

DIESEL DUAL FUEL your solution for cleaner and cheaper transport



Newest dual fuel system **for self ignition engines**
designed and developed for use with LPG and CNG, with automatic
calibration and correction of gas injection

saving through
INNOVATION

Fuel Fusion

- A **dual fuel system** that allows your engine to work on Diesel + LPG/CNG/LNG
- For **all** types of vehicles with a diesel engine, the newest (Euro 6), as well as the less advanced, which do not have advanced engine control systems.
- Built-in fuel consumption monitoring for Diesel and Gas.
- An **alternative** for investing in expensive vehicles powered by natural gas only (NGV)
- **First** dual fuel system with automatic calibration and correction of gas injection
- **Full synchronization** of gas injection frequency with engine speed and the number of cylinders, which ensures a uniform supply to all cylinders, better engine smoothness and increase in the efficiency of gas as additional fuel.



A close-up photograph of a metal fuel nozzle attached to a vehicle's fuel tank. The nozzle is silver and has a metal ring around its base. A metal pin is inserted into the nozzle, and a metal ring is attached to it. The background is blurred, showing a dark tire and a white railing.

SYSTEM APPLICATIONS

City buses & coaches



Road transport



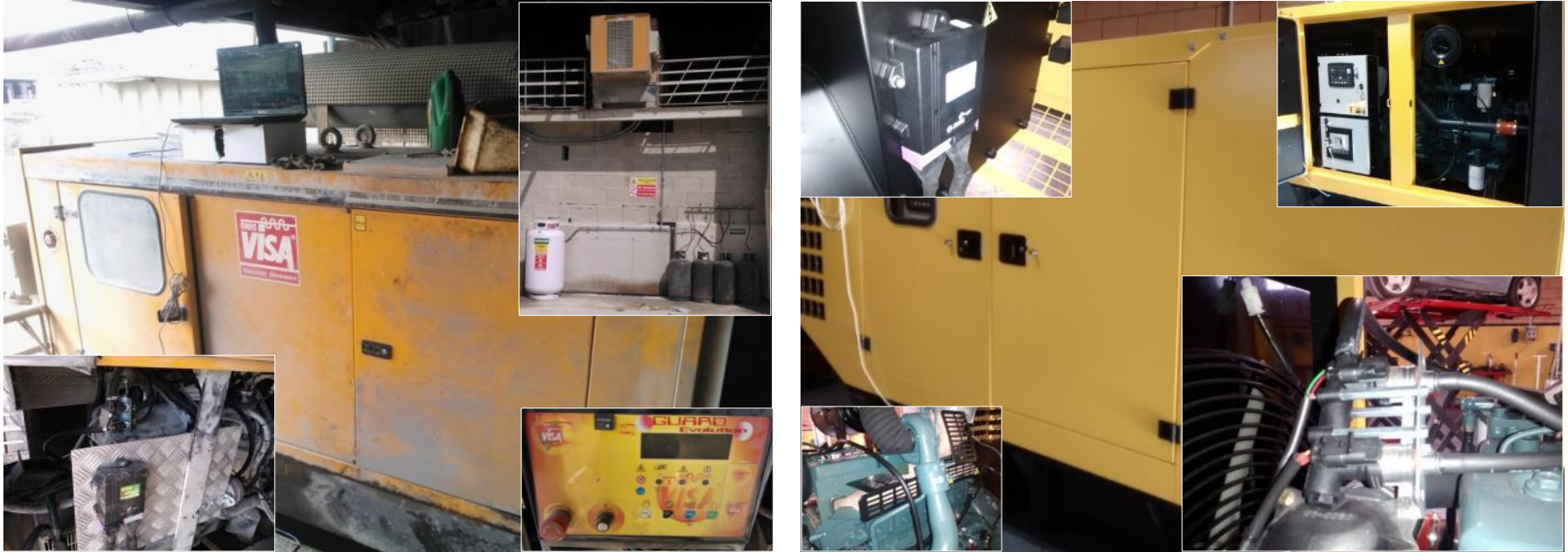
Vehicles of enterprise public utilities



Farming



Power generators



Open pit mines, construction, etc.



