



Piloting LPG/Petrol Hybrid Vehicles in the Western Cape

City of Cape Town – Western Cape

Developing a local Proof of Concept (POC)

Opportunity

The transition to a sustainable mobility future will likely occur in several phases, and LPG-hybrid vehicles present a step forward towards full decarbonisation. Globally, there are over 27 million New Gas Vehicles (NGVs) compared to 7.2 million electric vehicles (EVs), with approximately 1.4 billion total vehicles on the roads. Locally, some automotive original equipment manufacturers (OEMs) like Nissan, Scania, Isuzu, DAF, Iveco, and Hyundai, now offer OEM approved NGVs.

Compared to ordinary internal combustion engine vehicles and battery-petrol hybrid electric vehicles (which are projected to grow exponentially), LPG hybrid vehicles significantly reduce vehicle emissions and provide significant cost savings. LPG currently has VAT applied to the price, hence fleet owners can claim this and make further savings. The reduced carbon build-up in LPG vehicles also leads to lower vehicle maintenance costs because of more extended periods between services and increased life for spark plugs.

LPG is safe, and cleaner than petrol/diesel and could be a viable alternative to mainstream fuels in the short-term (or as a transition fuel to full decarbonization), particularly for light delivery vehicles.

This opportunity also presents significant job creation and investment potential for the Western Cape. There are six refineries in South Africa, of which five produce LPG. These five refineries produce over 80% of LPG consumed in South Africa annually, while the remainder is imported to compensate for the shortfall. These are: Shell and BP South African Petroleum Refineries (Pty) Ltd; Engen Petroleum Ltd; Sasol Synfuels (Pty) Ltd; The Petroleum Oil and Gas Corporation of South Africa (Pty) Ltd ("PetroSA"); and Chevron South Africa (Pty) Ltd. However, the Engen and Astron (previously Chevron) refineries are currently offline. This LPG hybrid vehicle opportunity could provide offtake potential for these facilities. Additionally, the recent government announcement of draft legislation around private energy procurement has opened South Africa up to many renewable energy options and could boost LPG.

The Maximum Refinery Gate Price (MRGP) and Maximum Retail Price (MRP) is determined on the first Wednesday of each month by the Department of Mineral Resources and Energy (DMRE) – at the same time as the other fuel prices are announced.

MRP on the other hand only applies to domestic use of LPG. The wholesaler or retailer can set commercial and industrial pricing. Generally however, this is aligned to MRP or slightly lower in some instances. There is also often a lag in pricing between imported LPG pricing and locally produced LPG pricing.

Piloting a Solution

Octotel (Pty) Ltd is a Cape Town-based fibre network operator. They are Cape Town's largest Open Access Network, focused on both Fibre to The Home (FTTH) and Business (FTTB), and operates a large fleet of (petrol) vehicles covering considerable mileage daily. The company provided two of their internal combustion engine vehicles to KepuGas to conduct a proof of concept and evaluate the benefits of LPG (Liquid Petroleum Gas) as an alternative fuel for their large vehicle fleet.

The POC aimed to assess and collect data on the following:

- Actual savings by using LPG as an alternative fuel source.
- The practicality of using LPG as an alternative fuel source.
- Reliability of the Stag Autogas system. The Stag system meets the highest international safety standards.
- Savings on harmful emissions.
- Creating a more sustainable transport solution.

KepuGas is in the process of building a network of LPG refuelling stations in the Western Cape as demand grows, including at the Atlantis Special Economic Zone for Green Technologies (ASEZ). The LPG supply for this pilot was provided from their LPG fuelling station in Salt River, Cape Town, which gets its LPG supply from the Sunrise Energy LPG import and storage facility in Saldanha Bay. Additional reserves are provided by other bulk storage facilities in the Western Cape or via Port Elizabeth and Richards Bay.

The Pilot Vehicles

Fig. 1: NISSAN NP200 1.6 8V bakkie



This vehicle was fitted with a STAG Qbox Next LPG ECU and a 90 litre cylinder-type tank that was mounted on the load bed of the bakkie. Safety regulations dictate that an LPG vessel can only be filled to 80% of rated capacity, e.g., a 49 litre tank can only

Fig 2. FIAT FIORINO 1.4 panelvan



This vehicle was fitted with a STAG Qbox Basic LPG ECU and a 49 litre external toroidal tank fitted in the spare wheel space.

