

NATURAL GAS VEHICLES – THE CLEANER ALTERNATIVE

The focus on climate change in recent years has tended to be on renewable energy, efficiency and carbon capture and storage. If transport was in the spotlight, it tended to be biofuels or, more recently, electric cars that dominated. Natural gas vehicles have attracted little attention, but they have serious emission-cutting potential and, in some countries, energy security appeal. At present, the market reach of NGVs is patchy and regulatory incentives are equally inconsistent. But opportunities exist in a number of fields, including infrastructure, vehicles, cylinders and conversion.

New Energy Finance finds that:

- Natural gas can fuel every form of transport, from rickshaws to cargo aircraft.
- CNG is best suited to low-mileage trucks, taxis or buses that can refuel from a central point. LNG is more suitable for vehicles that make longer journeys.
- NGVs offer improved energy security because gas resources are more widely distributed than oil, and because alternative sources are available such as coalbed methane, flared gas from oilfields, landfill gas and biomethane from agricultural or forestry waste and wastewater treatment.
- NGVs offer considerable savings in running costs over petroleum vehicles and have lower emissions of CO₂ and other pollutants. Air quality is often the major driver for the uptake of NGVs.
- The NGV market lacks global scale, with market penetration varying widely from country to country. South America and Asia are key markets, with Italy the biggest source of demand in Europe.
- This lack of scale hinders economies of scale in every area from dedicated gas vehicle production to refuelling infrastructure. In many cases, after-market conversion is the only option. The sector is also hindered by the volatility of oil markets. CNG requires more storage space than petroleum, both at fuel stations and on vehicles, while liquefying gas is a costly process and requires significant infrastructure.
- A significant increase in LNG capacity is coinciding with a trend towards tighter emissions standards around the world. Introducing NGV models is one of the quickest and easiest ways to cut fleet emissions.
- The growth of the NGV market provides a variety of opportunities including the production of natural gas only vehicles, refuelling infrastructure, gas cylinders, conversion kits, home refuelling equipment (except where absolutely necessary)
- Conversion costs for cars range from \$1,000 to \$4,500 in different markets. LPG conversion is cheaper than that for LNG or CNG.

Definitions

LPG

LPG (liquid petroleum gas) – as the name suggests, LPG is a by-product of the petroleum industry. LPG is one of the first products to be created by oil refineries and it has been used as a fuel since the 1940s. Currently, 40% of LPG production comes from oil refineries and 60% from stripping out the butane and propane from “wet” natural gas. Because it is a by-product, its price tends to fluctuate with the oil price and vehicle makers have shied away from making LPG-only products, meaning that conversions are the only way to get one.

LNG and CNG

CNG (compressed natural gas) and LNG (liquefied natural gas) are the same substance (methane) but stored differently. CNG is compressed between 40 and 200 times to reduce its volume, while LNG is cooled to -160°C so it becomes a liquid, which reduces the volume even more. LNG is about 600 times as dense as natural gas and therefore requires less space per unit of energy than CNG – but it is much more expensive to liquefy gas than to compress it.

Applications

Natural gas has the potential to fuel almost any kind of vehicle - motorcycles and three wheelers, cars, vans and pickups, fork-lift trucks, buses, trucks, trains, boats, even aircraft. In practice, the main applications are cars, trucks and buses. CNG is not ideal for motorcycles because of the limited space available for fuel, but three-wheelers such as tuk-tuks are well-suited, having more room for storage, and are widely used in Asian countries such as Thailand, India and Bangladesh.

CNG can technically be used in any car engine, but is best suited to high mileage vehicles such as taxis, vans and pick-ups as many CNG cars are conversions and the high mileage cuts the payback period. The other advantage of using CNG for taxis is that their geographical range tends to be limited, meaning that they are less affected by the lack of a widespread refuelling infrastructure than vehicles that roam further afield.

Converted vehicles have a storage cylinder in the boot of the car as well as a conventional fuel tank, resulting in a loss of space. CNG-only cars have the cylinder installed within the chassis to maximise the use of space.

CNG's low emissions make it ideal for fork-lift trucks, which need to be low emission because they are often used indoors. Another advantage over LPG is that the lift truck can be refuelled without having to swap over heavy cylinders.