Source of gas - BIOGAS

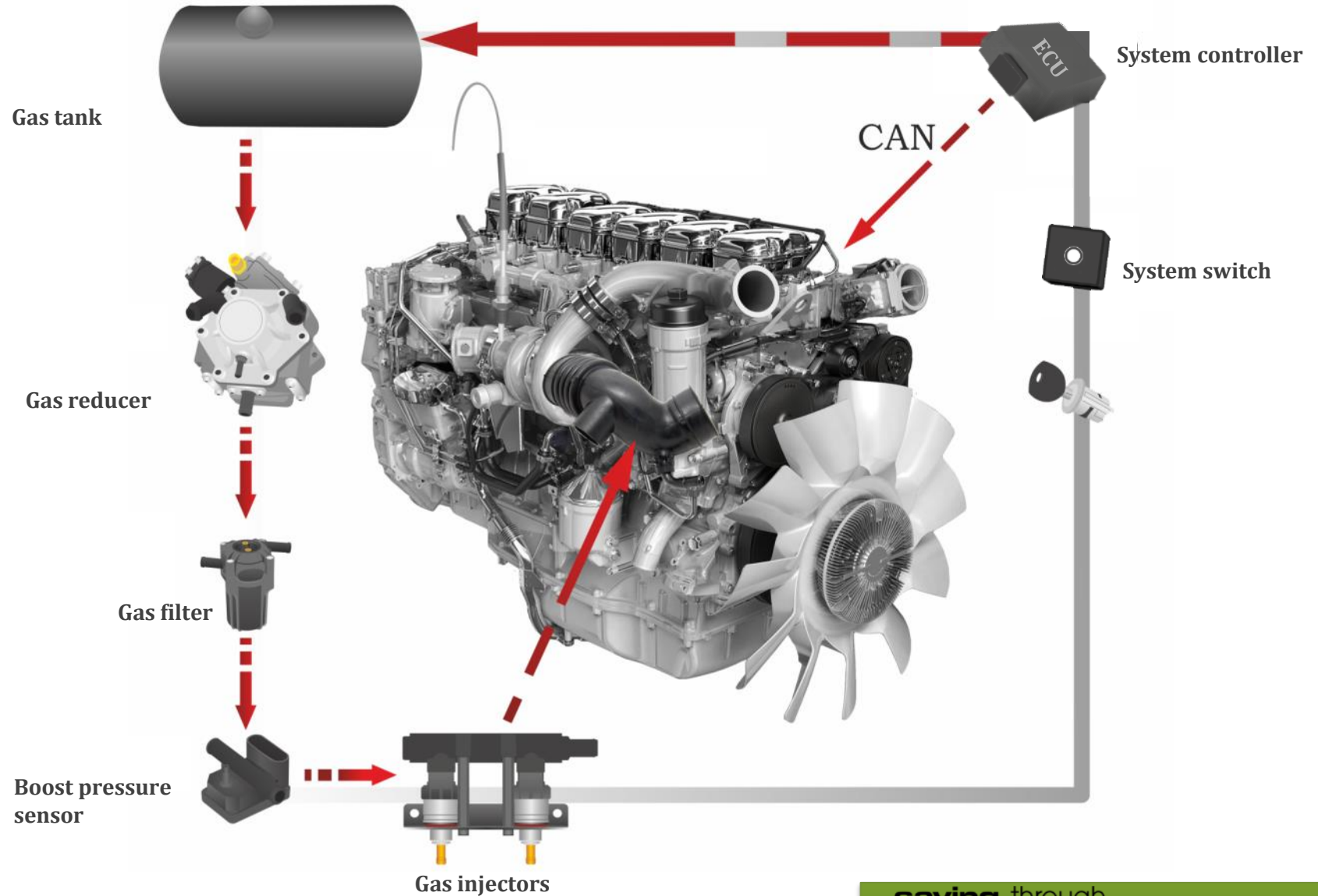
In addition to the use of LPG / CNG / LNG, the system can also **use the biogas** produced in the **biogas plant**.

Biogas typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from a raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste.

Biogas is a **renewable energy source** and in many cases exerts a very **small carbon footprint**.



System conceptual diagram



Installing the system



Installing gas injectors involves drilling two holes in the air intake before the turbo charger.



The gas tank is attached directly to the vehicle's frame using two brackets.