Both vehicles were fitted with the in-house proprietary **S-Telematic devices** with the following features:

- These telemetry devices connect directly to the STAG ECU and read and report various data in real-time.
- Precise and real-time measurement of LPG Consumption through innovative Intelligent Gas Level technology (IGL).
- Real-time measurement of distance on LPG v Petrol.
- Real-time savings calculator based on current LPG/Petrol pricing.
- Real-time CO₂ savings calculator.
- Other innovative features such as: GPS Tracking, Engine heat alerts, speed alerts, rev alerts, Eco-drive alerts.
- The telemetry system provides extensive reporting for the fleet environment.

Findings

Nissan NP200 1.6 8V

- Installation of the STAG Autogas system to the vehicle was seamless, and downtime was 1 day per vehicle.
- The vehicle drove 5 141km during the POC, whereby 4 703.93km was driven on LPG.
- The vehicle refuelled a total of 8 times, equalling 520.08 litres of LPG.
- Estimated **22% less CO₂ and 68% less NOx** emitted compared to Petrol.
- A **44.2% cost saving** was achieved (Petrol vs. LPG/Petrol hybrid).

Table 1: Savings Summary

TOTAL LPG (LITRES)	520.08L
Days	49
Distance (mileage)	4703.93 Km
Litre /100km	11.06
Calorific Loss	16.61%
Actual Litre /100km	11.22
Petrol Litre /100km	9.22
If 100% Petrol	R6 958.00
If 99% LPG	R3 8825.51
Saving	R3 075.49
Saving %	44.20%
VAT	R582.38
ANNUALISED SAVING	R16 444.44

LPG has a lower calorific value than petrol. **Key assumptions:** As such, slightly more LPG is used than petrol, which is reflected above, and consumption figures are adjusted accordingly to take this into account. Autogas converted vehicles require a start-up ignition (on petrol), and therefore the LPG figure is quoted as 99%. The annualised savings is based on a work year of 262 days. The May 21 ULP95 price of R16.60 was used in the POC. LPG Price = R8.69 excl. VAT.

FIAT FIORINO 1.4

- Installation of the STAG Autogas system to the vehicle was seamless, and downtime was 1 day per vehicle.
- The vehicle, however, experienced some high initial consumption figures due to incorrect injector nozzle sizes deployed. This was due to a discrepancy between the EU and local specifications of the available data. This was corrected and resulted in a reduction in LPG consumption.
- The vehicle drove a total of 4924 Km during the POC.
- The vehicle refuelled a total of 13 times, equalling 447.37 litres of LPG.
- A total of 3711 Km was driven on LPG
- Estimated **22% less CO₂ and 68% less NOx** emitted compared to Petrol.
- A **39.8% cost saving** was achieved (Petrol vs. LPG/Petrol hybrid).

Table 2: Savings Summary

TOTAL LPG (LITRES)	447.37L
Days	54
Distance (mileage)	3711 Km
Litre / 100km	10.17 (Vehicle had incorrect injector nozzle size and a faulty spark plug)
Calorific Loss	16.65%
Actual Litre /100km	10.33
Petrol Litre /100km	8.47
If 100% Petrol	R5 962.48
If 99% LPG	R3 589.64
Saving	R2 372.84
Saving %	39.80%
VAT	R538.45
ANNUALISED SAVING	R17 416.38

For savings calculations, the last 2 refuels will be used in the savings calculation. NB: As stated, incorrect injector size nozzles were fitted to this vehicle resulting in a higher-than-average LPG consumption. The vehicle also had a faulty spark plug which was replaced. The tank size of this vehicle is significantly smaller than that of the Nissan vehicle, hence the more frequent refills.

Insights and lessons learned

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The use of LPG as an alternative fuel for transport provides a significant saving, especially in a fleet environment.

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LPG is VAT-able.

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LPG provides a significant reduction in vehicle emissions and significant cost savings.

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Autogas is safe and cleaner than petrol/diesel and could be a viable alternative to mainstream fuels (or as a transition fuel to full decarbonization).

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The use of LPG as an alternative fuel is safe.



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