



## Solbus LNG buses September 2012



**SOLBUS**

# Solbus Bus Factory



Bird's view of the Solbus production plant

Solbus is a family-owned Polish bus manufacturer, which developed LNG-fuelled buses already in 2008.



Solbus buses in one of the family's bus-operating companies.

Solbus owners have shares in bus-operating companies. The dual perspective of a bus manufacturer and a bus user was one of the main factors in taking the strategic decision to develop Solbus LNG-propelled buses.

# Solcity 12 & 18 - the first series-produced LNG buses



Solbus Solcity LNG was presented for the first time in 2008. The Solcity model was awarded with the gold medal by organizers of the Transexpo bus exhibition. The first series of Solcity LNG buses were produced in 2009.



Solcity buses are driven in the major Polish cities including the capital city of Warsaw.

# Solbus: quality components, EU standards, ISO system



	<b>Solbus Solcity</b>	<b>Mercedes Citaro</b>	<b>MAN Lion's City</b>
Engine		Mercedes-Benz	
Gearbox	<b>VOITH</b>	<b>VOITH</b>	<b>VOITH</b>
Axels			
Suspension	<b>WABCO</b>	<b>WABCO</b>	<b>WABCO</b>

Steering

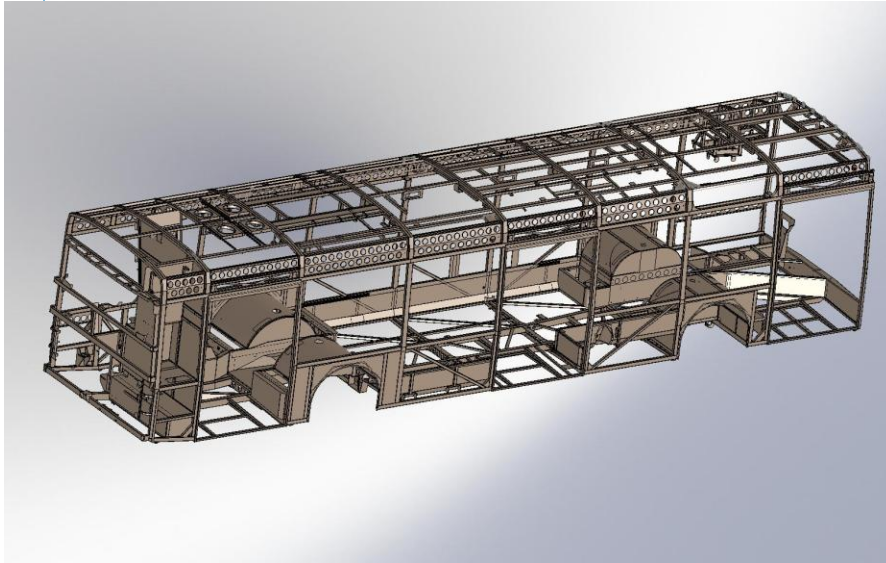


Solbus buses are produced according to ISO 9001 and comply with the most stringent EU's safety & environmental standards.



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# Solbus Solcity is the lightest bus in class



Light, monocoque design



Stripping out of weight takes place also in the production process.

Solbus Solcity body is welded from corrosion-resistant steel elements grade 1.4003. Due to very light design and weight-reduction production techniques Solbus Solcity is the lightest low-floor city bus in „maxi” class.



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# SOLBUS SOLCITY 12 LNG – technical data

- Low-floor city bus
- Curb weight: **10 ton**
- Passenger capacity: **110** pers. + 1 wheelchair (the best result for a 12-meter-long NG bus)
- Number of seats: up to 30 + 1 drivers
- Engine: **Cummins**; 8,9 l., max. power 280-320 HP,  
- factory option = full warranty - **dedicated 100% Natural Gas- EURO 6 compliant**
- Gear box: automatic **Voith D864.5**
- **Chart Ferox HNLG-97** tank: - 330 dm<sup>3</sup>
- Range: **400 km** in city traffic(it is possible to extend the range over 500 km by installing larger LNG tanks)



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# LNG vs. CNG technology

The only difference between CNG and LNG vehicles is the technology of storing fuel (methane).



