Gas LNG Europe

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GLE Position paper: GLE's views on Small Scale LNG

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Who is GLE?

Gas LNG Europe (GLE) is one of the three columns of GIE, the European association of natural gas infrastructure operators. GLE represents the sole interests of LNG Terminals Operators in Europe. Since being established GLE has been a very active association gaining an excellent reputation as an expert voice to be listened to in relation to LNG topics at a European Union level.

GLE is in permanent contact with the European Commission, CEER, EFET, Eurogas and other market stakeholders, and over the last years GLE has published a significant number of position papers and studies that were highly appreciated by European and National institutions as well as the whole gas business.

GLE is continuing efforts to promote recognition for LNG infrastructure activities at European level as well as the proper legislative and regulatory framework for the LNG industry in Europe. While doing so GLE seeks to ensure that LNG business specifics are taken into account in any future European Union regulatory developments.

GLE currently represents **13 LNG Terminal Operators from 9 countries**.

Executive Summary

1. The use of LNG as a fuel for heavy trucks, rail and shipping offers an excellent opportunity for improving the environmental footprint and will be key in meeting the increasingly strict environmental requirements for the transport sector: trucking, rail and shipping.

2. Distribution of LNG from main EU import terminals to smaller regional and local terminals will improve security of supply and market functioning in the EU, as well as enable a cost-effective way of supplying natural gas where adequate network connections are not available.

3. Securing these opportunities will require a regulatory and fiscal framework that recognizes these benefits.

4. GLE is excited about the opportunities offered by Small Scale LNG and will play its part in promoting its further development.

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Introduction

In recent years, the number of LNG regasification terminals in the EU has rapidly increased. At present there are more than 20 LNG import terminals connecting the EU with the world gas market. A further 32 are under construction or being planned. In such terminals, gas is typically regasified near the end-user market and delivered to customers through the gas networks. These terminals have very substantial benefits for security of supply and market functioning of the EU internal market for gas.

The emergence of more and more of these terminals is now giving rise to an exciting new opportunity: *Small Scale LNG*. In fact, Small Scale LNG actually refers to *two* opportunities:

1. **LNG as a fuel for heavy transport**
   The first opportunity involves the application of small scale LNG as a fuel in the heavy transport sector (trucking, rail, shipping, buses). This is rapidly rising on the agenda of policy makers and business (e.g., transporters, oil and gas suppliers, infrastructure operators, ship owners and ship engine makers). A key driver is the increasingly strict regulation concerning emissions (SOx, NOx, CO_2), especially for shipping. In the coming years interest will likely increase even further due to changing energy policies aimed at reducing carbon footprint, and oil price development.

   GLE underlines the use of small scale LNG as a key solution to a cleaner transport sector, taking into account potential environmental and other benefits, safety, and the EU targets for the reduction of emissions. This is particularly important as traditional, oil derived transport fuels have been notoriously difficult to replace by cleaner fuels, especially in the heavy transport sector.

2. **Breaking bulk**
   The second opportunity involves the distribution of LNG from the EU main import terminals to smaller regional and local regasification terminals throughout the EU: breaking up bulk cargoes and delivering to smaller markets. This is the process of loading LNG from a large LNG terminal into smaller vessels carrying around 5.000 to 30.000 m^3, trucks carrying some 50 m^3 and rail 500-1.500 m^3.

   GLE notes that the redistribution of LNG to smaller terminals has great potential to improve security of supply and market functioning in the EU and will allow areas that are not easily connected to the main pipelines systems to benefit from the availability of natural gas.

Proven and safe technology

Experience over more than 40 years shows an excellent safety record for LNG operations. LNG can be safely produced, transported and landed near the relevant markets. A number of countries have already gained considerable experience in using LNG as a transport fuel for

heavy trucking and shipping. The technology is proven and the LNG distribution network continues to expand.

There are plenty of examples around the world where small scale LNG is already applied successfully. For example in Norway, where the government is strongly promoting LNG as a ship fuel. Due to tendering conditions on emission reduction by Norwegian government, ferry services are operating on LNG. Already, some twenty ships fuelled by LNG are sailing in Norwegian waters.

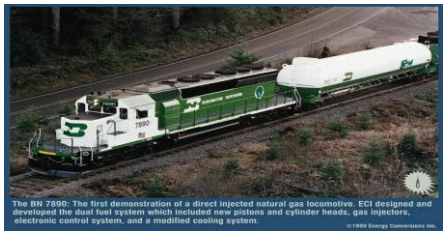
Globally, an increasing number of road trucks are using LNG as a fuel. For example in the United States, Australia, and in some countries in Europe. And not just for long-haul road transport - in some cities LNG is also used as fuel for public buses or garbage trucks. Due to its nature, LNG is ideal for powering road commercial fleets or trains and ships.