Buses are an ideal market for natural gas as they are based at depots that can host refuelling facilities. The storage cylinders can go on the roof, allowing for even distribution of the weight of the fuel. HCNG, a blend of hydrogen and CNG, is being tested in a number of trials.

CNG is ideal for low-mileage trucks or those that return frequently to a depot, such as garbage trucks, while those that travel longer distances use LNG, often in conjunction with diesel to compensate for the lack of fuel stations. Natural gas engines are becoming lighter than diesel engines, while cylinder makers are starting to use lightweight composite materials.

Peru, Sweden and India have natural gas train programmes and CNG is becoming a popular choice for boats that operate fixed routes such as ferries. Aircraft fuelled by gas have only flown on an experimental basis, but those experiments show the capability of the fuel - the aircraft that have used it range from helicopters and single-engined propeller planes to the mighty Antonov AN-225 cargo plane.

Advantages

Energy security

Simply by virtue of not being oil, gas increases energy security, particularly for the transport sector. While it can be seen to present many of the same problems as oil, in that the countries with the largest reserves are Russia and Iran, these countries and other key suppliers such as Qatar are not able to control the market to the same extent as OPEC has done in the oil market. There are other significant players such as Canada and Australia that are developing not just offshore gas fields but also their significant coal resources to capture coalbed methane, which can be a source of transport fuel with minimum treatment.

In addition, the creation of a significant NGV market provides incentives for the use of biomethane, gas that is flared from oil fields and other unconventional sources such as CBM. In many markets, there is already a significant natural gas pipeline infrastructure that removes many of the costs of transporting the fuel as all these various sources of gas can simply be injected into the pipeline from wherever they are produced. And while there remains a critical shortage of CNG or LNG refuelling stations, this problem can be partly circumvented by refuelling cars overnight at home. It takes a long time to fully refuel a car (about 16 hours) but an overnight top-up would allow most vehicles to complete their daily commute.

Figure 1. CNG 'Tuk-Tuk'



Source: Clean Fuels Consulting

Lower costs

As Figure 2 shows, there has been a consistent price differential in favour of gas compared to oil. This contributes to the fact that NGVs are cheaper to run, with the average family car in Europe saving about 60% compared to an equivalent petrol engine and 33% compared with a diesel version, according to the European Natural Gas Vehicle Association. In many countries, there are tax advantages that reinforce this cost saving.

Lower pollution

NGVs are also considerably less polluting than petroleum vehicles - not just in terms of carbon emissions but also NOx and particulates. NOx is a key cause of smog, while particulates can cause serious damage to human health. As car usage has grown rapidly in emerging markets, air quality has become a serious problem in many of the world's largest cities. As a result, the main driver for the uptake of natural gas vehicles is often air pollution rather than climate change.

As the development of hydrogen-powered vehicles continues, natural gas is likely to be the most common feedstock for hydrogen for some time to come so the development of the NGV market will be an important step on the road to the hydrogen economy.

Safety

Perhaps surprisingly, NGVs are seen to be safer than petroleum vehicles. As well as producing fewer emissions, natural gas poses fewer environmental hazards than other fuels. In accidents, natural gas dissipates into the atmosphere rather than spilling on to the ground - a major benefit in pollution terms. This, and the lack of emissions, is important in applications such as fork-lift trucks, which work indoors in areas where high concentrations of pollutants are a health hazard.

Flexibility

Another feature of NGVs is their flexibility. They are available as mono-fuel, designed only to run on methane; bi-fuel, which can operate on petrol or methane but use petrol for ignition so always requires some gasoline; dual fuel, which use a combination of gas and diesel; and even tri-fuel, which can use ethanol as well as gas and petrol. While the lack of infrastructure is a real problem for the sector, NGVs can be refuelled from anywhere with a gas supply, including homes, offices and other business premises. As a result, home refuelling is an option - something that is not available for other fuels apart from electric.

Disadvantages

The key disadvantage for NGVs at the moment is the lack of scale and the patchy distribution of NGVs. For example, there are more than 500,000 vehicles in Italy but less than 300 in the UK. This hinders economies of scale in all sorts of areas ranging from the vehicles themselves to refuelling infrastructure.