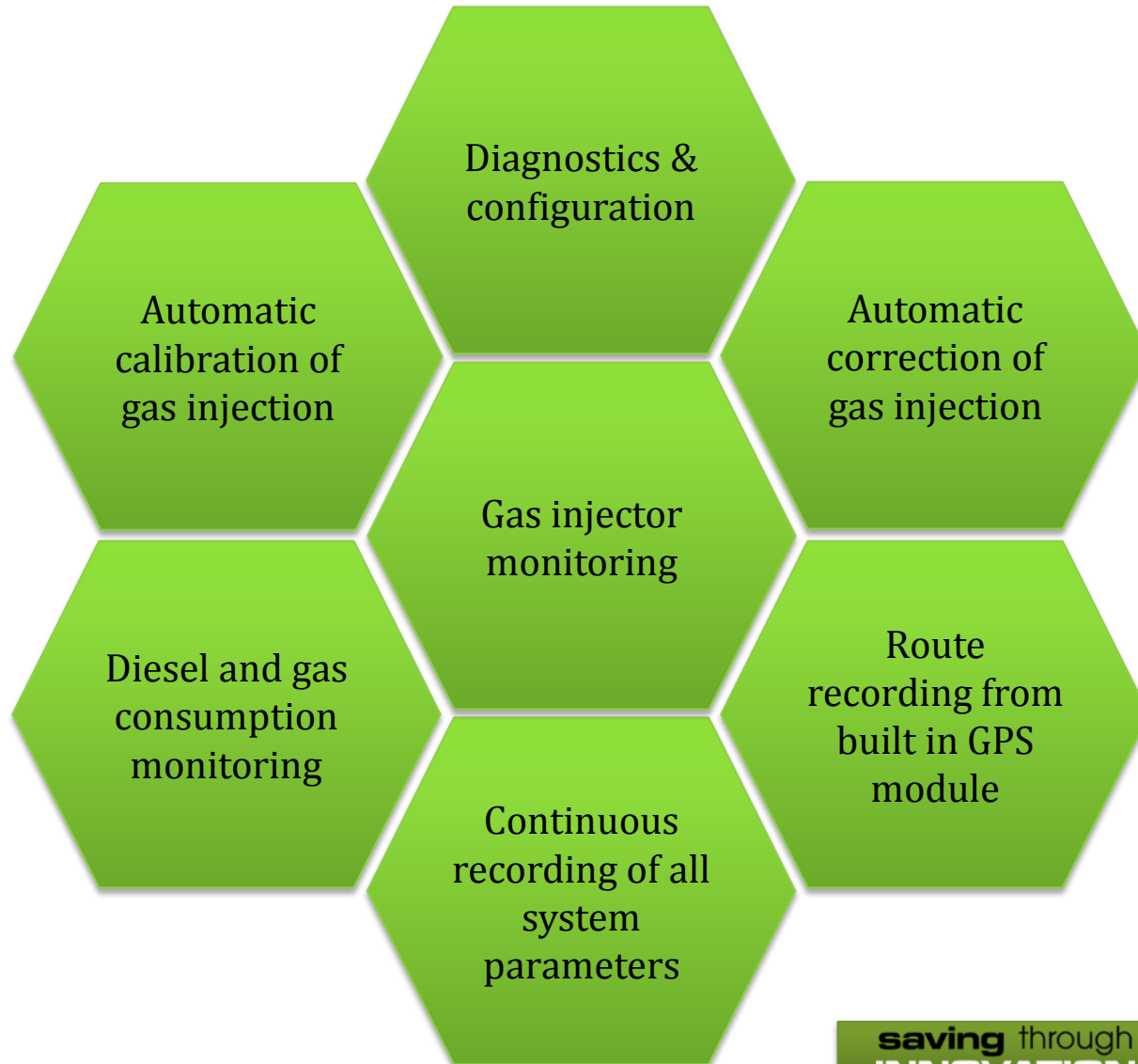
Installing the gas reducer involves connecting it to the engine's cooling system



Installing the exhaust temperature sensor involves drilling a single hole in the exhaust.

In addition to the procedures mentioned here installing the gas system does not require any physical interference in the engine or its accessories. However, the gas systems wire harness is connected to such elements as the electronic has pedal, alternator or CAN bus.

System functions



System performance control

- **Monitoring** of key vehicle performance parameters and recording them in internal memory
- **Gas injectors monitoring sensor** protecting engine from uncontrolled gas injection
- Diesel and gas **level and consumption monitoring**
- **Recording of route and distance** based on information from built-in GPS module
- Ability to connect up to 2 fuel probes directly to the system controller for **monitoring fuel level in Diesel tanks**
- **Temperature monitoring** for the engine, gas reducer and exhaust gas

Demonstration of system performance results

In its internal memory the system controller records data needed to prove the effects of its performance. At a moment in time the data is available for download to your computer hard drive for fuel consumption or route analysis, error diagnosing, etc. For example:

- **Diesel consumption** data is retrieved directly from the vehicle's CAN. **Gas consumption** is calculated based on gas injectors working parameters. Fuel consumption summary in a given period allows you to verify consumption calculated from refueling.
- **Route and distance travelled** is recorded from the built-in GPS module, which makes the system independent from the on-board computer and gauges, and shows the actual mileage of the vehicle.
- System work status, engine speed, ignition status, gas reducer temperature, power supply voltage, engine and exhaust gas temperature, etc. allow for **verification of the dual fuel system operation** and demonstrating possible reasons in case of poor performance.

The background of the slide is a composite image. On the left, a semi-transparent globe of the Earth is visible, showing continents and oceans. On the right and top, there are several vibrant green leaves with detailed vein patterns, some appearing to be in the foreground and others slightly blurred in the background. The overall color palette is dominated by greens and yellows, suggesting a natural, eco-friendly theme.

ECOLOGY

Innovation solution for cleaner air in cities

Solution to defend smog in cities

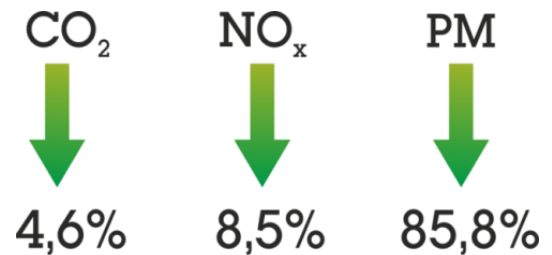
- There are two main types of air pollution in cities, which contribute to the creation of harmful smog.
 - **Solid particles** are one of them, and they are emitted in a substantial amount by diesel engines.
 - **Photochemical pollution** is the second type of which 68% comes from motor vehicles.
- Every summer big cities faced the problem of smog caused by vehicle exhaust.
- This process cannot be reversed, but it can be fixed by making diesel engines more environmentally friendly.



This is the pollution of air during smog.

Solution to defend smog in cities

- The main source of smog in summer is emission from **vehicle exhaust**
- This process cannot be reversed, but it can be fixed by **making diesel engines more environmentally friendly**.
- Dual fuel system **reduces harmful substances**.
- The reduction **has been confirmed** by tests made by Polish Motor Transport Institute and Poznań University of Technology.



