



WHITE PAPER

Sustainable transport with LNG trucks



Reducing CO₂ emissions is an important theme within the transport sector. Both service providers and shippers will often pull together in order to realise these reductions. Measures are focussed both on fuel savings as well as improving load factors and the development of multimodal solutions. Sustainable mobility is also very high on the list of Vos Logistics' priorities, in addition to these measures. We have been actively involved with the development and application of an alternative fuel for many years: LNG. We built our first LNG station and started driving LNG trucks back in 2010. We have further specialised in the use of LNG trucks for both national and international transport over the years. We would like to use this white paper to introduce you to the sustainable transport possibilities LNG can offer.



What is LNG?

The LNG abbreviation stands for Liquefied Natural Gas. Natural gas has been used as fuel in the transport sector for decades. Natural gas is the cleanest of all fossil fuels. LNG becomes a liquid when cooled to -162°C. LNG takes up 600 times less volume than its gaseous counterpart, making it easier to transport and store.

Why LNG?

LNG is currently the only sustainable fuel which presents a viable alternative to diesel for transport over longer distances. CNG (compressed natural gas) could also be used for less heavy vehicles over shorter distances. CNG is often used in fine distribution and public transport within cities. LNG's operating range is greater than that of CNG, as LNG in liquid form takes up approximately 3 to 4 times less volume. Other alternatives for short distances include electric (hybrid) and hydrogen-based vehicles. These last two alternatives are seeing rapid developments, but their availability is currently very limited for transport over longer distances.

What are the advantages of LNG?

✓ Cleaner

The regulations designed to reduce the pollution caused by fine particles and greenhouse gases are becoming more and more stringent. LNG engines produce significantly less sulphur dioxide (SO_x), nitrogen oxide (NO_x) and particulates than diesel engines, plus the carbon dioxide (CO₂) emissions are 15% lower too. LNG engines therefore amply comply with the emission requirements.

✓ Quieter

Environmental requirements apply to both air and noise pollution. LNG engines are 50% quieter than diesel engines, contributing to a greater quality of life. LNG trucks in the Netherlands can therefore also become Piek-certified. This increases the time windows during which the vehicles can load and unload in inner city areas.

✓ Safer

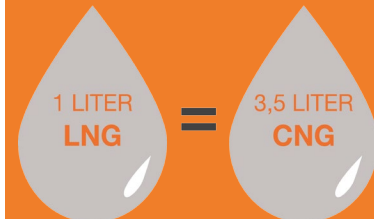
LNG is a safe fuel, as it's both non-toxic and non-corrosive. It has a high combustion temperature of 650°C, more than twice as high as that of diesel, which means it cannot spontaneously combust. LNG is also lighter than air, so even if it did escape it would immediately rise, leading it away from any possible ignition sources.

✓ Cheaper

LNG is on average between 10 and 25% cheaper than diesel, plus LNG trucks' average fuel consumption is also more favourable. LNG is measured in kilograms; as a kilogram of LNG has a higher energy density than a litre of diesel, a vehicle will be able to travel further on one kilogram of LNG than on one litre of diesel.

✓ Future-proof

LNG is a widely available fossil fuel, resulting in a stable supply. Liquefied Bio Gas (LBG), a renewable fuel, is currently going through some major developments to enable it to become mass-produced and introduced to the market. This gas can be extracted from waste materials, compost or plant matter and subsequently liquefied. The use of LBG will lead to a spectacular drop in CO₂ emissions: more than 80% lower compared to current diesel engines. No new investment in equipment would be required once LBG is introduced, as LNG engines and fuelling stations can process both LNG and LBG. It remains unclear when LBG will be available on a large scale at competitive pricing, although the expectation is that this could still be several years off. LBG will most likely be gradually introduced by blending it with the fossil fuel LNG, steadily increasing the proportion of LBG.



Particulate emissions **-95%**



Nitrogen emissions **-80%**



CO₂ emissions per km **-15%**

What are LNG trucks' characteristics?

Growing capacity

At present, there are two manufacturers offering monofuel LNG trucks on the European market: Scania and Iveco. They offer LNG trucks with a capacity of 330-340 bhp, which are suitable for most transports. Iveco has announced the introduction of an LNG truck with 400 bhp in the third quarter of 2016.

Driven kilometers and LNG price determines the total cost of ownership

An LNG truck is more expensive than a diesel truck. The average price difference between a mono-fuel LNG truck and a comparable diesel truck is currently €25,000-35,000. LNG trucks generally also have higher maintenance costs. The key to recovering these costs is to cover as many kilometers with LNG trucks as possible, considering every LNG kilometer travelled is cheaper than diesel due to the lower fuel price. LNG price developments, along with the number of kilometers covered with LNG trucks, will determine the time needed to recover the costs (i.e. the total cost of ownership).

