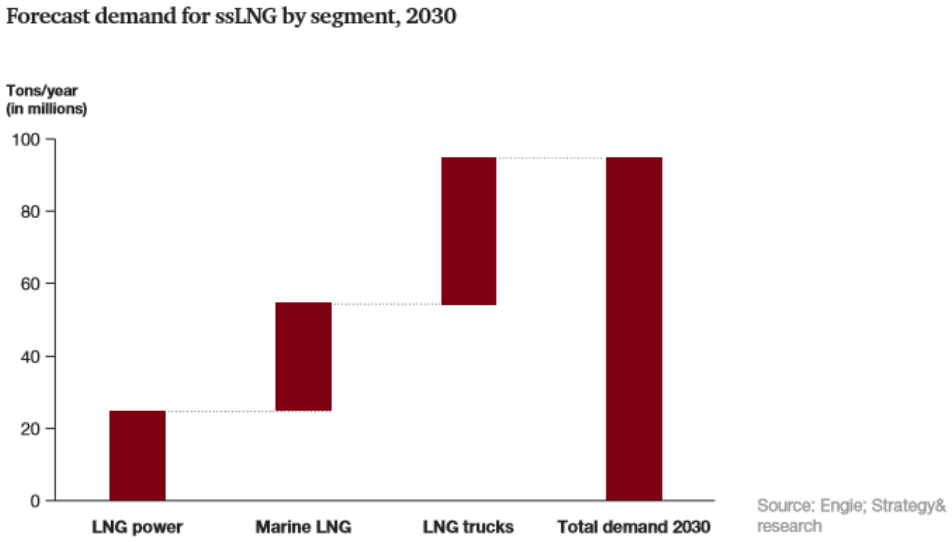
Small scale LNG: The role of Liquefied Natural Gas (LNG) in the wider energy mix for industrial businesses off the mains gas grid.

Could LNG be the right off-grid fuel solution for your industrial heat and process applications?

We asked AvantiGas Engineering Manager Stephen Hallett to assess the potential of LNG – Liquefied Natural Gas – for UK industry. Stephen focuses on the role of LNG in the wider energy mix for industrial businesses which are off the mains gas grid and he explains how LNG can help both industry and government to improve competitiveness and meet environmental decarbonisation targets. Finally, Stephen considers the technical characteristics of LNG and the installation concerns a business may have when considering an LNG solution.

As a major worldwide energy solution, natural gas is the cleanest-burning hydrocarbon and is among the most economical. But as AvantiGas Engineering Manager Stephen Hallett says: "Countries such as the UK rely on imports to meet demand. Major producers such as the US, Australia and the Middle East export natural gas in liquefied form to shrink its volume, for safe, easy and economical storage and shipment."

A report by PricewaterhouseCoopers titled *"Small going big: Why small-scale LNG may be the next big wave"* highlights the potential for small scale LNG in industry and that it is already profitable and scalable.



The market is expected to grow to approximately 100m tons per annum by 2030 with the International Gas Union forecasting a rise in annual global demand to 30m tons in 2020.

Engie projects that the bulk of the demand will be from heavy goods vehicles (42%) and marine (32%) with the industrial power sector (26%) being highly correlated with the economics of alternative fuels.

So, what is Liquefied Natural Gas (or LNG)? "LNG is a clear, colourless, non-toxic liquid formed when ambient pressure natural gas is cooled to -162°C or -260°F, shrinking the volume of gas by around 600 times. In liquid form, natural gas is not flammable, but the vapour that is released burns just like the natural gas you use on a hob or in a boiler at home. With LNG, the product is turned to vapour en-masse at re-gasification plants, so it can then be piped to domestic, commercial and industrial properties via the national grid."