Ecology

- By taking **advantage of the diesel dual fuel technology** cities can significantly **lower the emissions of solid particles** and other harmful compounds, which are the main sources of smog.
- This is a far **cheaper alternative** to upgrading currently used fleets of diesel vehicles to expensive NGV's.
- The power of Fuel Fusion can play a significant part in the fight for **clean air in the cities.**



Differences in view with and without smog in cities

Report the Results of Emission – Polish Motor Transport Institute

- The purpose of this work was conducting tests of exhaust fumes emissions (CO, NO_x, THC, PM, PN) from exhaust system, maximum net horse power on wheels and verification of correct functionality of the OBD system in vehicles PEUGEOT 508 GT and PEUGEOT BOXER 3.0 HDI equipped in self-ignition engines supplied with diesel (mono fuel) or mixture of diesel and liquid gas propane-butane (dual fuel).
- Vehicles presented for test were equipped with installation Solaris Diesel adapting them to be supplied with mixture of diesel fuel and liquid gas propane-butane, which was manufactured by company PHU Car-Gaz.



INSTYTUT TRANSPORTU SAMOCHODOWEGO
ul. Jagiellońska 80, 03-301 Warszawa
Centrum Ochrony Środowiska



AB 502

SPRAWOZDANIE Z BADAŃ NR 10670/1/COŚ

Badania porównawcze samochodów PEUGEOT 508 GT i PEUGEOT BOXER 3.0 HDI wyposażonych w silniki o zapłonie samoczynnym zasilanymi olejem napędowym z możliwością zasilania olejem napędowym wraz z paliwem propanbutan (dual-fuel)

Nazwa Zleceniodawcy:	PHU Car Gaz Henryk Rewers
Adres Zleceniodawcy:	ul. Pokrzywno 5 lok. 30 61-315 Poznań
Nr zamówienia:	0012/COŚ/13
Data sprawozdania:	08.04.2013
Liczba stron:	12
Liczba egzemplarzy:	4
Nr egzemplarza:	3

Zastępuje sprawozdanie z badań nr 10670/COŚ

sporządził:
Kierownik ds. technicznych
Centrum Ochrony Środowiska
S. Taubert
mgr inż. Sławomir Taubert
(imię i nazwisko, podpis)

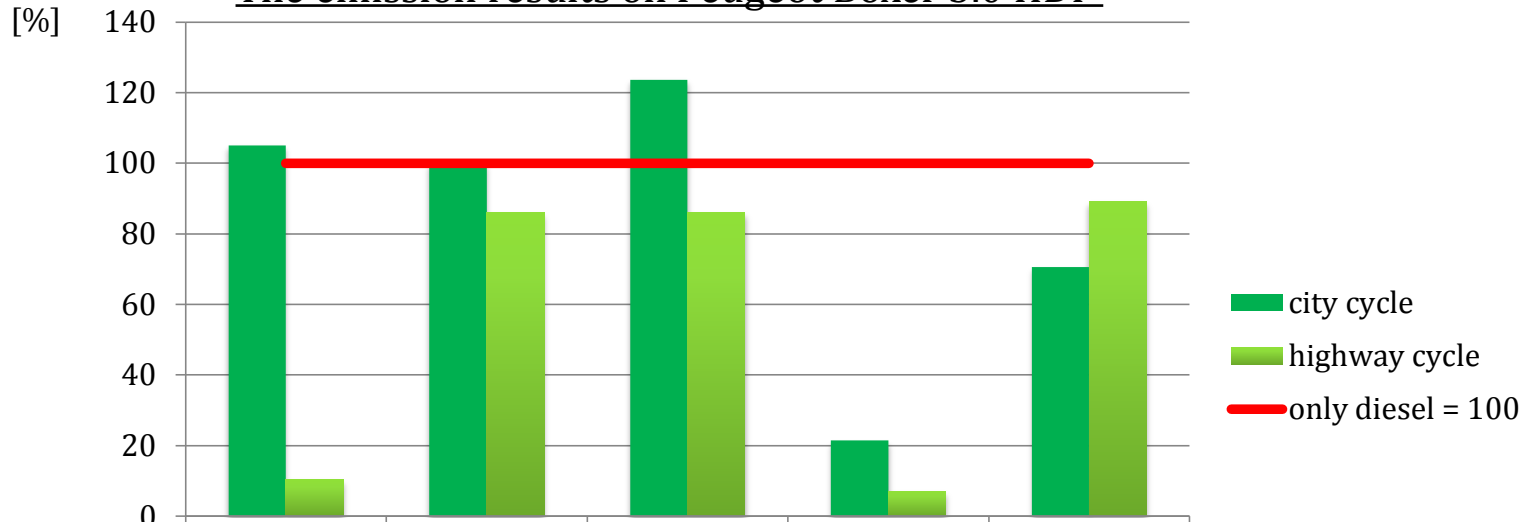
autoryzował:
[Signature]
mgr inż. Sławomir Taubert
(imię i nazwisko, podpis)

Rozdziałnik:	egz. nr 1	- Archiwum ITS
	egz. nr 2, 3	- Zleceniodawca
	egz. nr 4	- COŚ ITS

Wyniki badań przedstawione w sprawozdaniu dotyczą wyłącznie obiektów przedstawionych do badań.
Opinie/interpretacje zamieszczone w niniejszym sprawozdaniu są wyróżnione kursywą.
Bez pisemnej zgody Instytutu Transportu Samochodowego sprawozdanie nie może być powielane inaczej niż w całości.

