

GASSING UP THE HIGHWAY

As demand for natural gas grows overseas, Australian company iGas continues to develop its heavy-duty CNG solution. Matt Wood catches up with the latest incarnation of the company's Westport CNG-powered prime mover.



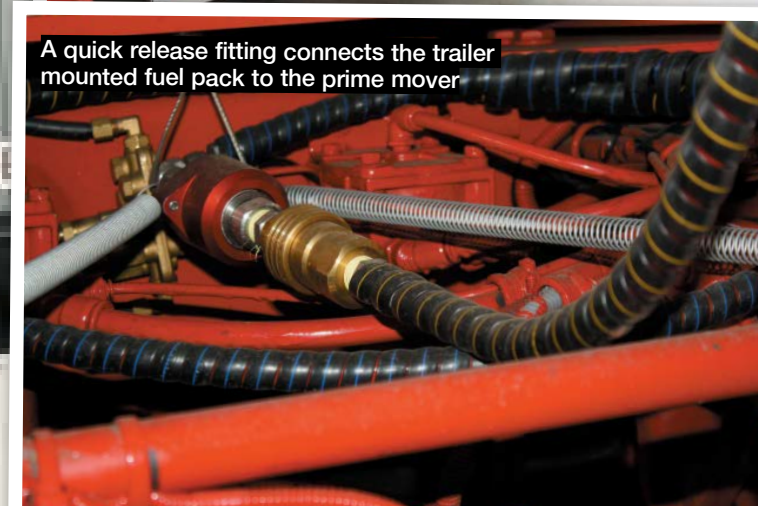
The latest incarnation of the iGas CNG adaptation; larger tanks and a new fuel delivery system have given the vehicle a longer range.



New horizontal 100 inch (2,540mm) x 26 inch (660mm) carbon fibre tanks have increased on-vehicle storage.



A chassis-mounted booster unit forces the CNG into the engine at high pressure.



A quick release fitting connects the trailer-mounted fuel pack to the prime mover.

Specs

Make/model: Western Star 4800FX with iGas CNG (working prototype)
Engine: 15-litre Westport HD550 High Pressure Direct Injection (HPDI)
Fuel: Compressed Natural Gas (CNG)
Storage: Cool 5000 high density carbon fibre tanks
Delivery system: iGas high pressure CNG booster
Emissions: ADR80/03 compliant EGR equipped
Power: 550hp (411kW)
Torque: 1,850ft-lb (2,509Nm)
Transmission: Eaton Autoshift 18-speed
Range: 1,500km plus, depending on CNG tank configuration
GVM: 70,000kg

THE FORMER Saudi Oil Minister Ahmed Yaki Yamini has become famous for his oft quoted gem, "The stone age didn't end for lack of stone, and the oil age will end long before the world runs out of oil".

The quote is over a decade old now but it still pops up on all sides of the energy debate, as well as in climate politics. Though many are still debating if and when peak oil has already happened, there are growing signs the search for alternative fuels for transport is gaining momentum.

RAMPING UP

And as far as heavy transport in North America goes, it seems the Americans are pulling out all stops in their quest for energy self-sufficiency. Recent shale gas discoveries are seeing the country on course for the role as an energy exporter by as early as 2016. Australia, too, has been ramping up natural gas

production and building on the export markets offered by Natural Gas Liquids (NGLs).

According to figures recently released by energy and resources consulting agency Wood Mackenzie, Australia has gone from supplying 7 per cent of the world's Liquefied Natural Gas (LNG) in 2000 to a forecasted 25 per cent of the global LNG demand by 2018. It seems, when it comes to gas in this country, we're full of it.

But the American, Asian and south Asian love affair with natural gas just hasn't captured the imagination of Australian transport operators. The main point most will bring up in road transport terms is the lack of infrastructure and while LNG infrastructure is quietly creeping up the east coast, it will still be a while before we see enough refuelling points to cover the major eastern seaboard freight routes.

Cost and weight are also factors and there's the not-so-insignificant fact that many see it as yesterday's technology and lacking the gee whiz factor of sexier technology. History hasn't helped, as some heavy vehicle gas system providers have come and gone over the years leaving some customers wondering about back up over the long term.

OPTION OVERLOAD

There are a number of different heavy vehicle gas systems available, though the vast majority of heavy-duty applications are taken care of by LNG systems. LNG is natural gas that has been cryogenically cooled to around -161C where it then liquefies. In liquid form the gas is easier to store and transport because it takes up less space than it does in gas form.

The different types of LNG systems out there also tend to muddy the waters a

bit in what quickly becomes an acronym-heavy discussion. For a start there are dual fuel systems that enable a prime mover to run on diesel and gas at the same time; the advantage of this is if the vehicle runs out of gas it will revert to running on diesel.

The downside of the dual fuel system is its low substitution rate often between 45 to 50 per cent of the fuel burn. Then there's the High Pressure Direct Injection (HPDI) approach that only uses diesel as an ignition source, so the engine runs on 95 per cent LNG all of the time. The Cummins-derived 15-litre Westport HD550 LNG engine is the main player for this technology and offers no power loss.

