









## TCO2 CHAMPION STRALIS Natural Power

# Test report of Iveco LNG-powered HD-truck

### Period 20/06/2017 - 15/07/2017

LNG supplier in Poland LNG vehicle provider Transport service provider Shipper Cryogas M&T Poland Iveco Link Transport Unilever



### Table of contents

Ι.	Introduction	3
II.	LNG truck configuration	4
III.	LNG refuelling infrastructure	5
IV.	Test results	7
V.	Drivers feedback	9
VI.	Summary	10
VII.	External sources	11



### I. Introduction

- **Aim of the test:** measurement of LNG truck efficiency and performance in comparison to Diesel standard truck.
- Test period: 20/06/2017 15/07/2017
- Unilever test route: Factory in Bydgoszcz (PL) Warehouse in Tiel (NL)
- Unilever distance: ~1 100km
- Unilever test sample: 6 loads (3 LNG & 3 Diesel)
- Unilever product category transported: Home and Personal Care (ambient)
- o Average Unilever load weight for LNG truck: 18,9 t
- Average Unilever load weight for DIESEL truck: 17,9 t
- Average load weight (including roundtrips) for LNG: 20,7 t
- Average load weight (including roundtrips) for DIESEL: 21,1 t
- Test partners: Cryogas M&T Poland, Iveco, Link Transport, Unilever
- Tested vehicles: Iveco Stralis NP (LNG) Fig.1, Iveco Stralis (Diesel) Fig.2.

Fig.1. Iveco Stralis NP AS440S40T/P<br/>LNG 2017.Fig. 2. Iveco Stralis<br/>AS440S46T/FP-LT 2017.Image: Stralis Colspan="2">Image: Stralis Colspan="2"Image: Stralis Co

Fig. 3. Tested route: Bydgoszcz – Tiel (with refueling in Śrem).



Source: Google maps.



### II. LNG truck configuration

Table 1 presents technical specification of the tested LNG truck.

Table 1. Technical specification of LNG truck.

General information		
Producer and model	lveco Stralis NP400	5.
Version	AS440S40T/P LNG	_
Engine		
Model	Cursor 9 NP Euro VI	
Displacement	8.700 ccm	TCC
Max Power / RPM	400 HP [294 kW] / 2.000	
Max torque / RPM	1.700 Nm / 1.200 – 1.600	
Transmission		
Gearbox	Automated EuroTronic	
Туре	AMT (12AS)	.a.
Rear axle ratio	3,36	
LNG fuel system		
Number and type of cylinders	Double cryogenic LNG tanks	
Volume	1.080 L (2 x 540 L)	
LNG storage	390 kg (2 x 195 kg)	
Body/Tyres		6
Cab Type	AS (Hi-Way)	10
Colour	50122 - blue	
Front tyres	385/55 R22,5	
Rear tyres	315/70 R22,5	







Fig. 4. LNG EURO 6 technology.



Source: Iveco Stralis NP – information brochure.



### III. LNG refuelling infrastructure

#### • LNG as a fuel

Liquefied Natural Gas (LNG) is a methane natural gas that has been transformed into a liquid form in order to facilitate transport and storage in areas beyond the reach of conventional gas grids or as a fuel for road transport (trucks, buses) and water transport (vessels). LNG is a safe substance with the same physical and chemical features as gas from grid. First of all, natural gas is purified from, among others, carbon dioxide and moisture in a liquefaction plant. Then it is cooled, condensed into a liquid form and distributed in cryogenic tanks. Other LNG sources are sea terminals.

On Polish territory LNG can be supplied from various sources, both onshore liquefaction plants and sea terminals. This ensures on-time delivery to customers and competitive prices. In terms of wholesale supply availability, LNG is comparable to Diesel.

LNG in the tested vehicle was stored in 2 LNG tanks under the pressure of 9-10 bar (g). The implemented solution is compliant with rigorous safety requirements of R110 standard. The total capacity of tanks is 1.080 L, which allows refueling up to 390 kg LNG and reaching vehicle range of 1.500 km.

#### • Refuelling infrastructure and used standards

During the trial, the major part of refueling was carried out at the station in Śrem (Mateuszewo). Other refueling took place at LNG stations in the Netherlands.

The infrastructure in Śrem is supplied with LNG by Cryogas M&T Poland. The station offers CNG refueling as well.

All LNG stations are equipped with standard LNG connections, procedures, documents and movies with instructions. It means that each LNG truck is compatible with all LNG stations. To get the access for LNG refueling in NON STOP 24/7 mode, it is usually required to obtain a dedicated RFID access card.

#### • Access for LNG stations – present situation and perspectives

Currently there are 3 LNG refueling points in Poland, one of which is the station in Śrem, dedicated for LNG powered trucks. There are plans to launch new LNG stations in Poland in the consecutive quarters. In the EU territory, the number of LNG stations is near to 100.



LNG refueling points are tailor-made solutions. Cryogas is open for discussion to provide LNG in the most convenient place.

#### • LNG pricing – retail price and dedicated conditions

It is worth mentioning that the leading priority of the performed test, was to check LNG consumption and general maintenance of LNG trucks. LNG fuel was bought on general terms of retail price. Such situation is common for occasional operations of private drivers. LNG fuel gross price in that period was about 0,95 – 1,00 EUR/kg.

For each client, Cryogas may offer a contractual parity price of LNG to Diesel. This solution ensures that a transport service provider operating on LNG trucks can remain competitive with the ones operating on diesel. Moreover, PKN Orlen's Ekodiesel pricing is competitive in comparison to wholesale prices available on the market (e.g. offered by Lotos or German refineries).

Provided a volume of at least 50 LNG trucks for each refueling station, a 90% of the wholesale diesel price can be achieved for LNG (in wholesale).