Report the Results of Emission - Polish Motor Transport Institute

The emission results on Peugeot Boxer 3.0 HDI



	CO	NOx	NOx + THC	PM	PN
city cycle	105	100	123,56	21,4	70,56
highway cycle	10,34	85,89	85,91	7,05	89,08
only diesel = 100	100	100	100	100	100

The chart shows the emission results obtained on the Peugeot Boxer 3.0 HDI. The results obtained during the city cycle and the highway cycle while the dual fuel system was on are compared with the results obtained under the same conditions while the vehicle drove only on diesel fuel [diesel = 100].

Report the Results of Emission – Polish Motor Transport Institute

The tests results on Peugeot Boxer 3.0 HDI

Emission	CO	NO _x	NO _x + THC	PM	PN
City cycle	508,7	310,2	313,2	2,99	4.62E+11
Highway cycle	5,8	268,7	270,5	1,70	7.97E+10

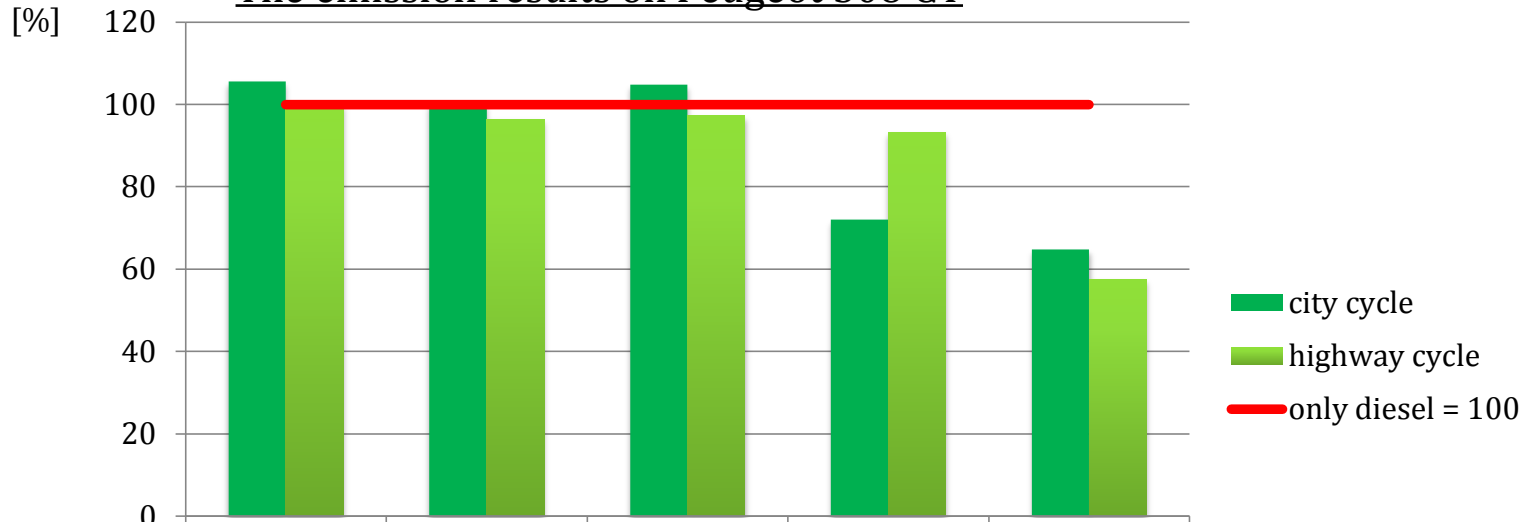
Measurement of emissions of exhaust fumes from the exhaust system [mg/km |#/cm³] followed by test type I Regulation 86.06 EKG ONZ, amended series 06 with diesel supply.

Emission	CO	NO _x	NO _x + THC	PM	PN
City cycle	535,9	310,2	387,0	0,64	3.26E+11
Highway cycle	0,6	230,8	232,4	0,12	7.10E+10

Measurement of emissions of exhaust fumes from the exhaust system [mg/km |#/cm³] followed by test type I Regulation 86.06 EKG ONZ, amended series 06 with the mixture of diesel and liquid gas propane-butane supply.

Report the Results of Emission - Polish Motor Transport Institute

The emission results on Peugeot 508 GT



	CO	NOx	NOx + THC	PM	PN
city cycle	105,47	100,17	104,71	71,95	64,75
highway cycle	100	96,38	97,21	93,24	57,48
only diesel = 100	100	100	100	100	100

The chart shows the emission results obtained on the Peugeot 508 GT. The results obtained during the city cycle and the highway cycle while the dual fuel system was on are compared with the results obtained under the same conditions while the vehicle drove only on diesel fuel [diesel = 100].

