*Jana Lippelt**

Liquid Gas on the Rise

According to BP, natural gas is currently the fastest growing fuel. Particularly liquid natural gas (LNG) has developed into a significant factor on the global energy market and will continue to grow in the future. Due to environmental policy decisions, flexible transport options and promising developments in the transport sector, global demand has increased by 6.6 percent annually since 2000 and is currently growing seven times faster than natural gas (see BP 2017).

LNG is natural gas which is cooled down to approximately – 162°C and passes into the liquid aggregate state. As a result, its expansion is only six hundredths of the gaseous state (see Linde Group 2016). The advantage is that LNG can be stored and transported in large quantities, which is done with special tank vessels and storage in special containers. LNG is therefore particularly suitable for long transport distances, while in the case of shorter routes, mostly compressed natural gas (CNG) is used. The long distance transport is mainly carried out by LNG tankers, of which more than 400 are currently in use worldwide (see International Gas Union 2016). At the port of arrival, the liquefied gas is then returned in the gaseous state in regasification plants and fed back into pipelines or transported by truck.

Natural gas generally accounts for 25 percent of global energy demand, while LNG accounts for 10 percent of the energy demand. This share has hardly changed since 2010 (see International Gas Union 2016). LNG is traditionally used in power generation and in industry to generate refrigeration for process flows as well as shore power supply in ports. It is especially important in those countries where there is no pipeline network, such as Japan, South Korea or Taiwan (see International Gas Union 2016).

For some years, LNG has been increasingly used as a marine fuel for inland sea shipping and is increasingly replacing heavy fuel oil and ship diesel. One of the reasons for this is the introduction of emission control areas in different maritime regions of Europe and North America under the MARPOL agreement, which imposes stricter limits on the emission of airborne pollutants (see LNG for Shipping 2015). In addition, savings in fuel costs and the accessibility of new sales markets play a role. Liquid gas has the advantage that nitrogen and sulfur dioxide emissions can be reduced by up to 100 percent compared to diesel engines. Also CO_2 emissions can be reduced by 20 percent. Furthermore, the noise pollution is reduced by half compared to diesel-powered ships (see World Ports Climate Initiative 2016). Up to now, however, only around 90 ships with pure LNG drive have been operating worldwide. This is partly due to the still inadequate LNG infrastructure in many ports. By 2020, however, it is expected that between 400 and 600 LNG vessels will be put into service (see LNG World Shipping 2016). LNG is also used in road traffic, especially in buses and urban vehicles as well as heavy vehicles in the mining industry. Increasingly, however, trucks are being equipped with LNG drives. In the future, there will be a substantial potential for growth worldwide in this sector (see Börsenzeitung 2016).

* ifo Institute.

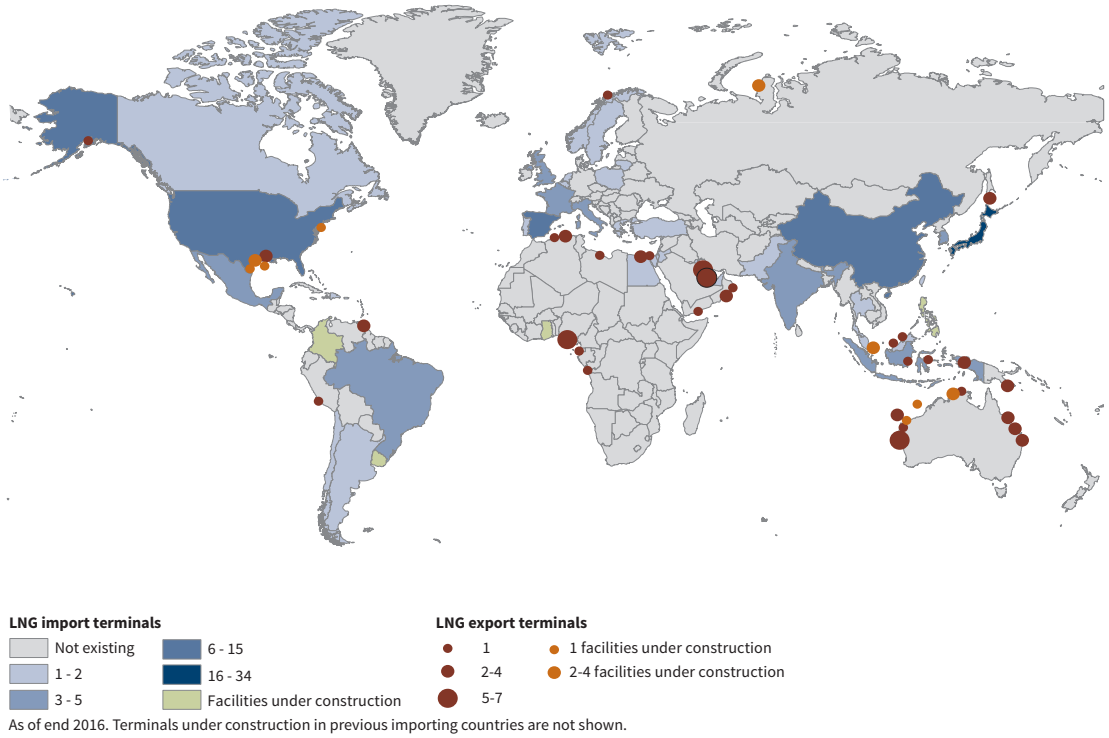
INFRASTRUCTURE

The global infrastructure in LNG is currently distributed among some 46 countries and is being steadily expanded. In 33 countries, there are more than 120 import terminals where LNG is fed into the regional pipeline network or otherwise transported (see Figure 1). In addition, there are almost 20 countries that liquefy natural gas and export it. This is particularly evident in Australia and the United States, which already have a large number of plants or are expanding them further. However, LNG is also exported in large amounts from the Middle East, Southeast Asia and Africa.