In the US, for example, there are 800 NGV filling stations, compared to 175,000 that sell gasoline. Many fuel stations are not open to the public, but limited to municipal buses or refuse trucks. Though some NGV-only models are made, there are far fewer car models available as NGVs and in many markets, conversion - a relatively expensive process in terms of payback - is the only option.

Arguably, there is a vicious circle at work: there is a lack of fuelling stations, so manufacturers do not make NGVs, so the oil majors do not build fuelling stations. It is only in recent years that the focus of the energy sector has moved to gas and that the infrastructure for large scale transport of LNG has come on line. Conspiracy theorists would argue that the energy companies have a vested interest in encouraging gasoline and diesel rather than gas because that is the infrastructure they have in place - and if NGVs become widespread and people can refuel them at home, they lose that market.

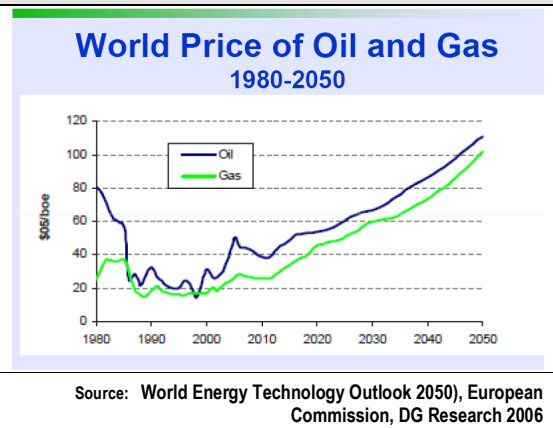
CNG requires more storage space than petroleum, both at fuel stations and on vehicles, while liquefying gas is a costly process and requires significant infrastructure.

Because gas prices are linked to oil prices, their relative price advantage, particularly over options such as hybrids or biofuels, is eroded by the high prices and volatility we have seen recently.

Regulation and global markets

The largest single-point sources of emissions now firmly targeted for emissions controls through initiatives such as the European Emissions Trading Scheme, and forthcoming schemes in the US, Australia and

Figure 2. Oil and gas price differential



elsewhere. So the focus is turning to emissions from transport, that have soared by 35% since 1990 (including shipping and aviation), with much of the impetus happening as global economic growth increased during the early part of this decade.

Global LNG capacity is increasing drastically – Qatar’s massive gas liquefaction plants and terminals in Europe, the US and Asia are set to add about 30% to LNG capacity in 2009-10. This capacity is coming onstream at a time of reduced industrial demand and may provide a boost to NGVs as suppliers look for alternative markets for their product.

Another factor that may boost the market is the increasing focus on cutting emissions from the transport sector, which have grown rapidly in recent years. While emissions from the power and manufacturing sectors have fallen by 15-20% since 1990, transport emissions have jumped 35% in that time.

Fuel efficiency standards are one of the main weapons in the battle to cut the impact of vehicles – and NGV is one of the easiest and quickest ways to cut the emissions of a fleet. Tighter rules have been introduced in the EU, the US and China and the trend is likely to be for emissions to have to be cut further in future.

The EU’s Directive Promoting Clean and Energy Efficient Road Transport Vehicles also encourages low-carbon choices in public procurement by making authorities consider whole life-cycle costs in their purchase decisions. “The intention is to stimulate and improve the market for alternative fuel vehicles by building a critical mass for original-equipment-manufactured vehicles as well as retrofit vehicles and replacement engines,” says Seisler.

The directive may help the many cities that have committed to cut their emissions to introduce NGVs in their public transport and municipal fleets. “If member states follow through on the mandate it should have a significant impact on building demand for alternative fuelled vehicles,” says Clean Fuels Consulting. “Each year governments in the EU-25 purchase 110,000 passenger cars; 110,000 light duty commercial vehicles; 35,000 heavy duty vehicles; and 17,000 buses.”

Seisler says that it is important that regulations on alternative fuels apply to use of the fuels, not just the capability to use them. Many NGVs are dual fuel. An Arizona directive allowed drivers to receive a rebate of thousands of dollars to convert a vehicle but did not compel them to actually use it.

