>
<td>Diesel</td>
<td>Yes in vans (mostly converted)</td>
<td>Yes (%)</td>
<td>Yes (city use only)</td>
<td>Yes</td>
<td>Yes (CNG)</td>
</tr>
<tr>
<td>Heavy urban trucks</td>
<td>Diesel</td>
<td>No</td>
<td>Yes (%)</td>
<td>No</td>
<td>Yes</td>
<td>Yes (CNG)</td>
</tr>
<tr>
<td>Suburban &amp; urban buses</td>
<td>Diesel</td>
<td>No</td>
<td>Yes (%)</td>
<td>Yes, small Yes (wired)</td>
<td>Yes</td>
<td>Yes (CNG/LNG)</td>
</tr>
<tr>
<td>Coaches</td>
<td>Diesel</td>
<td>No</td>
<td>Yes (%)</td>
<td>No</td>
<td>No</td>
<td>Yes (LNG)</td>
</tr>
<tr>
<td>Heavy on road trucks</td>
<td>Diesel</td>
<td>No</td>
<td>Yes (%)</td>
<td>No</td>
<td>No</td>
<td>Yes (LNG)</td>
</tr>
<tr>
<td>Heavy off road trucks</td>
<td>Diesel</td>
<td>No</td>
<td>Yes (%)</td>
<td>No</td>
<td>No</td>
<td>Yes (CNG/LNG)</td>
</tr>
<tr>
<td>Railway locomotives</td>
<td>Diesel &amp; electric</td>
<td>No</td>
<td>Yes (%)</td>
<td>Yes (wired)</td>
<td>No</td>
<td>Yes (LNG)</td>
</tr>
<tr>
<td>Ships</td>
<td>Diesel</td>
<td>Short sea (converted)</td>
<td>Yes (%)</td>
<td>No</td>
<td>No</td>
<td>Yes (LNG)</td>
</tr>
</tbody>
</table>
LNG trucks for long distance transport

Two engine technologies are available for heavy engines:
- Dedicated, using 100% natural gas
- Dual fuel, using diesel injection for ignition and natural gas as the main fuel

LNG opened the way for the medium and long distance road transport

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North American and Australian LNG trucks

More than 5,000 LNG heavy trucks in service in USA
Chinese LNG trucks

More than 4,000 LNG heavy trucks in operation

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European LNG heavy duty tractors

Still about 200 LNG heavy trucks in Europe
LNG fuelled ships are growing rapidly

- Nov. 1\textsuperscript{st}, 2011
  Japan’s Ministry of Land, Infrastructure, Transport and Tourism had indicated its intention to develop safety standards for vessels powered by \textit{liquefied natural gas (LNG) which it expects will largely supersede oil-fueled marine transportation}, reports L-News. JPY 647 M (€ 6,2 M) has been set aside in the 2012 budget for \textit{the creation of comprehensive safety measures pertaining to marine renewable energy}.

- November 29, 2011
  Norway: \textit{“We believe 500 LNG fuelled ships will be on order by 2015, several thousands by 2020,”} Mr. Remi Eriksen, COO of Det Norske Veritas Asia Pacific & Middle East
LNG Terminals in Europe and in the world

LNG terminals in Western Europe
Liquefaction: 1 in Norway, above the Arctic Circle
Finland is also building a liquefaction terminal to store the imported Russian gas, not consumed (Take or Pay)

Regasification:
16 in operation (Portugal, Spain, France, Belgium, Italy, United Kingdom, Greece, Turkey)
52 projects (Albania, Croatia, Cyprus, Germany, Ireland, Netherlands, Poland, Romania, Ukraine)

LNG terminals in the world:
Liquefaction: 21 in operation
47 planned/being built
US is also building some liquefaction plants to export its new resources of unconventional gas (shale gas)

Regasification: 62 in operation
127 planned/being built

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GasHighWay. Compressed bio & natural gas
The LNG Blue Corridors Project

These initially proposed Blue Corridors will also develop with connection to other LNG distribution initiatives as:

- Danube Inland Waters Blue Corridor, from Romania to Viena
- AGRI (Azerbaijan-Georgia-Romania-Interconnection) project to transport LNG from Azerbaijan to the EU through Georgia and Romania.

NGVA Europe is working in the preparation of a European Program to develop the concept of European LNG Blue Corridors

The intention is to define four initial pan European routes with strategically placed LNG filling stations that would allow the heavy, long distance truck transport throughout Europe:

- Portugal-Spain to France, Netherlands, UK and Ireland
- Portugal-Spain to France, Germany, Denmark, Sweden
- Mediterranean arch to Italy and with another branch to Croatia
- Ireland-UK to Austria
GC.SST.2012.2-3. Demonstration of heavy duty vehicles running with liquefied methane

Call: FP7-TRANSPORT-2012-MOVE-1

Content and scope:
- The overall objective is to perform large-scale demonstration in order to facilitate a broad market development for heavy duty trucks running with liquefied methane. The specific objectives for the project should be:
  - To optimize the complete powertrain and storage system of LNG heavy duty vehicles with respect to energy efficiency and pollutant emission, by fully utilizing the technical potential of liquefied methane in an optimized fuel-engine system.
L-CNG infrastructure in Europe

From the North to the South, from the West to the East, we have to implement the European L-CNG infrastructure that will allow us full gas run mobility across Europe and will also help to reduce oil dependence.