Report the Results of Emission – Polish Motor Transport Institute

The tests results on Peugeot 508 GT

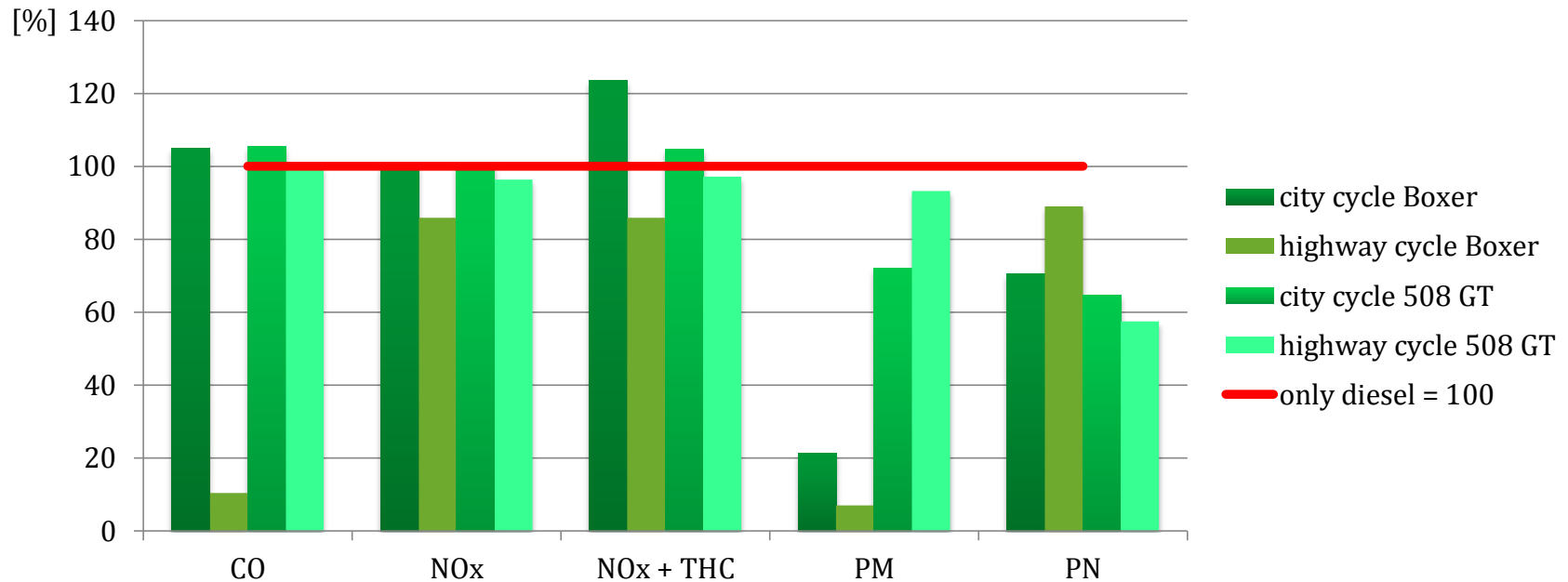
Emission	CO	NO _x	NO _x + THC	PM	PN
City cycle	190,1	227,2	279,9	1,64	8.54E+10
Highway cycle	0	190,8	201,1	0,74	7.88E+09

Measurement of emissions of exhaust fumes from the exhaust system [mg/km |#/cm³] followed by test type I Regulation 86.06 EKG ONZ, amended series 06 with diesel supply.

Emission	CO	NO _x	NO _x + THC	PM	PN
City cycle	200,5	227,6	293,1	1,18	5.53E+10
Highway cycle	0,5	183,9	195,5	0,69	4.53E+09

Measurement of emissions of exhaust fumes from the exhaust system [mg/km |#/cm³] followed by test type I Regulation 86.06 EKG ONZ, amended series 06 with the mixture of diesel and liquid gas propane-butane supply.

Report the Results of Emission - Polish Motor Transport Institute



The chart shows the emission results obtained on the Peugeot Boxer 3.0 HDI and Peugeot 508 GT. The reduction of emissions is directly proportional to the engine size and to the quantity of fuel consumed by the engine. **The larger the engine displacement the higher percentage in emissions reduction is achieved.** Engines that comply to the strict Euro 5 and Euro 6 norms, can also benefit from the diesel dual fuel technology and lower their emissions even more.

Report the Results of Emission – Poznań University of Technology

- CO₂ emission research has been done at the road stretch, with total length of 56 km.
- The object of the research was a tractor-trailer Scania R450 Euro 6. The vehicle has advanced exhaust gases purification system, which includes EGR, DOC, DPF, 2 SCRs and 2 ASCs.