Quick and easy refueling

Filling an LNG tank is as quick and easy as filling a diesel tank. The driver spends around 7 minutes at the station from entry to exit. The actual refueling takes around 4 minutes. Drivers must wear protective glasses and suitable gloves during refueling for their own safety.

Suited to both national and international transport

LNG engines are available in both dual-fuel and mono-fuel configurations, i.e. with or without a combination with diesel. Vos Logistics has opted for mono-fuel trucks, in order to make the most of LNG's cost and environmental benefits. A mono-fuel LNG truck has a range of approximately 650 kilometers, enough for most daily haulage work. Trucks can be fitted with dual tanks for international transport, increasing their range to more than 1,000 kilometers.



LNG station network

The number of LNG fuelling stations will partly determine the future growth of LNG trucks on the road. There are currently around 50 LNG fuelling stations in Europe, mainly in the Netherlands, Spain, the UK and Sweden – many more would be needed before they could be described as an international network. Measures taken at European level would have a positive effect on their further development; European Regulation 2014/94 requires all member states to have an LNG infrastructure alongside the European core road network by 2025. This network will be further reinforced by the simultaneous development of an LNG fuelling infrastructure along (inland) shipping routes.



Vos Logistics in LNG

Vos Logistics is ahead of the LNG game within Europe. North West Europe's first LNG station was built on Vos Logistics' premises in Oss in 2010. We have been deploying LNG trucks for our customers on a daily basis since that time, both nationally and internationally.

More and more shippers are now using us to transport their goods on LNG trucks, as this contributes to their own sustainability objectives. We are always happy to enter into new partnerships with customers and suppliers in order to expand our LNG activities; this perfectly fits in with our innovative and sustainable solutions strategy for transport and logistics.



“In 2008, we at Desso have initiated our Cradle to Cradle® strategy. We may be a manufacturer of broadloom and carpet tiles, our main goal though is to offer our customers a healthy and pleasant living environment. By 2020 we want all of our products and processes, including our transport, to contribute to a healthy and clean environment in a positive way.

In 2011 we have come into contact with Vos Logistics, who was back then pioneering with LNG trucks and construction of the first LNG station in the Netherlands. By choosing for LNG for our own internal transport, we wanted to contribute to and support the development of the LNG infrastructure. LNG trucks are less polluting and have a lower noise level, which is beneficial to the urban areas our vehicles are passing through.

The transition from conventional trucks to LNG trucks was a first step for us. We are looking forward to the moment that LBG will become available in abundance, since this fuel is 100% renewable. When it comes to sustainable development, Vos Logistics is a front-runner. Their BREEAM facilities are a prime example and show that sustainability has been fully integrated in their company strategy. Thanks to their commitment to sustainability, Vos Logistics is the perfect partner to expand the Cradle to Cradle principles® in our transport- and logistics activities.”



Willem Stas

Director Operations at Desso

A Tarkett Company



Vos Logistics has also looked into other new sustainable solutions, like truck platooning, in addition to the search for alternative fuels. This concept involves trucks driving short distances from each other in a 'train' like fashion (less than 1 second / 10 to 15 meters), based on automated driving technology. This way of driving could result in a 5 to 15% reduction in fuel consumption and CO₂ emissions. A great deal is already possible from a technical point of view, although not quite where the legal aspects are concerned. We are expecting truck platooning to be properly put into practice between 2020 and 2025.

Vos Logistics is a strong advocate of LNG transport, in collaboration with various parties. We are members of the National LNG Platform and NGVA (Natural Gas Vehicle Association) Europe. We also participate with Unilever's Connect2LNG project, which aims to stimulate the development of the LNG fuelling station network.

"With Connect2LNG, we're working with partners from across the value chain, including logistics companies, infrastructure companies and manufacturers. We're taking a step towards the overall reshaping the road freight industry in Europe, working towards a sustainable transportation future."



Mark Rickhoff

Logistics Transformation & Innovation Manager at Unilever

From: www.unilever.com

In addition, we are involved with a number of other consultative structures regarding LNG and we regularly consult government authorities, shippers, truck manufacturers and LNG suppliers. All this helps us to stay on top of further developments in the LNG infrastructure, LNG engines and the introduction of LBG.

**Interested in an opportunity
to make your transport more
sustainable?**

We are constantly looking for new opportunities to further expand the use of LNG transport.

**We will be happy to
advise you on sustainable
transport using LNG trucks**



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