But what are the options for businesses not connected to the mains grid? This is where AvantiGas comes in to play as one of the UK's major off-grid energy suppliers, serving domestic, commercial and industrial customers via a network of distribution centres. Products include Liquefied Petroleum Gas (LPG) in both bottled and bulk form as well as aerosol propellant, biomass, natural gas and of course Liquefied Natural Gas or LNG. Steve again:

"As Engineering Manager leading the Projects team at AvantiGas, I'm responsible for large industrial installations and the application of LNG where it proves viable. I've worked on hydrogen applications in both academia and industry and, as a senior LNG development engineer, I've managed projects varying from small, two-tonne installations all the way up to multiple vessel (nearly 50-tonne) installations serving industrial supply schemes and heavy goods vehicle refuelling stations.

"A current oversupply of LNG worldwide has seen the product price fall, fuelling demand for it as an alternative energy source. LNG supply globally is changing and it's a complex topic, because of fracking in the US and LNG assets coming on line in Australia, Algeria and across the Middle East. The US has flipped from being a net importer of LNG to a net exporter. If you imagine how much liquefied natural gas the USA uses, you'll see this has a massive effect on the world market."

Steve points out that the UK has always been a spot market, which puts us in a strong negotiating position to get the best possible price when buying, allowing AvantiGas to pass on the benefit to our customers in a number of applications:

"LNG can also be used as a fuel for transport – both road (especially HGVs) and marine, but developing this application is likely to take a back seat while oil prices remain depressed. That position could change rapidly if oil prices start to move upwards, giving LNG (which incidentally is currently exempt from duties imposed on other road fuels) a boost in the process.

"Marine bunkering is increasing in popularity as vessel owners are facing pressures to cut operational costs in the light of weak freight rates and stricter environmental emission legislation. The biggest barrier in both sectors (particularly marine) is the development cost (of the engines and supporting technologies) and CAPEX of infrastructure.

Due to strict sulphur and emissions regulations coming into force by the International Maritime Organisation (IMO), shipping companies are having to look to new technologies and/or fuels to meet the stringent requirements. One of the most feasible, affordable and "readily" available solutions is LNG and the necessary port and bunkering infrastructure is growing worldwide to support an increasing LNG fuelled fleet size.

"With the increase in exploitable LNG-producing assets, global supply will be more stable and secure, which will ensure that supply can continually meet demand. With many analysts and producers predicting significant growth in the LNG market in the coming decades, as the world fights climate change and as individual countries set and strive to meet their own environmental and carbon targets, the role of LNG in the energy mix is going to be increasingly important and competitive."

LNG is best-suited to consistent demand throughout the year, so businesses which use it for process work all-year-round are particularly suitable. Typical industrial processes may involve generating steam or heat for specific applications, or for tasks such as cleaning, sterilising and cooking as well as for traditional space or water heating requirements.

Says Steve: "The key is finding the right application. If you're asking me 'Would LNG work in a domestic property?' the answer is typically no. In a high-use commercial property or industrial setting, it could be the preferred solution.

"Heavy industrial energy users have powerful incentives to look closely at LNG, not only because of energy cost pressures, but due to environmental pressures too. Business and industry account for around 25 per cent of the UK's total emissions, and around two-thirds of industrial emissions come from a small number of energy-intensive industries such as chemicals and steel, according to the Government's recently-published Clean Growth Strategy."

The strategy, announced by the Minister of State for Climate Change and Industry, Claire Perry MP, aims to limit the UK's annual emissions to 57% below 1990 levels by the year 2032. With LNG, there's an actual carbon reduction as methane (or CH4) has less carbon per hydrogen molecule than propane, butane, gasoline products or diesel.

The strategy launch is in line with decarbonisation roadmaps up to 2050 for several specific carbon-intensive industries including iron and steel, oil refining, cement, glass, ceramics, food and drink, chemicals, and paper and pulp. Each plan within the strategy contains voluntary commitments to reduce emissions while "maintaining international competitiveness." Coupled with the Government's Industrial Strategy to help businesses improve their productivity and competitiveness, this initiative aims to not only deliver carbon savings and make the UK more energy-efficient, but also to stimulate economic growth. Steve comments:

"With the current oversupply and consequently depressed price of LNG, the installation of an LNG solution to take advantage of both carbon benefits and cost reductions could be an enticing option for many UK industrial businesses. The commodity price tends to be cheaper, so although the infrastructure cost may be higher, it's the low commodity price that makes it really attractive."