POLITECHNIKA POZNAŃSKA
Instytut Silników Spalinowych i Transportu
Zakład Silników Spalinowych



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RAPORT

Badania emisji CO₂ pojazdu Scania R450 zasilanego
dwupaliwowo spełniającego normę Euro VI

Praca wykonana pod kierunkiem:
prof. dra hab. inż. Jerzego Merkisz

Poznań, październik 2013

Warszawa, dnia 20.03.2014 r.
Nr sprawy: ITS/COS-4503-01/13/ST/010
Ldz. ITS/COS/846/14

PHU CAR-GAZ Henryk Rewers
ul. Pokrzywno 5 lok. 30
61-315 Poznań

Instytut Transportu Samochodowego z siedzibą w Warszawie, zaświadcza niniejszym wiarygodność dokumentu „RAPORT – Badanie emisji CO₂ pojazdu Scania R450 zasilanego dwupaliwowo spełniającego normę Euro VI” wystawionego w Poznaniu, w październiku 2013 poprzez Politechnikę Poznańską. Tym samym potwierdzamy wyniki zrealizowanych testów uwzględnionych w wymienionym dokumencie.

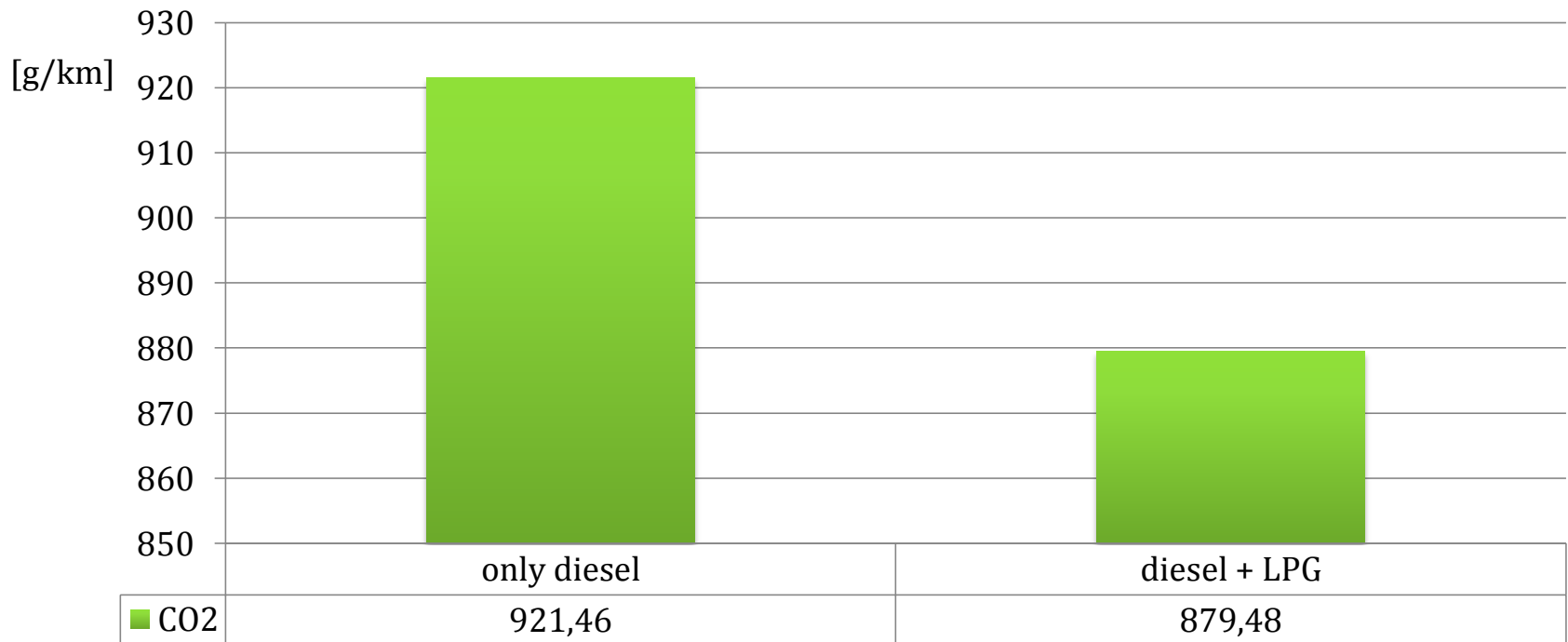

mgr inż. Ryszard Procyński

Report the Results of Emission – Poznań University of Technology



- The object of the research was a tractor-trailer Scania R450 Euro 6 equipped with dual fuel system Solaris Diesel.
- For the measurement of the fuel consumption and CO₂ emissions was used mobile instrument. The instrument had GPS and enabled communication with vehicle diagnostic system.

Report the Results of Emission - Poznań University of Technology



The chart shows the results of the CO₂ emission test on Scania R450 Euro 6 with applied dual fuel system and only on diesel

The reduction of CO₂ emission is **4,59%**.

A photograph of a city street at dusk. On the left is a modern glass bus stop with a colorful striped bench. A blurred bus is moving past on the right. The sky is a deep blue, and streetlights are visible in the distance.