Many countries with low pipeline network density use local distribution of LNG to efficiently supply their industries or local networks. A significant example is Spain, where LNG is being used also to supply some small and medium cities, not yet connected to the grid. The Spanish experience of transporting LNG tanks by truck is probably one of the biggest in the world, with more than 40.000 loads transported each year. In Japan remote areas are mostly supplied with LNG using railroad transport.

Some examples of proven LNG applications

LNG powered offshore supply vessel, Norway

LNG powered vessel design (Source: DNV)



Locomotive converted to LNG, US

LNG trailer 50 m^3, China

LNG bus, Poland

LNG truck, Netherlands

NG and LCNG station, US

Source: IGU/NGVA Europe/DNV

Recently, in Europe the first export operation of reloading LNG into a small LNG carrier has taken place at the Zeebrugge terminal in Belgium. With this first loading, the concept to load at large terminals has been proven in Europe and gas shipping specialists are convinced that the demand for small scale LNG will continue to increase as an environmentally superior alternative to conventional marine fuels.

Reloading of LNG into a small LNG carrier at LNG terminal Zeebrugge, Belgium May 2010

Source: Fluxys

Rapid development

At the moment, small scale LNG fleets varying from vessels between 5.000 m^3 and 35.000 m^3 are being developed. These can be used for local distribution of the LNG from the main import terminals to smaller receiving terminals in countries with a relatively low density of gas networks or countries that want to diversify their supplies of natural gas.

The potential for LNG as a shipping fuel is huge due to its superior environmental performance compared to other bunker fuels, especially regarding NOx and particle matter (PM). In particular, there is great potential for LNG used as a fuel for shipping (ferries, tankers, container feeders) in the Baltic Sea (as an environmentally sensitive area) and North Sea (with the huge population density in the surrounding countries).

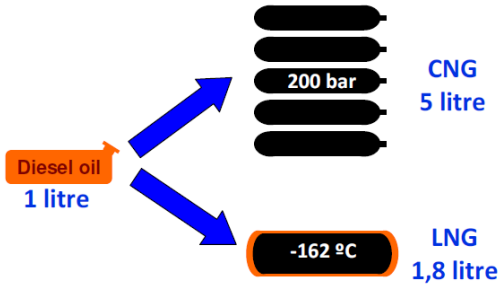
Due to the introduction of more stringent regulation SECAS zones (Sulphur Emission Controlled Areas for Ships), after 2015 ferries in the North Sea and Baltic Sea will not be able to run on heavy fuel oil. LNG seems to be the preferred replacement. In this case, the need of additional infrastructure is low because of the fixed routes. Although the technology is available, currently most LNG import terminals are not yet equipped to facilitate bunker fuel retail. Additional investment in secondary distribution and storages will be required.

Similarly, the environmental benefits of LNG as a fuel also apply to heavy road transport, where the vehicle and refuelling technology is already available and would only need the necessary political push. An additional benefit could be that engines using LNG as a fuel are more quiet than diesel engines, which may allow trucks access to city centres during night time for supply of warehouses and supermarkets etc. The average noise emission of a heavy duty spark ignited gas engine compared to a heavy duty compressed ignition diesel engine could be 4-5 dB lower, which means that the perceived noise is halved.

Commercially viable

The high density of LNG is a big advantage of this fuel compared to compressed natural gas (CNG). This increases the driving range significantly: with one tank of fuel a road truck ran drive for around 800-1.200 km. This makes LNG an excellent option for the heavy transport and shipping sector.

Energy equivalence: Diesel / CNG / LNG



Source: NGVA Europe

Many other factors also need to be taken into account: fuel prices, bunker consumption, investment costs and payback period, the age distribution of ships and the number of ships and trucks, current and future regulations and so on. Close examination of these aspects indicates that small scale LNG is commercially viable:

- The potential demand is substantial. Many companies identify international shipping as a growth market for gas, through using LNG as a bunker fuel for ferries, cargo ships and tankers. At the moment some 90.000 vessels are used in the world fleet, they use around 280 MT/a of petroleum fuels which represent a potential market for LNG as a shipping fuel of up to 315 million tonnes. This is 1.25 times the amount of the LNG production capacity today.

- LNG prices are becoming attractive compared to other bunker fuels. Over the past 20 years price differentials between fuel oil, gasoil/diesel and LNG have changed significantly. In 1997 oil prices hovered around $20 per barrel (West Taxes Intermediate) and around $2.50 per MMBtu for Henry Hub natural gas in the US. Today, these are around $100 per barrel for oil and $5 per MMBtu for natural gas. These continuing widening differentials strongly indicate that switching fuels to LNG for ship owners may make economic sense.