The down side of this system is mainly the fact that if you run out of gas, you stop, and there's still not a huge LNG refuelling network out there yet. But overall, one of the bigger down sides of LNG is if it heats up it vaporises, so while the vehicle is in use, the gas will be consumed, but park it up and the fuel tanks will vent and the LNG will turn to vapour and disappear into the atmosphere.

NOT BLEVEY GOOD

Compressed Natural Gas (CNG) is attractive in other ways; for a start it's cheaper and doesn't require the energy intensive cooling process that LNG does. It's also more stable, as it's a gas it doesn't need to stay cool like LNG does. If you park a CNG vehicle, the fuel just stays put until you start it again. And, arguably, CNG is safer than LNG as it is lighter than air and will dissipate more quickly. In an accident there's no chance of the dreaded Boiling Liquid Expanding Vapour Explosion (BLEVEY) that the media love to associate with LNG, however unlikely that scenario may be.

"THERE'S NO CHANCE OF THE DREADED BOILING LIQUID EXPANDING VAPOUR EXPLOSION (BLEVEY)."

The down side of CNG is that it does tend to take up a lot more room on the chassis of a road-going truck. Another issue has been that most CNG truck engines use spark ignition, where the diesel injectors are replaced with spark plugs and this causes a loss in horsepower and torque.

And for this reason, to date, most CNG applications have been restricted to city-based light- and medium-duty trucks that don't need the torque or the horsepower a heavy-duty vehicle does.

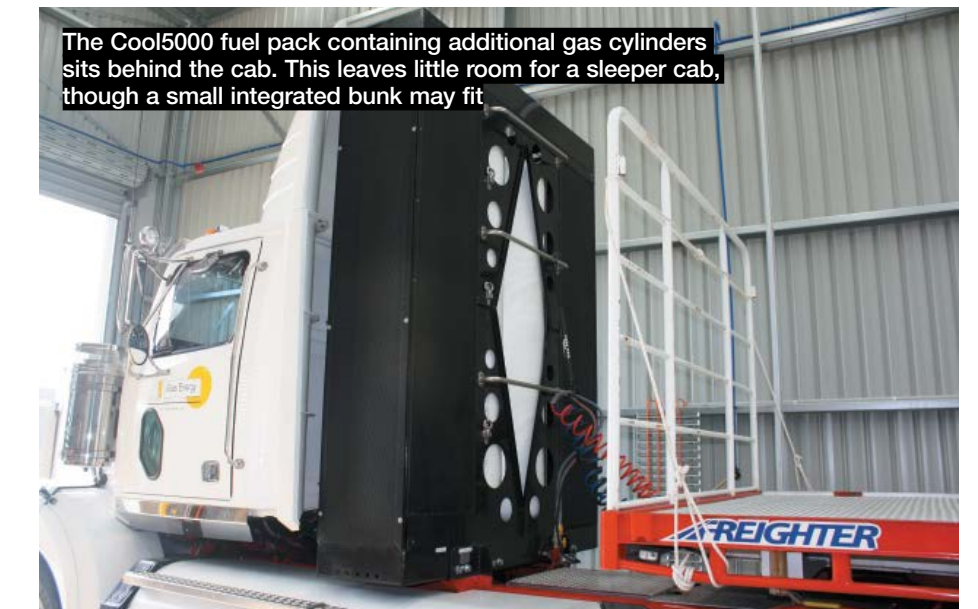
But what if you could have the best of both worlds? Have the advantages of LNG in terms of performance and range; but the advantages of CNG in terms of cost and stability. And what if refuelling could be as simple as installing a refuelling point directly off a gas pipeline, without the need for a retail distribution middle man or paying for fuel deliveries?

NOSE TO THE GRINDSTONE

Queensland-based company iGas Energy has been plugging away at a cost-effective and practical heavy-duty CNG concept for over two and half years now. The company has been trialling its own CNG adaptation of the 15-litre Westport HPDI LNG engine; this system has the same 95 per cent substitution rate that the LNG version has and still uses a fine mist of diesel for combustion. Over this time, iGas has had two Western Star prime movers working for a national transport company under real working conditions and have been gradually streamlining their CNG package.

Recently iGas demonstrated the third and latest incarnation of the CNG Westport engine installed in a Western Star 4800FX prime mover. The original versions of the gas engine used a concept, rather clumsily named PLIGATS, which stands for Pressurised Liquid Injection Gas And Transfer System. The PLIGATS system used a water-based hydraulic liquid to force CNG out of the carbon fibre storage tanks and into the Westport engine. The pressure for this came from a Vickers 20/20 hydraulic pump that handled power steering duties for the prime mover as well.