LNG tank



Vaporiser



Gas @  
8,5 bar

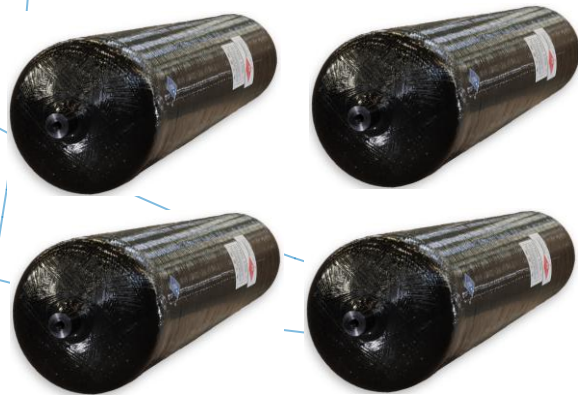


Pressure  
regulator

CH<sub>4</sub>



Natural gas  
engine



CNG tanks

Gas @  
200 bar



Both CNG and LNG buses  
have natural gas engines  
in which they burn methane!



SOLBUS

# We have tested LNG as transport fuel in practice

The two Solbus LNG buses have made over 115.000 km since 2009:

- around 100.000 km in Ostrów Wlk. i Wałbrzych
- close to 15.000 during the joint testing program organized by Gazprom-Germania and Solbus in April and May 2012
- more demo runs planned for autumn/winter 2012/2013 with new , state-of-the-art. mobile, LNG station



Solbus LNG buses together with the station on A4 motorway, on the way to Cracow.

# International media coverage



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## GAZPROM, Solbus and Polish Municipalities Explore LNG Potential for Buses

May 3, 2012 | Poland

Berlin-based GAZPROM Germania, a subsidiary of GAZPROM, together with the Polish bus manufacturer Solbus, a company that specializes in the development and production of environmentally-friendly city buses powered by natural gas, and local municipal transport companies are organizing a series of demo-runs of liquefied natural gas (LNG)-fuelled buses across Poland during April and May 2012. Two Solbus Solecity buses will be servicing regular lines in several cities, available for the use of the general public.



Solecity 12 LNG

«Газпром» запустил автобусы на сжиженном газе в Польше

09.05.2012

GAZPROM Германия совместно с польскими производителями паровозов автобусов Solbus начал эксплуатировать автобусы, работающие на сжиженном природном газе (СПГ). В период с апреля по май 2012 года два городских автобуса на газомоторном топливе будут выходить на регулярные маршруты в нескольких польских городах, собирав серия пробных рейсов. Планируются введение автобусов на газомоторном топливе в других городах Польши и в соседних странах, а также создание необходимой для этого инфраструктуры заправок СПГ.

Этот пилотный проект призван наглядно продемонстрировать потенциал применения СПГ. Партнеры по проекту планируют также использовать автобусы Solbus для предоставления широкого спектра возможностей на маршрутах для городского транспорта.

Пробный рейс автобуса СПГ, в составе пилотной группы, стартует в городе Сolecity, что и широко при перспективной альтернативе постоянно.

### LNG WORLD NEWS

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## Gazprom Germania, Solbus Promote LNG Buses in Poland

Posted on May 2nd, 2012 with tags Buses, Europe, Gazprom Germania, LNG, News, Poland, Promote, Solbus

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GAZPROM Germania together with the Polish bus manufacturer Solbus and local municipal transport companies are organizing a series of demo-runs of LNG-fuelled buses during April and May 2012.

Two Solbus Solecity buses will be servicing regular lines in several cities, available for the use of the general public. The initial list of host cities for the demo-runs includes Torun, Gdynia, Olsztyn, Warsaw and Katowice.



Solbus i Gazprom Germania zaprezentowały w Warszawie pierwsze w Europie autobusy z LNG

2012.05.18, Gazprom Germania, Solbus

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Gazprom Germania and Solbus demonstrate LNG fuelled bus

May 2, 2012 Gazprom Germania together with municipal transport companies are organizing (LNG) fuelled buses during April and May 20 regular lines in several cities, available for the cities for the demo-runs includes Torun, Gdynia. This pilot project aims to demonstrate the c field of activity for Gazprom. The event embro provides LNG and refuelling through a mobile u buses; and the municipal transportation compa of natural gas as economically effective and a help create the synergies allowing all parties to producing natural gas. Gazprom also works to promote the use of natural gas as an environmentally friendly energy source applications. Together with partners, Gazprom runs projects to further establish the clean, efficient utilization of natural gas as a It is also investing in refuelling infrastructure that allows CNG and in the future also LNG powered vehicles to be used throughout

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### Gazprom Germania-Solbus: Παρουσιάζουν στην Πολωνία Λεωφορεία με LNG ως καύσιμο

Ένα νέο έργο για τη χρήση φυσικού αερίου εγκαινιάστηκε από τον όμιλο Gazprom σε συνεργασία με ξένους συνεργάτες.