Examples of successful mandates include New Delhi (see Case Study 1) and the South Coast Air Quality Management District (SCAQMD) Clean Fleet Rules in Southern California, which require certain fleet operators to use natural gas vehicles.

Case Study 1. New Delhi

One of the best-known examples of a NGV mandate is the public bus system in Delhi, India, which is required to use compressed natural gas (CNG). There are more than 10,000 CNG buses on Delhi’s roads. This has led to significant improvements to air quality. The mandates are unusual in having been imposed by the Supreme Court of India, rather than as a result of Government policy. The Supreme Court decision arose from civil suits brought in relation to the right of citizens to breathe clean air.

Source: Clean Fuels Consulting

NGV markets

As Figure 3 shows, the spread of NGVs is extremely patchy. Almost half (48%) of the world’s approximately 10m natural gas vehicles are in Latin America, chiefly Brazil and Argentina, with Pakistan, Iran and India also significant players. In Europe, Italy is by far the biggest market, with more than 500,000 vehicles thanks to a 30-year history of encouraging the technology.

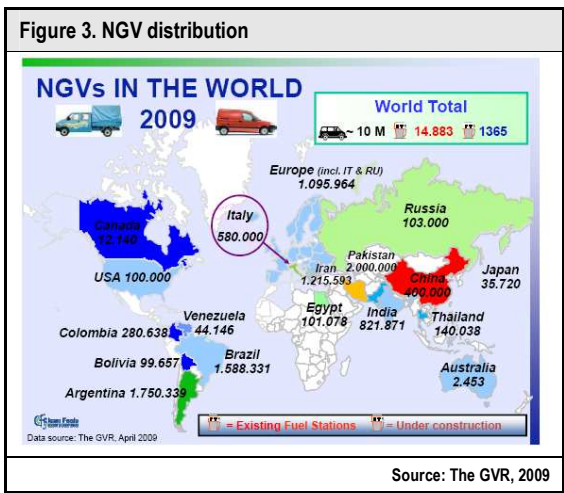
Latin America

CNG vehicles are common in South America, with taxis in the main cities of Argentina and Brazil comprising the main market. Argentina’s 1.7m vehicles make up 21% of the total fleet, while Brazil’s 1.5m are 6% of the total. Bolivia (90,000 units), Colombia (250,000) and Peru (41,000) are also significant markets, with Peru in particular expected to grow because of its large gas reserves.

North America

Neither Canada (12,000 vehicles) nor the US (100,00 units) are big NGV markets, but both have indigenous natural gas resources and US concerns about energy security, along with tighter fuel efficiency standards, could drive the market in future. About 97% of US gas needs can be met domestically. Growth potential is significant because the US’s 100,000 vehicles represent just 0.05% of the nation’s 235m fleet.

California is the biggest market in the US, with extensive use of CNG for municipal vehicles, while Utah



offers a subsidised statewide network of CNG filling stations at a rate of \$0.85/gge, which pertained even last year while gasoline is above \$4.00 a gallon.

California's budget travails are likely to have a dampening effect on the market, even as the state recently won the right to impose its own emission standards under the Clean Air Act. The EPA says 13 other states and the District of Columbia also plan to adopt the standard. New federal standards announced by President Obama in June are expected to take effect in 2012 and will require new vehicles to improve their fuel economy to an average of 35.5 miles per gallon by 2016.

In the 2008 election, California voted down a \$5bn bond measure that would have given rebates to state residents that purchase CNG vehicles. Oklahoma has also just introduced legislation encouraging the use of CNG vehicles.

While CNG-powered buses are common, the only CNG vehicle currently produced in the US is the Honda Civic GX sedan, which is made in limited numbers and available only in a few states. Otherwise, the only sources are aftermarket conversions and government-used vehicle auctions.

T Boone Pickens, who is making waves with his proposals for a massive expansion of wind power, is also proposing an initiative, known as the Pickens Plan, which envisages an expansion of the use of CNG in heavy vehicles, with his company Clean Energy Fuels – one of the largest providers of CNG and LNG in the US – supplying much of the fuel, from landfill gas projects and other sources.