- According to a recent study, the age of ships operating in the Baltic Sea is fairly evenly distributed from new to about 40 years old, meaning there is a continuous replacement of old vessels and that it will take about ten years to replace a quarter of the fleet.

- It is expected that total bunker demand for all fuels will grow by 20% to 2020 and 50% to 2030. Whereas the shipping industry will not be able to immediately convert all ships to run on LNG, new ships, publicly or privately owned, could be built to be able to run on LNG.

The different options for ship owners to adapt their fleet to the International Maritime Organisation (IMO) regulation in 2015 in the Emissions Control Areas and in 2020 or 2025 in the world are installation of scrubbers, running on Diesel, running on LNG or run on other fuels (e.g. DME). The market might choose various solutions, however due to stricter regulations it is expected that LNG will get a substantial share. IHS CERA estimates the size of the market for LNG as fuel for ships in 2030 as 65 MTpa.

Of course there are also challenges to overcome: extra investments for ship-owners (engine, tanks, pipes, safety measures), impact on operational costs, potential loss of commercial space leading to lower cargo capacity, etc. Short Sea Ships (an alternative to road haulage and a way to transport goods efficiently between ports within a region) and ships with fixed routes (e.g. ferries) seem at present the best candidates to be fuelled by LNG because the bunkering locations needed are fewer and they can be gathered to big ports.

For heavy trucks, competitiveness of LNG depends strongly on the fiscal regime. Historical and current prices of diesel and LNG show that with a minimum critical size, LNG is competitive compared to diesel (including extra cost required to adapt the truck). A logical and economically viable path to develop this business could be to focus first on local fleets and subsequently on truck corridors across Europe.

The development of small scale business for local regasification could be especially interesting in remote areas with insufficient network coverage, with low supply diversity, or with very low industrial density.

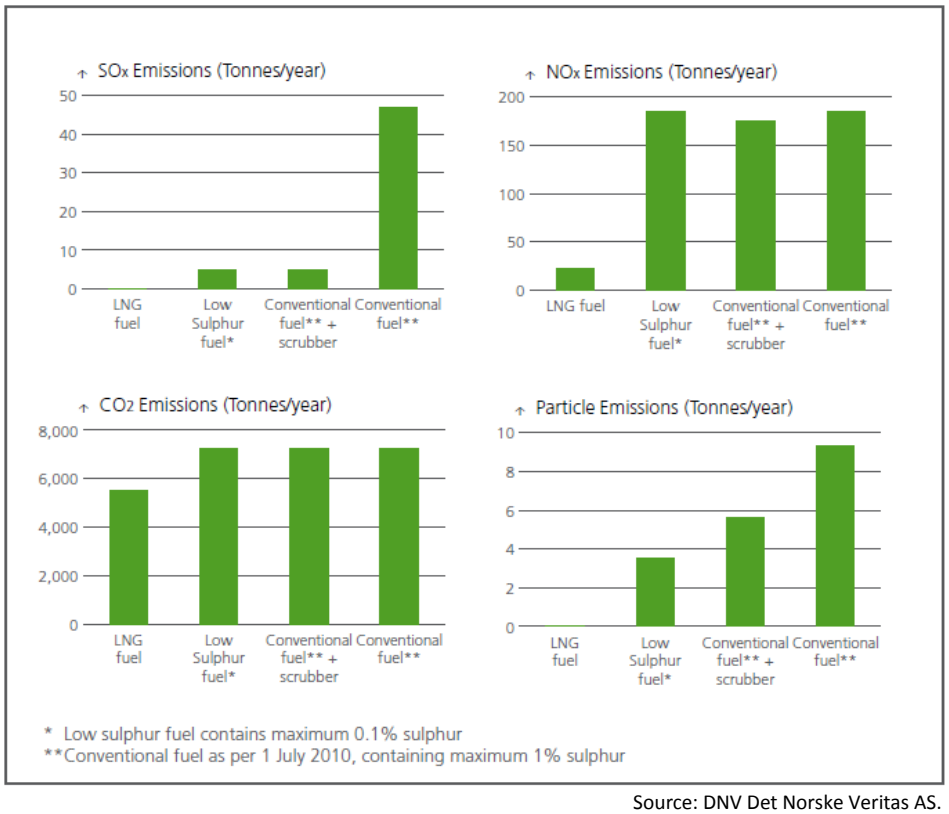
Environmental benefits

The shipping industry carries more than 70% of global freight and more and more goods are transported between and around highly populated areas. In terms of fuel efficiency of moving freight, shipping is most efficient. However, shipping is also one of the most significant contributors to local pollution due to the main fuel used today. Heavy Fuel Oil (HFO) is a residual oil product and contains high amounts of sulphur oxides (SOx), nitrogen oxides (NOx) and particulate matter (PM). Around 70% of these ship emissions occur within 400 km of land and directly affect air quality and global emissions. The European industry has

already developed a proven know-how in "green" shipping technologies, which could assist the shipping sector to improve its environmental performance.