More information regarding LNG features and refueling facilities is available at the dedicated webpage - transport.cryogas.pl



Fig. 5. LNG station in Śrem (Poland).

Source: Raport z testów pojazdów lveco (PDF).



### **IV. Test results**

Test results comparison of LNG vs Diesel is presented in the table 2.

Table 2.	Test	results	comparison	LNG vs	Diesel.
Tuble 2.	1000	results	companison		Dicoct.

Test result	LNG <sup>1</sup>	Diesel <sup>2</sup>	LNG vs Diesel
Average fuel consumption [/100 km]	23,6 kg	27,7	-15%
Average fuel gross cost in test [/100 km]*	23,1€	27,4€	-15%
Average fuel net cost in test [/100 km]*	18,9€	22,2€	-15%
Accessible fuel net cost [/100 km]**	16,6€	21,7€	-23%
Average CO2 emissions	0,65 kg/km	0,73 kg/km	-11%

Source: Test results provided by LINK Transport - Excel file.

<sup>1</sup> **LNG vehicle test**. Truck passed 10 637 km and burned 2 506 kg of LNG. Total cost of fuel was 2 471 EUR. Average load weight was 18,9 ton.

<sup>2</sup> **Diesel vehicle test.** Truck passed 9 504 km and burned 4 477 l of Diesel. Total cost of fuel was 2 591 EUR. Average load weight was 17,9 ton.

\* Fuel net cost in test: LNG price - 0,802 EUR/kg; Diesel price - 0,800 EUR/l.
\*\*Fuel net cost in wholesale: LNG price - 0,705 EUR/kg; Diesel price - 0,784 EUR/l.
Diesel oil price is wholesale price in Poland in period of June 20th - July 15th 2017. LNG price is 90% parity to Diesel price.

#### **Truck efficiency**



LNG truck total fuel consumption was 15% lower than Diesel one. It is a very good result taking into account the total distance covered (12% more by LNG truck than by Diesel). Average fuel consumption per 100 km turned out to be lower by 15% for LNG truck vs Diesel, although the average loadfill was 5% (1t) respectively higher.



Source: Test results provided by LINK Transport – Excel file



#### Fuel consumption vs load weight





Source: Test results provided by LINK Transport - Excel file.

Based on the available data, it can be assumed that there is a no linear correlation between load weight and LNG consumption. However, the trial volume is not sufficient to determine it unambiguously, due to the fact that other factors may affect fuel consumption, like weather conditions, driving technique, differentiated landform, etc.

#### CO<sub>2</sub> results

A significant CO<sub>2</sub> emissions decrease was observed for LNG truck, with an average result of -11% vs Diesel truck. This result confirms other analyses and official fuel emission factors provided by external company *Conlogic*. It is worth to mention, that emissions of other particulate matters (PM) and nitrogen oxides (NO<sub>x</sub>) are also significantly lower.

#### Fig. 8. Average CO2 emissions [kg/km] Comparison LNG vs Diesel



#### Cost benefits

In terms of total fuel cost, there was 5% saving noted for LNG truck. It is worth mentioning that there is still low competition

on the LNG supply market. The cost benefit was achieved mainly due to fuel consumption efficiency. The average fuel price of both fuel types during the trial was comparable (0,99€). Further savings, up to 23% are possible in case of long-term LNG supply contracts (2-3 years).

Source: Test results provided by LINK Transport - Excel file.



### V. Drivers feedback



• Comfortable and spacious cabin.

- Easy-to-use and functional on-board computer.
- Driving similar to diesel trucks.



Difficult refuelling process and time consuming in case of issues.
Difficulty to check fuel level remaining in tank.
Insufficient knowledge about LNG trucks (example: unknown reason

of yellow control light after refuelling).





### VI. Summary

The trial results have provided a basis for drawing the following conclusions:

- Iveco Stralis NP (LNG truck) enables CO<sub>2</sub> emissions reduction by around
   -11% vs Diesel standard truck.
- Yearly estimation of Unilever lane from Bydgoszcz to Tiel (assuming 50% of volume switched to LNG transport) would give CO<sub>2</sub> reduction of -27,6t.
- LNG truck average fuel consumption is 14,8% lower than Diesel standard truck.
- There was no significant correlation between average fuel consumption and load weight observed (loadfill during the trial varied between 17,0-24,5t).
- Cost benefit proven by the trial (5% saving for LNG truck vs Diesel) was driven mostly by the higher fuel efficiency of LNG truck.
- Iveco Stralis NP was well rated by the drivers in terms of comfortability.
- One of the LNG trucks advantage is a lower noise level: LNG max 72dB vs Diesel max 82dB. This feature may be especially useful for nocturnal deliveries.
- Several drawbacks were raised, most of them relating to LNG truck utility, technology knowledge as well as insufficient density of LNG station network. The last one results in complex route planning.
- Unilever factory slots are compatible with LNG trucks. Loading of LNG trucks is fully compliant with Safety, Health & Environment rules. Also, no risk was identified in case of extended waiting for loading (no methane evaporation).





### VII. External sources

- 1. Iveco, *Iveco TCO<sub>2</sub> Champion Stralis Natural Power* material presented by Iveco representative in the meeting at the Unilever HUB on 16.02.2017.
- 2. Iveco, Stralis NP information brochure.
- 3. Cryogas M&T Poland, Ikea, Iveco, *Raport z testów pojazdów Iveco LNG w Polsce*.
- 4. Cryogas M&T Poland LNG as a fuel, *www.transport.cryogas.pl*
- 5. Official Connect2LNG website, www.connect2lng.com (accessed 2017-08-11).
- 6. Blue corridors website: *www.lngbc.eu* (accessed 2017-08-11).