Tax credits of up to 50% of the cost of conversion and the cost of CNG home filling stations are available. However, the conversion requires a "type certificate" from the EPA, showing conformity with emission standards, and it can cost up to \$50,000 to meet the requirements of a type certificate.

In the largest corporate commitment to alternative fuels in the US, AT&T plans to spend \$565m on more than 15,000 alternative-fuel vehicles over the next 10 years. About \$350m of that will buy about 8,000 natural gas vehicles.

Europe

Italy has the biggest NGV market in Europe, with more than 500,000 CNG vehicles, mainly private cars and vans, at the end of 2008 and 630 public refuelling stations. The market has been driven by strong government support, a very active retrofit industry and the commitment of Fiat to producing CNG versions of many models. There are also some 1,200 CNG trucks, mainly operating in refuse collection, and 2,300 urban buses.

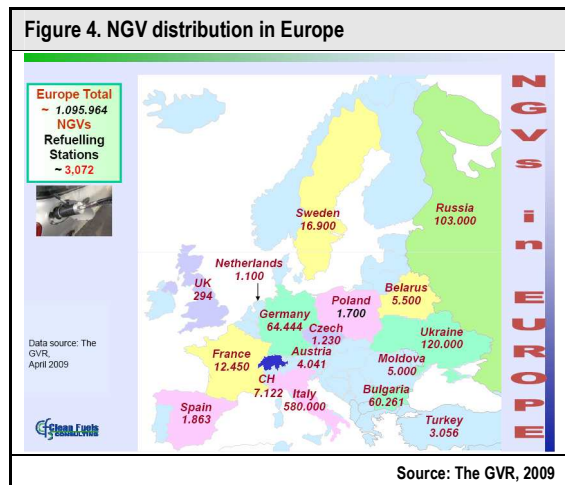
Germany is Europe's second-biggest market but lags far behind Italy with about 80,000 vehicles at the end of 2008. However, the market has grown quickly thanks to a rapid development of the public CNG refuelling network, which now numbers more than 800 filling stations; and a government commitment to maintain lower tax on natural gas as a fuel up to 2018. Several cities have local incentives for the purchase of NGVs, which have been heavily taken up by professional users such as taxi drivers and driving schools.

Germany's carmakers have also played their part, with Mercedes currently offering one CNG passenger car model, VW three models and Opel two models. Germany has some 450 heavy duty CNG trucks and 1,300 buses, all of them working in urban services. There are also a number of light duty CNG commercial vehicles from Opel, VW and MB.

Sweden lags yet further behind but is in third place with 16,900 units. Nonetheless, this is an impressive achievement given that the country lacks a widespread gas pipeline system. It has built up a strong refuelling network in the southern half of the country, and is now expanding into the north, partly through the use of local plants producing biomethane, which makes up more than half of the total gas used in Swedish NGVs. In more than a dozen cities, the bus fleets are completely fuelled with biomethane.

Sweden is promoting the production of biomethane from forestry waste on a large scale, and encouraging consumer take-up through a range of incentives including free parking for NGVs in many cities, tax breaks and priority lanes for CNG taxi cabs. Volvo Trucks offers natural gas buses and trucks, while Volvo Cars cancelled its three CNG models. However, several new models were due on forecourts in 2009.

France has more than 12,000 units and has seen a variety of government measures to encourage NGVs, including an agreement between the government and the car industry that by 2010, there should be 3,000 CNG urban buses, 1,200 CNG urban services trucks and 100,000 CNG cars and light duty vans. There will



also be 300 public filling stations, although currently there are only 125 CNG stations, the vast majority used for private fleets.

Asia

CNG is a major fuel source in India, Bangladesh and Pakistan. The latter's more than 2m NGVs comprise 29% of the total fleet, with cheaper fuel costs being the key driver for their use.

Singapore has a Green Vehicle Rebate for users of CNG technology that gives a 40% discount on the cost of newly-registered CNG vehicles. Introduced in 2001, the scheme will end at the end of 2012 as the government believes the 'critical mass' of CNG vehicles would then have been built up.

In Malaysia, CNG was originally confined mainly to taxicabs because of a lack of incentives and government subsidies on petrol and diesel. By the end of 2008, there were only about 200 CNG refuelling stations. However, the removal, from June 2008, of fuel subsidies led to a 41% price rise in petrol and diesel and a 500% increase in the number of new CNG tanks installed.

