RUNNING on gas

What goes into a gas-powered vehicle, and does converting make sense?

Gas has been used for generations to run stoves, furnaces, water heaters and other appliances. Vast global supplies are projected to last well into the next century, so it should be no surprise that gas will remain significantly cheaper than petrol on an energy-equivalent measure.

In a properly tuned engine, gas combustion delivers 20 per cent lower carbon emissions and about a 25 per cent reduction in greenhouse gases compared with the

This is no ordinary minivan. It's a Dodge Caravan converted to run on petrol and gas. The high-pressure fuel line can make fill-ups as fast as petrol and cheaper too – but things are complicated.

Michael Nemeth

cleanest petrol engines, all without damaging existing catalytic converter systems. So right about now you're probably wondering: why aren't we putting this stuff in our cars?

As it turns out, there are very few technological barriers to overcome. In fact, converting existing vehicles to burn gas isn't particularly challenging.

Unfortunately, in many parts of the world, if you tried to do it yourself, you'd more than likely run foul of legislation against modifying fuel systems.

Fortunately, there are certified installers to do the job.

A typical US installer, NatGasCar augments petrol cars by installing a parallel gas fuel system. Their latest creation is a dual-fuel Dodge Caravan intended for airport taxi service. It starts on petrol and switches over to gas once the engine warms up.

NatGasCar's biggest component is also its most crucial and expensive – the compressed-gas fuel tank situated behind the rear seats in the cargo area. The company uses a Type 4 tank, the most advanced kind. It reduces weight with a plastic composite core wrapped in carbon fibre and is rated for severe impact and puncture resistance.

Between the tank and the engine is the fuel regulator, which reduces the fuel-tank pressure of 250 bar to a usable 9 bar delivered to the engine. The fuel regulator is heated to prevent freezing from the expansion of the gas. The lower-pressure gas travels to the engine, Chrysler's flex-fuel-capable Pentastar V-6. A flex-fuel engine is important, since it has hardened valves and valve seats, which are necessary for CNG operation.

The gas is routed through a parallel fuel rail, and a second set of injectors is plugged into a clever adaptor designed to accommodate both the petrol and gas injectors on the same injection port. Gas runs at an ideal air–fuel ratio of about 16,8:1, whereas petrol runs happily at 14,6:1 for the Pentastar engine. As a result, the programming for the new injectors has to be slightly different. NatGasCar's wiring harness intercepts the signals from the engine-control module and, depending upon which fuel is selected, turns on either the petrol or the gas injectors. The signals bound for the petrol injectors are modified to deliver the appropriate amount of fuel to the gas injectors. This way, very little fine-tuning is necessary, and the car's engine-control unit does most of the work.

LPG vehicles globally

Country	Vehicles	Dispensing sites
South Korea	2 187 066	1 533
Poland	2 050 000	6 700
Turkey	2 000 000	6 853
Italy	1 002 118	2 350
Australia	620 000	3 200
Russia	600 000	2 000
Mexico	550 000	2 500
India	500 000	550
Japan	292 300	1 900
Netherlands	270 000	1 900
South Africa	About 160*	3

*Before the start of the AIDC project.

BITS AND PIECES

UNDER THE BONNET: GAS CONVERSION

LET'S TALK TANKS All gas tanks must withstand the same standards for impact and puncture resistance as an under-car petrol fuel tank while also vastly exceeding the strength requirements.