But what does a business need to think about when looking into an LNG installation as a possible fuel solution? Steve says: "Factors to consider include storage area, site layout, access for fuel deliveries, volume of gas required and frequency of use, as well as the specific application that the gas will be used for. Every business is unique and often an energy solution will be a bespoke installation.

"From a technical perspective, the key engineering challenge is that LNG is a cryogen (cryogenic liquids are typically liquefied gases at -150 °C or lower) and this presents storage challenges. In industrial applications

(where specified gas conditions are not critical to operation) you've got to keep the product as cold as you can for as long as you can. You need to use special materials – carbon steel becomes brittle when very cold, so you have to use stainless steel pipework and fittings, which is more expensive.

"LNG vessel orientation may be different to LPG (Liquid Petroleum Gas) as both horizontal and vertical LNG vessels are available. There's little difference as both are certified and safe to use, but vertical tanks take up less space. Spherical vessels may also be used for very large air separation cryogenic units."

Vessels used for LNG storage are much like a typical 'Thermos-style' flask. They consist of an internal vessel storing the product, which is surrounded by insulation under vacuum, with an external shell to hold it all together. They range from around 1,000 litres to up to 100,000 litres in volume.

Steve again: "For industrial supply schemes, the inner vessel will typically be stainless steel, and the outer may be stainless or carbon steel. The design of these vessels should minimise the amount of thermal transfer between inner vessel and outer vessel/shell. An insulation material called perlite is often used along with a vacuum to prevent heat transfer – the vacuum improves the efficiency of the perlite as an insulator."

If you're using LNG as a gas rather than as a liquid, and if you're putting it into either a commercial or domestic property, the Gas Act says it must be odorised to make leaks more easily detectable. But AvantiGas doesn't like to leave anything to chance. Says Steve: "All our LNG installations will have active gas detection – it's more reliable than people. The odorant typically used to give the gas a smell becomes solid at cryogenic temperatures, so it must be added on site, at the point of use."

"The vast majority of LNG installations will require hazardous consent in some form unless they're quite small operations. In terms of planning for LNG, hazardous consent is required when storing 15 tonnes or more, compared with LPG at 25 tonnes. If you exceed 50 tonnes of storage on site, lower tier COMAH (Control of Major Accident Hazards) consent is required and the associated Major Accident Prevention Plan (MAPP) must be submitted and reviewed with the Health and Safety Executive (HSE). Upper tier COMAH consent is required if exceeding 200 tonnes." Any LNG installation provided by AvantiGas will come with an operator's manual and training on how to use it.

On capital expenditure, the important thing to remember is the long-term return on investment. Steve again: "The CAPEX cost of an LNG installation is currently higher than other options, but the savings from the commodity price of the gas can outweigh the initial investment cost over time. Coupled with the carbon benefits, LNG is increasingly seen as a cost-effective solution by businesses which are off the mains gas grid. For these businesses, choosing an efficient yet reliable energy source is critical. As one of the UK's major off-grid energy suppliers, AvantiGas will find the right energy solution for your business, whether that be LNG, LPG or renewables."

If you're looking to de-carbonise your plant, upgrade an old, inefficient boiler or take advantage of potential cost reductions, AvantiGas technical sales manager Chui Green will provide a free site survey and evaluation, taking into account your current usage and demand as well as your projected future requirements. We offer comprehensive technical support for all our installations and will assist customers through all stages of the design, installation and operation of their LNG facility. AvantiGas can even offer project funding, with no upfront fees and quick payback times on investment.

Find out whether LNG is the right solution for you. For a free site survey, contact Chui Green on 0808 208 0000 or email applications@avantigas.com.

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