In China, companies such as Sino-Energy are active in expanding the footprint of CNG filling stations in medium-sized cities across the interior of the country, where at least two natural gas pipelines are operational. Companies such as Fortune Energy are providing natural gas for taxis and buses in a number of cities, sourced from coalbed methane as well as more conventional sources.

John Pexton, deputy CEO of Fortune Oil, says the Chinese government wants at least to double gas use from 3% of the energy market, to 6%. However, development is currently being held back by the lack of an extensive gas pipeline network.

Middle East

The Middle East could be a significant growth area for NGVs. Those countries without oil will benefit from the lower cost of fuel, while those with fossil fuel resources will have more oil available to sell if they use less of it domestically. NGVs will provide a market as oil producers increasingly capture gas that is currently flared. "Gas has previously just been an inconvenience," says Pexton. There is not enough from each individual well to justify a pipeline, but there is enough to justify a small LNG plant. However, with demand for electricity growing fast in the region, NGVs will face competition from power stations for gas.

Egypt, with 63,000 units and a network of 95 filling stations, is well placed to expand, while Iran, which has some of the world's largest gas reserves, has a programme to produce dual fuel vehicles and convert existing vehicles to CNG. It has some 1.3m CNG equipped vehicles on the road. A government mandate forces local car manufacturers to produce 60% of all their new vehicles as dual fuel vehicles.

Opportunities

The growth of the NGV market presents a range of opportunities, including for OEM natural-gas-only vehicle models, aftermarket conversions for cars, buses and trucks, home refuelling stations, cylinder makers and other parts.

Fiat is one of the biggest manufacturers of NGVs, given the strong Italian market. Its experience in the field leaves it well placed to benefit from the growth of the US market once its deal with Chrysler is completed. Its Brazilian subsidiary already produces the Fiat Siena Tetra fuel, a four-fuel car that can run on 100% ethanol, an ethanol/petrol blend E20, pure petrol and natural gas, and switches from the gasoline-ethanol blend to CNG automatically, depending on the power required by road conditions.

Citroen, Peugeot, Mercedes, VW and Opel also produce models, so the eventual buyer of GM's European arm will be poised for the expansion of the sector. If Magna's bid is finally accepted, its links with Russia's Gaz may provide the opportunity for the expansion of the Russian NGV market, given the country's large gas reserves.

Toyota, Subaru and Suzuki also have models, but Honda is the most involved Japanese manufacturer, and the only company producing a NGV in the US. Its commitment may be linked to its research into new infrastructure technologies for the hydrogen economy such as home

Table 1. Top 10 NGV markets			
Country	NGVs	Fuel Stations	CNG price as % of petrol
Pakistan	2,000,000	2,600	77.1%
Argentina	1,750,000	1,808	64%
Brazil	1,590,000	1,705	59%
Iran	1,210,000	764	81.3%
India	821,872	325	68.4%
Italy	580,000	700	54%
China	400,000	1,336	59%
Colombia	280,638	437	58%
Bangladesh	180,000	296	67.3%
Thailand	140,036	305	66%

Source: The GVR

Case Study 2. Landi Renzo
<p>Founded more than fifty years ago, the Landi Renzo group specialises in the design, production and retailing of automotive methane and LPG fuel systems. It is world leader in its segment with a market share of 23% and supplies over 50 car manufacturers. The company was founded to cater for the demand for fuel systems for methane engines, which in Italy spread during the Second world war in response to petrol shortages. The Group's operations include two product lines - LPG and CNG - while the company trades under two separate brands (Landi and Landi Renzo). It sells to vehicle manufacturers (OEM) and the aftermarket - retailers and independent importers. In 2008, the Landi Renzo Group achieved consolidated income of EUR 216.2m, an increase of 31.9% compared to 2007, with an Ebitda of EUR 46.8m, a 33.3% increase.</p>
Source: Landi Renzo & Italtrade

refuelling and power stations. This work includes home refuelling for CNG vehicles as well as gas co-generation units for energy savings in homes. The company has a joint venture with Plug Power that produces a gas-fuelled Home Energy Station that provides electricity, hot water, and hydrogen for a fuel-cell vehicle all from one unit.