Illustration by Tamer Kosseli

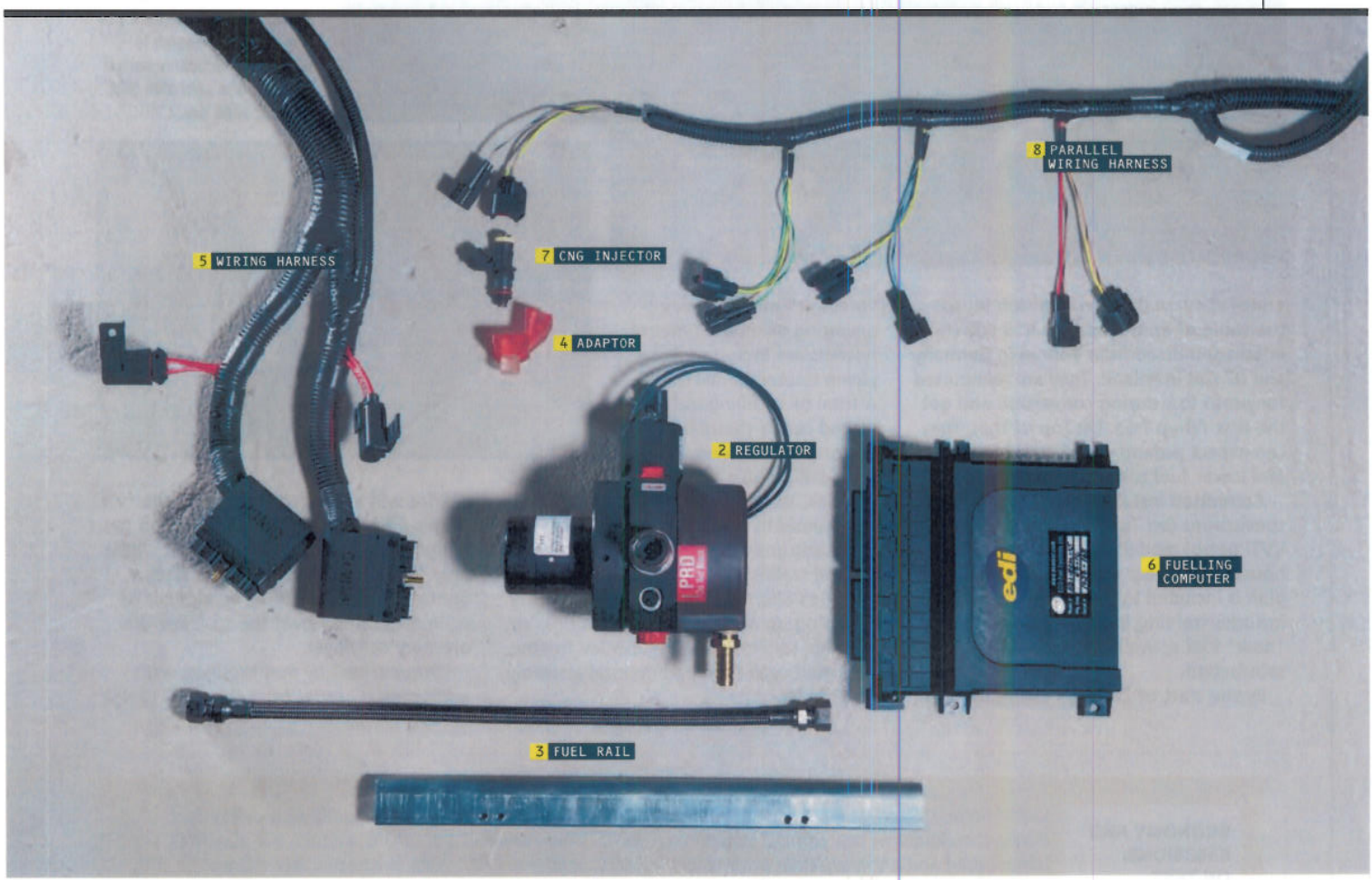
THE WORLD PICTURE

Globally, more than 13 million vehicles run on LPG. South Korea, Poland and Turkey top the list with about 2 million apiece; Poland and Turkey each have about 7 000 dispensing sites, four times that of the Koreans (see table, left).

South Africa's total of fewer than 300 is a drop in the ocean, but the Automotive Industry Development Centre (AIDC) aims to change that. The AIDC has partnered with the national taxi body Santaco and Sasol in a minibus taxi LPG conversion project that is expected to boost our total LPG vehicle park to about 400 vehicles and 9 sites.