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GAZPROM Germania i polski Solbus prezentują autobusy zasilane gazem LNG

Ukrainę Gazprom we współpracy z niezależnymi partnerami rozpoczęła w Polsce wieloletni program demonstracji i promocji przyrodniczego gazu ziemnego w transportie miejskim. Gazprom Germania wspólnie z polskim producentem motowozów Solbus oraz polskimi przedsiębiorcami z Międzyzdrojów w Polsce organizują serię próbnych kursów autowozów napędzanych z ciekłym gazem ziemnym (LNG) w kilku miastach w Polsce.

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GAZPROM, Solbus and Polish Municipalities Explore LNG Potential for Buses

Posted by admin | On: May 02 2012 | Comments Off

Solecity 12 LNG

Berlin-based GAZPROM Germania, a subsidiary of GAZPROM, together with the Polish bus manufacturer Solbus, a company that specializes in the development and production of environmentally-friendly city buses powered by natural gas, and local municipal transport companies are organizing a series of demo-runs of LNG-fuelled buses during April and May 2012.

# The testing program's results - summary

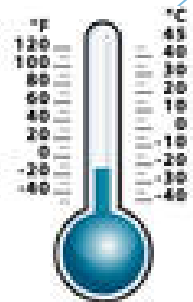
- LNG consumption in kilograms was by up to **10%** smaller than consumption of diesel in litres, when compared with EURO 5 diesel buses used on the same routes. The savings will be even greater when compared with diesel Euro 6 engines!



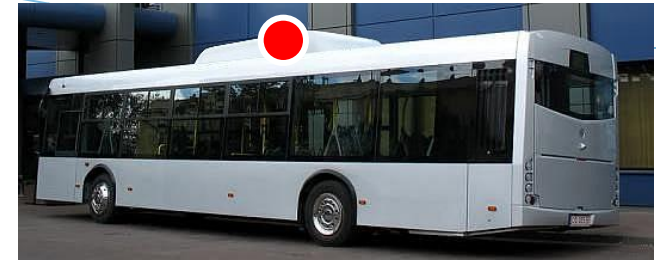
LNG buses have fulfilled bus operators' and the passengers' expectations.



- LNG technology is reliable and safe, however it requires some basic knowledge on cryogenics.



# LNG & CNG buses – feedback from users



Fuelling time	3+ minutes	15+ minutes
LNG tank' & fittings' volume / weight	330 dm <sup>3</sup> / 300 kg	1280 dm <sup>3</sup> / 650 kg
Fuel tank's position	above the engine	on the roof
Vehicle's height	3,15 m	up to 3,45 m

LNG buses fulfil Polish operators' expectations better than CNG buses because:

- It is possible to refuel up to 10-12 LNG vehicles per 1 dispenser in 1 hour, which allows to operate LNG buses in the same way as diesel buses regardless of their number in the depot.
- LNG buses have smaller and lighter fuel tanks located lower, hence the lower centre of gravity and better handling on the road (no need for extra stabilizers).

3. LNG buses have the same height as diesel counterparts so they can serve all lines in the city, also the ones under low bridges and viaducts (even 3,2 meter high).



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# Europe's largest CNG station in Madrid's EMT



## THE STATION'S PARAMETERS:

- refuelling time: **3 minutes/bus**
- capacity: 180 buses/hour
- compressors 9 times **350 kW**
- electric generators: 2 x 1 100 kVA
- investment: 6 million €

Despite high investment CNG buses are profitable for EMT.



**SOLBUS**

# Fuelling buses with LNG is simple and cost-effective



Source: Vanzetti Engineering

## „Elegantly” simple i reliable

- LNG may be refuelled efficiently even without cryopumps (thanks to the pressure difference). Therefore there is no need for power generators.
- LNG pump is a simple and reliable device compared to CNG compressor.

## Lower investment & running cost

- LNG stations cost less than CNG ones capable of serving the same number of vehicles per hour.
- Operational costs of running a LNG stations are only 10% of what it costs to run a CNG station.

# Diesel oil vs. LNG & CNG



<b>Energy content</b>	38,10 MJ/L	55,00 MJ/kg	55,00 MJ/kg
<b>Price (excl. VAT)</b>	1,0 - 1,2* EUR/L	0,7 - 1,0* EUR/kg	0,7 - 0,1* EUR/kg
<b>Storage conditions</b>	Ambient temperature Atmospheric pressure	Temp.: - 128 ° C; Pressure: 8 bar	Ambient temperature; Pressure: 200-250 bar
<b>Fuel qualities</b>	<u>may freeze in winter</u>	<u>lack of humidity and compressors' oil</u>	<u>may contain humidity and compressors' oil</u>

\* Values close to market prices in most EU countries

- In spite of high energy content of 1 kilogram of methane, in most EU countries, it costs 70-85% of diesel price (1kg LNG /1 L diesel). Given lower by 10% consumption of LNG (in kg) than diesel (in L) companies may **save up to 40% on fuel** by running on LNG.