The world´s highest density of terminals for the import of LNG is currently in Japan with 34 plants. The reason is that Japan, besides South Korea and Taiwan, has no pipeline network through which natural gas can be transported (see International Gas Union 2016). In China, 12 plants are currently in operation and 10 more are being planned or under construction. In 2015 the import terminals worldwide reached a regasification capacity of 757 MT, which is mainly due to new plants in Egypt, Jordan and Pakistan, but also Japan. In addition to the import and export infrastructure, the global LNG fleet is also being expanded. For example, 39 new LNG-powered ships where launched in 2016 (see Gas Strategies 2016).

Europe currently has only one liquefaction plant – in Norway (Hammerfest). In countries such as Spain, France and Britain, there are a number of import terminals that will continue to grow in the future (see International Gas Union 2016). At the beginning of 2016, the first terminal was put in operation, while in Germany there is still no such facility and the planning is still uncertain. The expansion of the LNG infrastructure is being pursued in Europe, among other things, by the EU Directive on the expansion of the infrastructure for alternative fuels (2014/94), adopted in 2014. They are intended to substantially reduce the dependence on oil as well as environmental pollution caused by traffic (see Europäische Union 2014). In addition, it envisages the expansion of loading points for LNG and electric

Figure 1
Global LNG Infrastructure



As of end 2016. Terminals under construction in previous importing countries are not shown.

Source: Gas Infrastructure Europe (2016); International Gas Union (2015); Federal Energy Regulatory Commission (2017); APPEA (2016). © ifo Institute

vehicles. By the end of 2025, a large number of LNG petrol stations in the seaports are to be established in the EU and by 2030 in inland ports. Terminal stations are understood to be terminals, tanks, mobile containers and bunkers (see Europäische Union 2014). Ships should be able to travel in the entire TEN-V core network.[1] Against this backdrop, in November 2016, the National Strategic Framework for Infrastructure for Alternative Fuels was adopted in Germany (see Bundesministerium für Verkehr und digitale Infrastruktur 2016). In addition to shipping, the construction of this filling station infrastructure also includes heavy road transport and is intended to complement the already existing petrol station network for autogas (LPG) in the EU. A special project within the framework of the EU Directive is the LNG Blue Corridors Project (2013), in which LNG is to be used as an alternative fuel for road transport on medium and long distant routes (see European Commission 2016).

WORLDWIDE DEVELOPMENT

The global trade with LNG reached a volume of 245 MT in 2015 and thus 4.5 MT more than 2014. The largest buyers, Japan, South Korea and China, came from Asia. However, sales here were lower than in the previous year. One reason for this is the fact that nuclear power plants have been back on line in Japan since 2013. In addition, Japan has increasingly focused on improving energy efficiency and expanding renewable energies (especially photovoltaics), which has led to lower demand for LNG (see International Gas Union 2016). The same is true for South Korea: here, since 2015, it has been increasingly invested in coal power, but also additional nuclear power plants. In contrast to falling demand in Japan and South Korea, sales in LNG were shifted to new customers such as Egypt, Pakistan, Jordan and Poland (see EIA 2016). In China and India, too, sales are expected to remain high. In North America, the import of LNG declined due to an increasing domestic production of shale gas in recent years, which meant that Canada and Mexico, supplied by the North American pipeline network, also required less liquid gas (see International Gas Union 2016).

Among the 19 global exporting countries for LNG, the Middle East is the strongest, with Qatar in 2015 providing around one third of the global supply at 78 MT. Exports from Southeast Asia (Malaysia, Indonesia) and Australia have also increased in recent years. In this respect, Australia has overtaken Malaysia and has been the world's second-largest exporter since 2015 (see International Gas Union 2016). This trend is expected to continue: until 2019 further locations are to be added (see Figure 1). Thus in a few years Australia could replace Qatar as the world's largest LNG exporter (see BP 2017). Also the US and Russia are further expanding their export infrastructures. Three other terminals in Russia and eight locations in the United States are currently under construction or are starting with first deli-

[1] TEN-T network: Transeuropean transport network, consisting of the total and core network, which includes roads, railways, inland waterways, sea and inland ports as well as airports and transshipment terminals in the EU – see Bundesverband der deutschen Industrie e.V. (2016).

veries. Russia is reacting to the increasing supply of Southeast Asia, Australia and the United States (see Börsenzeitung 2016). These developments show that the supply of LNG, which has already grown steadily in the recent past, is further expanding. According to experts, in the future there could be a much faster growth of spatially and temporally flexibly transportable LNG compared to traditional pipelines (see BP 2017). Already for 2016 an output of 270 MT LNG was expected and thus 9 percent more than 2015 (see Gas Strategies 2016). On the other hand, there has been a slight downturn in demand in some importing countries of Asia, which, however, could in the future be relativised by other sales markets (see BP 2017). After four new importers have already been added in 2016, only a few new sales countries can be expected in the near future. Due to this oversupply and low gas prices, some planned projects could be cancelled in the future.

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