AB Volvo, the truck maker, is among companies offering natural gas trucks, while Japan's Isuzu offers light trucks. Canada-based Westport Innovations has developed a proprietary technology called high pressure direct injection or HPDI, which involves the injection of both diesel and gas directly at high pressure into the combustion chamber. The system is reported to deliver performance equal to a diesel engine and has undergone extensive trials in a range of applications in North America. Clean Air Power also has a combustion technology that enables diesel trucks to use up to 80% methane and is working with Volvo, Daf and Mercedes Benz.

While refuelling infrastructure is lacking in many markets, this drawback is partially offset by the extensive natural gas infrastructure that exists – there are 1.8m miles of pipeline in the US and 1.8m km of pipeline in Europe. One of the great assets of NGVs is that they can be refuelled anywhere from existing natural gas lines, making home refuelling stations that tap into such lines possible. A company called Fuel Systems Solutions offers a system called Phill Home Refuelling Appliance, developed in partnership with Honda.

While it can take up to 16 hours to fill an almost empty tank, a NGV using a domestic supply is likely to be able to take on enough fuel for the daily commute. Refuelling at home is cheaper than using a filling station, with naturalgasvehicles.com suggesting it could cost as little as \$1.25 to \$1.50 per gallon.

Cylinder makers include companies such as Argentina's Inflex, UK-based Luxfer, Canada's Dynetek, and Landi Renzo, from Italy. Any existing petroleum-fuelled vehicle can be converted to bifuel CNG, creating a significant market for aftermarket conversions.

Landi Renzo exports conversion kits to markets including China and Brazil, while other producers include Tartarini Auto, Prins Autogassystemen, OML, BiGAs and AeB, which makes electronic parts that are used by most kit producers. Viridis is a Toronto-based provider of vehicle-fuel dispensing systems for CNG, as well as hydrogen, that sells its products around the world.

From the investor point of view, natural gas vehicles – like carbon capture and storage - is an area where many large corporations are involved, whether in vehicle manufacture or fuel infrastructure. Specialist companies such as Clean Air Power and Westport are quoted rather than VC-funded. In the future, business opportunities may come in linking the NGV framework to alternative sources of gas such as biogas, coal-bed methane and flare gas (although the latter two are utility-scale activities) and in linking it to developments in hydrogen.

Conversion costs

One converter in the US, Hendrix, says the cost of conversion is \$1,400, allowing customers to get their money back within six months based on last year's fuel price of \$4.10 a gallon, with LPG at \$2.45 a gallon. One of the key drags on the NGV market is that fuel prices have been so volatile that it is not always clear what the payback benefits are. Also, while gas is generally cheaper than oil, at higher oil prices its attractiveness compared to other options such as electric cars or hybrids is reduced.

Autoblog Green says that in Germany, LPG conversion costs from EUR 1,500 to EUR 2,500 whereas a CNG conversion can top up to EUR 4,500. In the UK, it costs around GBP 1,500-2,000 to convert a car or a light van to LPG, according to Greencarsite.

In Singapore, conversion of cars costs about \$2,500 (US dollars), while in Malaysia, the cost is \$1,000-\$1,400. In India, the process costs \$800-\$1,000 for cars and rickshaws.

Home refuelling stations may tap in to the growing support for decentralised energy and the advance of the hydrogen economy, but in the meantime, companies such as Clean Energy Fuels are rolling out fuelling facilities.

Selected Companies Mentioned in this Report

Company	Ownership	Relevant Sub-activities
Honda	Quoted	Vehicle making
Clean Energy Fuels	Quoted	LNG/CNG fuel stations
Fiat	Quoted	Vehicle making
Fortune Energy	Quoted	Oil and gas supply infrastructure
Fuel Systems Solutions	Quoted	Home refuelling equipment
Landi Renzo	Quoted	Gas cylinders
Luxfer	Quoted	Gas cylinders
Westport Innovations	Quoted	Fuel Systems
Clean Air Power	Quoted	Fuel Systems
OMVL	Quoted	Fuel Systems

Source: New Energy Finance

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