In response to environmental concerns the IMO enacted a revised Convention in 2008 for control of exhaust emissions from ships. The Convention places a global cap on SOx and NOx emissions from ship traffic between 2012 and 2025 at the latest. For example, the global limit on SOx in marine fuels is 4.5%. Under the revised Convention, the global fuel sulphur content must be 3.5% by 2012 and 0.5% in 2020 (evaluation of this date in 2018: could be postponed to 2025 if there are not enough capacities to replace existing consumption). In certain areas where shipping trade volumes are high, even stricter SOx emissions apply; these are the so-called Sulphur Emission Controlled Areas (SECAs). The Baltic Sea and North Sea are included as designated SECAs. Starting from 1 July 2010 the fuel sulphur content for these areas must be below 1% and must be further reduced below 0.1% by 1 January 2015. For news builds, after 2016 in the ECA zones, NOx emissions will have to be reduced by almost 80% to meet the emissions constraints (Tier III).

Environmental emissions for alternative concepts for a typical Baltic Sea cargo ship



Source: DNV Det Norske Veritas AS.

Next to IMO, the European Commission is also putting stricter standards in place. For example, EU Directive 2005/33/EC is relevant to ships operating in Member States' territorial waters and provides for, e.g.:

- Limiting to 1.5% the sulphur content of marine fuels used by passenger vessels on regular services to or from any port in the Union.

- Limiting to 0.1% the sulphur content of marine fuels used by ships on inland waterways and at berth.

Present and and under study ECA zones

Source: IMO/DNV

At the moment the Commission is considering submitting a proposal to align the EU Directives with the IMO Convention. The proposal particularly focuses on a second stage of sulphur limit values, designation of additional SECAs, the possible use of economic instruments and alternative measures. An even wider revision is foreseen in 2013, when the European Commission will carry out a comprehensive review of the EU's air quality strategy as part of the Roadmap 2050. Upcoming revisions in the framework of the CAFE program (Clean Air for Europe) will also include new fuels and new zones.

The Commission also considers supporting the deployment of shore-based infrastructure for alternative fuels and bunker delivery logistics in the European Union. An exemption from the electricity tax as recently proposed by the Commission in its proposal for a revision of the Energy Taxation Directive 2003/96/EC11 can be a first incentive to this end.

Further work required on the legislative framework

The existing legislative framework does not yet take into account the benefits of Small Scale LNG. In particular, the current fiscal treatment of LNG does not take knowledge of the superior environmental benefits of this fuel.

Also there is an important need of safety regulation, codes and standards for the development of this market. Safety standards are paramount and LNG operators must ensure that the current safety standards must be applied to the new market of Small Scale LNG. The regulatory framework for the development of a supply chain on Small Scale LNG is not yet fully defined. There is a wide divergence of laws and texts that could apply to a Small Scale Supply Chain development. More consistency and harmonization will make it easier for projects to come off the ground.

GLE is committed to contribute to help further develop the necessary conditions to enable investments in small scale LNG, in particular from the perspective of the LNG terminal operators.

Conclusions

With rising fuel costs, in particular for oil derivatives, and today's global interest in emission reduction, LNG is a promising alternative fuel for the shipping sector. Ship operators in particular face economic pressure from fuel costs combined with impending regulations aimed at reducing exhaust gas emissions. For them, LNG could be an outstanding practical and beneficial solution.

LNG as a fuel also has significant promise for heavy duty road transport and rail. Environmental and economic benefits and quiet operation are the incentives that will gain more and more prominence in the years to come.

The development of this market needs significant investments on infrastructure and on converting the trucks or vessels. Players will be understandably reluctant to take risks to invest too much before a certain critical mass is reached and before the legislative and fiscal framework is becoming clearer. GLE is ready to help contribute from its perspective to the establishment of a legislative framework that is conducive to making the required investments.

The use of LNG as a fuel for heavy trucks, rail and shipping offers an excellent opportunity for improving the environmental footprint and will be key in meeting the increasingly strict environmental requirements for the heavy transport sector.

Considerations regarding diversity of supply and market development will drive the development of local distribution of LNG to market areas that are not well connected to the main European grid. The distribution of LNG from main EU import terminals to smaller regional and local terminals will improve security of supply and market functioning in the EU.

Small-scale LNG has a sound business rationale. Importantly, capturing the opportunities related to small scale LNG will have significant benefits in various areas that are high on the European agenda for environment and energy policy. Securing these opportunities will require a regulatory and fiscal framework that recognizes these benefits.

GLE is excited about the opportunities offered by Small Scale LNG and will play its part in promoting its further development in a safe way.