The main downside of the original system was a lack of range, with a realistic operating range of nearly 1,000km. I drove the original PLIGATS version last



The Cool5000 fuel pack containing additional gas cylinders sits behind the cab. This leaves little room for a sleeper cab, though a small integrated bunk may fit.

iGas Director, Jim McDonald (left) and Executive Director Derek Fekete (right) both have a long history with gas infrastructure.



Trailer mounted gas tanks can be mounted underneath the trailer to extend range even further



“THERE’S POTENTIAL FUEL SAVINGS IN THE VICINITY OF \$150,000 A YEAR AT CURRENT GAS PRICES.”

year and found the performance and drivability of the truck identical to an equivalent spec Cummins ISX powered prime mover.

The new version of the iGas system has done away with the cumbersome hydraulic gas injection system which has been replaced by a gas booster or compressor that is powered by the same Vickers pump as the outgoing version. The booster pushes the CNG into the engine at 300 barg, which is around 4,400psi on top of atmospheric pressure which puts it into the ball park of 5,000psi. Energy density climbs exponentially at the 5,000psi mark.

BIGGER TANKS

Another development has been in the area of cylinder design with the availability of 100-inch (2,540mm) x 26-inch (660mm) carbon fibre tanks. The larger tanks now give the iGas truck a potential range of 1,500km.

The demonstration took place at the Wodonga TAFE, National Industrial Skills Training Centre at Barnawartha, Victoria. And it was a chance to have a closer look at some of the new features iGas has applied to their concept. Nothing has changed a great deal mechanically; the biggest advances have been in the storage and delivery of the gas to the engine. But iGas has also found a way to increase vehicle range even more by installing belly tanks in their step deck trailer.

The distance of the on-vehicle storage from the prime mover isn't an issue in terms of fuel delivery with the tanks connected to the prime mover via quick release fittings on the chassis of the prime mover behind the turntable. Theoretically there's no reason that a B-double or road train couldn't have belly tanks under each trailer to increase range even further.

Executive Director of iGas, Derek Fekete, ran me through some of the key areas of the new set-up.

“We now have the only known trailer that's actually registered as a gas vehicle,” he says, as we walk around the truck. Fekete is referring to the fact that because the trailer carries some of the truck's gas it needs to be registered as such.

THE WESTPORT SOLUTION

On the company's choice of engine, Fekete states “The Westport LNG engine has proven reliability in Australia. Now there are 40 on the road here in Australia, with the oldest having racked up 1.3 million kilometres in Western Australia.”

There are now more than 1,000 Westport engines operating globally, according to Fekete.

Gas engines tend to run quieter and also cleaner as the gas doesn't generate any soot, which also leaves potential for extended oil-drain intervals; from 60 to 80,000km. Fekete goes on to point out the engines run that clean that

the ADR80/02 engines come within a whisker of satisfying ADR80/03 without any after treatment. iGas is also claiming a world first as a 5,000psi heavy-duty CNG solution. There is however a weight penalty of 1,400kg over standard equivalent spec diesel prime mover.

SPOT THE DIFFERENCE

I had a chance to climb behind the wheel of the Western Star demo truck with its counterweighted trailer. Performance-wise there's little to report, it drives pretty much like the old one which drove pretty much like any other Cummins ISX powered 4800 I'd ever driven, 550hp and 1,850ft-lb (1,365Nm) of torque.

And really, that's a good thing. The only real noticeable difference is the quiet, somewhat subdued exhaust note of the HD550 engine. But what was startling was the fuel bill from the truck's 1,200km journey down from Yatala, Queensland to Canberra via Wollongong. When refuelling in Canberra the bill came to a paltry \$330. That's pretty bloody cheap trucking.

Director at iGas, Jim McDonald, reckons “there's potential fuel savings in the vicinity of \$150,000 a year at current gas prices.”

But what is worthy of closer attention is the refuelling infrastructure that iGas also manufacture. This uses the hydraulic PLIGATS system that used to be on the trucks and speeds up the notoriously slow refuelling time considerably — a common complaint with CNG.

The Chill-Fill process used on the iGas refuelling station drops the gas temperature to sub zero to ensure maximum fuel capacity is achieved. But all of this aside, the iGas system does have the potential to give an operator more power over their fuel supply chain. If you consider the ChillFill station is pretty much just plumbed into a gas pipeline like a stove or hot water service, the fleet operator can negotiate a metered rate from the mains and cut out retailing and delivery hassles and charges.

OFF SHORE SOLUTION

But as with many Australian innovations, the iGas system will most likely realise its potential on foreign shores. The company now has four United States-based employees and is currently talking to some US rail operators with a view to adapting the concept to rail locomotives.

One example of the gas boom in the US is the recent announcement that American logistics giant, Swift, with its 27,000 strong fleet, is in the process of installing natural gas refuelling points in its depots.

The former Organization of the Petroleum Exporting Countries (OPEC) mover and shaker and now octogenarian Yamini may have been onto something when he uttered his famous words on the future of stones and oil in the global economy. But, over the last few years, reports from the Middle East are indicating a shortage of quarrying materials in the Gulf States. Could it be the Arabs are running out of sand? ■