The payback period on bus operator's investment in LNG buses maybe as short as 3 years.

2. Both CNG and LNG may give additional savings because of financial incentives for green vehicles and the storage requirements that exclude theft.

3. LNG is the cleanest form of natural gas. It is never contaminated with compressor oil and contains no humidity.



# LNG replaces diesel - Gazprom is a fuel supplier

## Solbus:

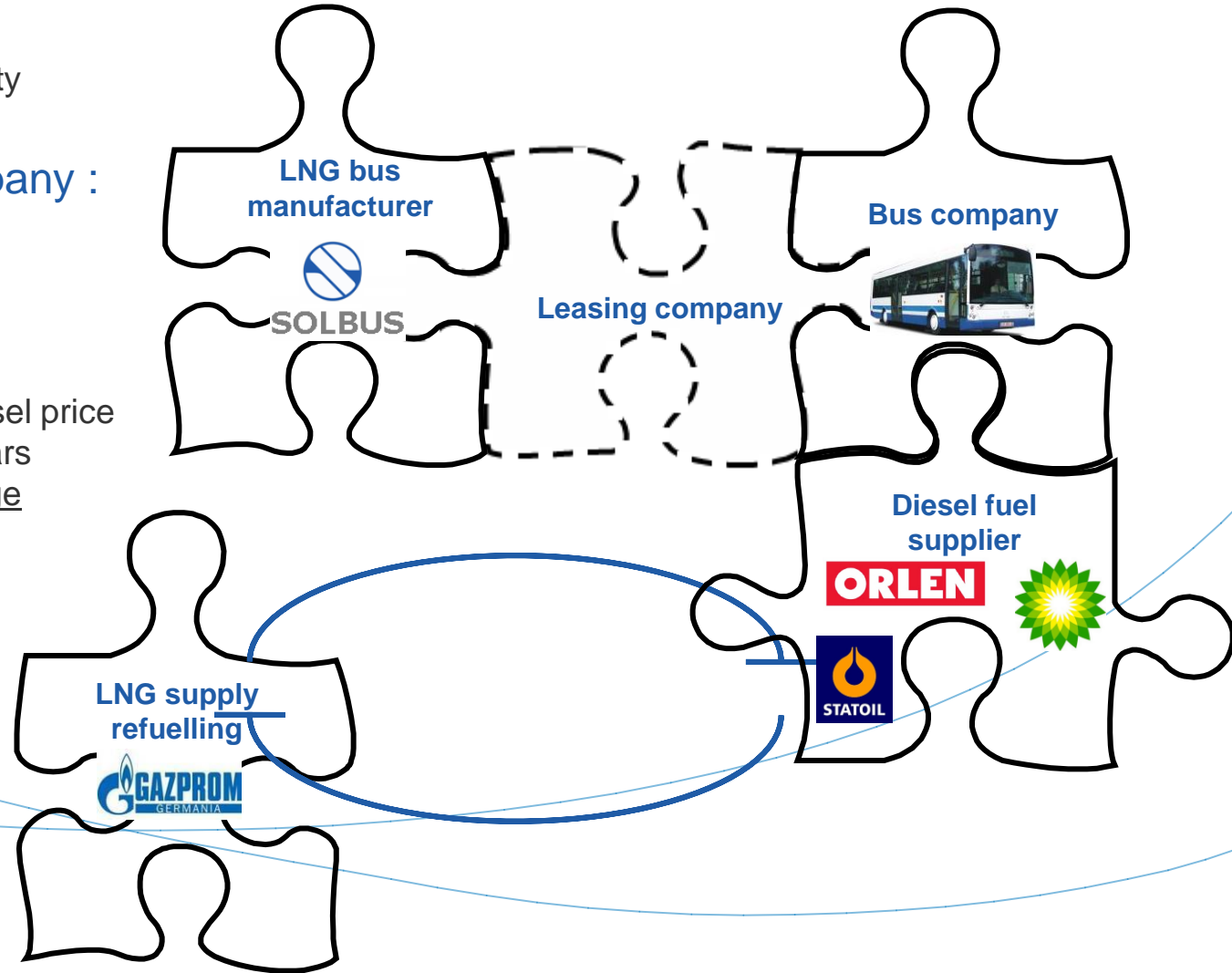
- LNG buses with full warranty

## Leasing company :

- leasing for up to 10 years
- no initial payment

## Gazprom:

- LNG @ x% discount to diesel price
- price guaranteed for 10 years
- LNG station is free of charge



# Thank you!

For further information please contact: **Michał**

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