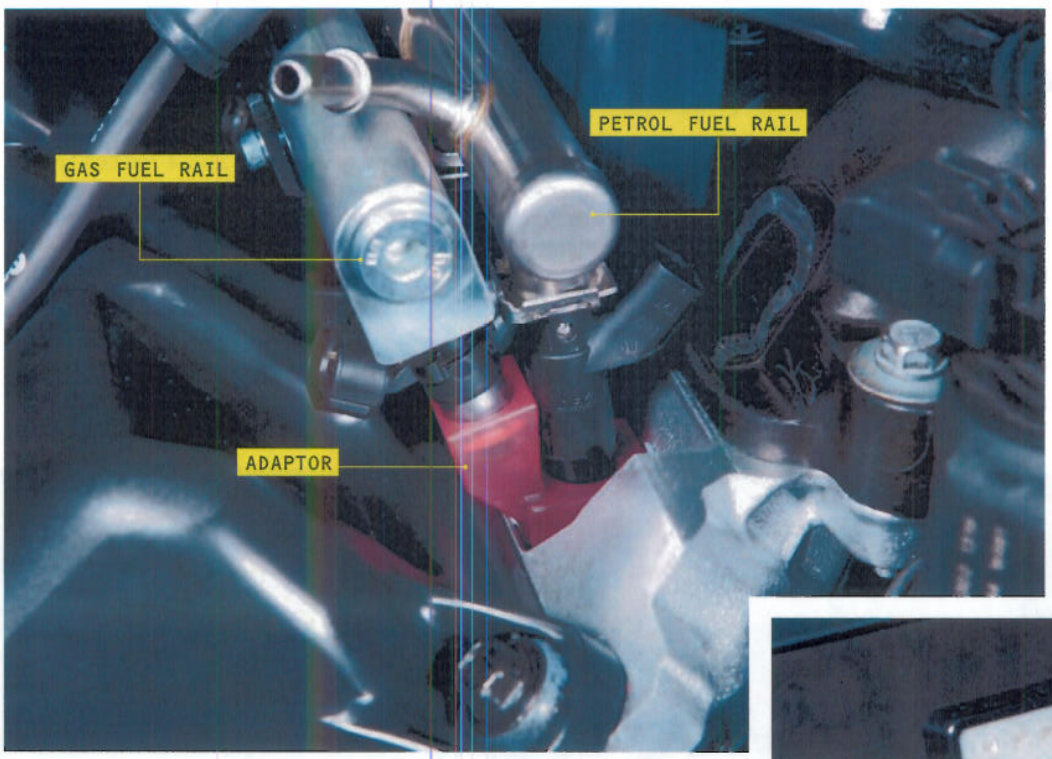
Gauteng, which accounts for less than 2 per cent of South Africa's land area, is home to 44 per cent of South Africa's 7,5 million registered vehicles. Its 32 000 minibus taxis provide the largest carbon footprint in this segment, with about 100 000 km covered a year. They're the most frequent road users, and constantly on the move.

For taxi operators who frequent the LPG conversion route as part of this project, it seems a no-brainer. They get a fully gov-



WHAT YOU'LL NEED FOR A NATURAL GAS CONVERSION

It doesn't take much besides a new fuel tank to convert a petrol-burning engine to one that also runs on gas, as this typical US installation shows. Attached to the fuel tank (1) is the regulator (2), which reduces tank pressure from 250 bar to 9 bar. Fuel is then fed to a parallel fuel rail (3) and to new, secondary injectors plugged into an adaptor (4). A wiring harness (5) plugs into the factory engine-control unit and intercepts throttle information, sending it to a new fuelling computer (6), which slightly alters the data and passes it to the gas injectors (7) through a parallel wiring harness (8).



Two fuel rails and two sets of fuel injectors feed the same port in the intake. The computer starts the car on petrol, and then switches to gas when the engine is warm. The indicator button below is the only clue that this car runs gas.

ernment-funded LPG conversion kit to the value of approximately R15 000 (fully installed) sourced from Voltran in Germany and DT Gas in Poland. They are reimbursed for profit lost during conversion and get the first fill-up free. On top of that, they can expect potentially less maintenance and lower fuel costs.

Accredited installers carry out the LPG conversions (on Toyota Quantum 2,7-litre VVTi petrol models only) in about four hours. A one-year warranty and service plan is included in the deal. Aftercare includes training in how to manage the "new" fuel as well as follow-up on driver satisfaction.

By the start of 2012, an estimated 285 "greener" minibus taxis operating on dual LPG/petrol systems are expected to be plying Gauteng's taxi routes. A total of six filling stations spread across the greater Pretoria and Johannesburg areas will service these vehicles. To cope with maintenance requirements, by December 2011 a total of 40 artisans would have received specialised training.

There's also the possibility of an industry springing up around LPG conversions, kit supplies, servicing and accessories. In time, this could even develop into local assembly of LPG kits.

Price will ultimately determine the fate of gas-powered vehicles. For now, gas has a high price of entry that makes it viable only for taxi services and other fleet operators, but over time, economies of scale may bring down the costs for the ordinary car buyer.

(Original text by Ben Wojdyla, with additional material from the AIDC.) PM

ECONOMY AND EMISSIONS: ON TEST

Liquefied petroleum gas, LPG, is a mixture of primarily propane and butane produced as a by-product during the extraction and refining stages of crude oil. When pressurised, LPG is a liquid, but at normal temperature and pressure it will evaporate. The AIDC says that LPG's vehicle-specific advantages include:

- Less carbon buildup, which means longer spark plug life;
- Longer intervals between oil changes;
- Less corrosion and engine wear than petrol engines;
- Lower harmful gas emissions.
- SABS emissions tests of the converted taxis showed an overall drop of 30 per cent in carbon monoxide levels when using LPG compared with petrol. CO_2 levels dropped by 11 per cent. During performance testing at Gerotek near Pretoria, the LPG version was marginally slower than the equivalent petrol-engined model.
- Fuel economy was noticeably worse with LPG – nearly 20 per cent – but lower LPG prices computed to an overall saving of 12,5 per cent on fuel alone.