SOLUTION FOR CITY TRANSPORT

saving through
INNOVATION

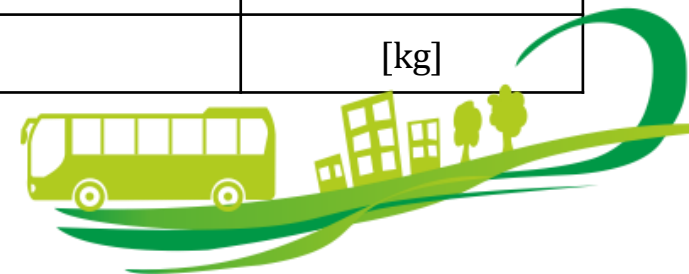
Solution for city transport

- **One adult African elephant**– this is the weight of the CO₂ emission during 1 year that could be reduced with dual fuel system*
- Despite the harsh emission standards for buses with EURO 5 emission standard, our system allows for the **5,6% reduction of CO₂ emissions.**
- Reduction in case of vehicles with emission standards EURO 1 to 4 is more evident.
- *Assumptions: Bus; consumption 50l diesel; dual fuel mixture 36,5l diesel + 17,6l LPG; 100.000 km per year; weight of 1 elephant 7.500 kg; emission standard EURO 5

Emission reduction for a bus in one year

Fuel	diesel	mixture		units
		diesel	LPG	
Fuel consumption (per 1 bus)	50,0	36,5	17,6	[l/100 km]
CO ₂ emission (1 bus)	129,3	94,4	27,7	[kg/100 km]
SUM	129,3	122,1		[kg/100 km]
SUM/km	1,29	1,22		[kg/100 km]
Emission reduction		5,6		[%]
Per 100 000 km	129.281	122.099		[kg]
Difference		7.181,52		[kg]

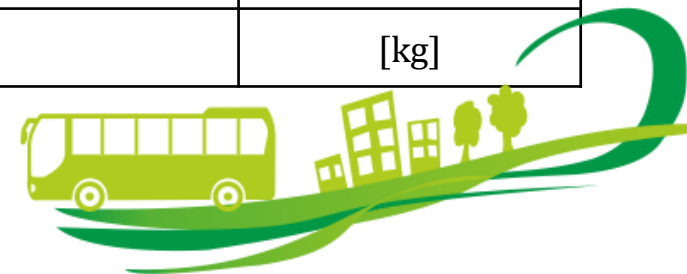
Assumptions: 100.000 km per year, emission standard EURO 5



Emission reduction for 100 buses

Fuel	diesel	mixture		units
		diesel	LPG	
Fuel consumption (per 1 bus)	50,0	36,5	17,6	[l/100 km]
CO ₂ emission (fleet)	12.928,1	9.437,5	2.772,4	[kg/100 km]
SUM	12.928,1	12.209,9		[kg/100 km]
SUM/km	129,28	122,10		[kg/100 km]
Emission reduction		5,6		[%]
Per 10 000 km	1.292.808	1.220.993		[kg]
Difference		71.815		[kg]

The table shows calculations for fleet 100 buses. It was assumed that 1 bus burns 50 l per 100 km. Buses with emission standard EURO 5.





Company

DUAL FUEL SYSTEMS SP. Z O.O.

- Over **20 years of experience** in the Autogas market
- Manufacturer of retrofit gas injection systems for Diesel engines – **Solaris Diesel** and **Fuel Fusion**
- A team of experienced individuals designing innovative solutions for more effective use of alternative fuels

Experience

- The **Fuel Fusion** system is the result of many years of experience with diesel dual fuel technology.
- We have taken **the best functions** of our previous system Solaris Diesel, added our knowledge, expertise, and experience gathered around the globe to produce a brand new electronic dual fuel control unit.
- **The best solutions and practices** have been implemented in one, small sized, universal dual fuel computer called **Fuel Fusion**.

References

Kalisz, 23.08.2016 r.



Reference Letter

Reference letter

With this letter we would like to provide our recommendations for the Solaris Diesel installation, which we use in our fleet to our full satisfaction, as it fulfils the promises of the manufacturer, and thus our expectations for economy and savings. Based on the current effects of using the LPG systems provided by CARGAZ BIS we are implementing the SOLARIS DIESEL DUAL FUEL solution for our entire fleet. Our cooperation began in October 2014 and since that time our vehicle Mercedes Actros 2544 equipped with Solaris Diesel has made more than 250 000 km. Before installing the system, the diesel consumption of our vehicle was about 29l/100km. Currently they managed to reduce diesel to about 19-20l / 100km plus 10-11l of LPG.

So far our experience gained during this cooperation, lets us confirm that it is a trustworthy company. The product puts this manufacturer at the forefront of all diesel-gas system developers. The services are provided by a specialized team of professionals and we can recommend them to other partners.



We would like to provide this reference letter for Solaris Diesel system, which we are using in our PUK S.A. company with full satisfaction.

The fuel savings and awareness, that our vehicles are more environmentally friendly ensures us that we have made the right choice by investing into dual fuel technology. Using Solaris Diesel is part of our sustainable development strategies and care for low emissions. It is an ideal and relatively inexpensive solution for municipal vehicles.

We are also happy with the professional service offered by the manufacturer's workshop. They have installed the Solaris Diesel system in a DAF LF 55 and are servicing it. The workshop employees are very professional, committed, and provide excellent technical support while we use the dual fuel system.

We recommend Solaris Diesel and CARGAZ BIS with full responsibility.

Wiceprezesa Zarządu
Andrzej Węgrzński

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52 800 K A L I S Z
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