Briefing

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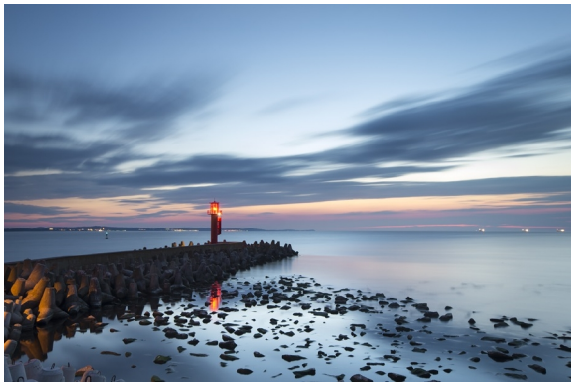
Liquefied Natural Gas in Europe

SUMMARY

Liquefied Natural Gas (LNG) represents the main alternative to pipeline supplies of gas. In liquefied form, natural gas (methane) can be stored and transported across long distances, contributing to diversification of supply and enhancing energy security in Europe. The gas market in the EU is characterised by gradually declining domestic consumption and more rapidly declining domestic production. Import needs are likely to increase in the short and medium term, and remain broadly stable in the longer term. The recent plunge in gas prices, combined with abundance of supply and a weak global economic scenario, has encouraged the diversion of LNG supplies to Europe. The International Energy Agency and the European Commission expect this trend to continue in the coming years. Major new LNG suppliers are emerging and the prospect of US shale gas being exported as LNG could further reshape global gas markets.

The European Commission is developing an EU strategy for LNG and gas storage, one of several measures under the Energy Union package to improve energy security and diversify sources of supply. Infrastructural projects, often with EU funding, are helping several Member States to access LNG supplies, while others have sufficient import capacity to meet expected future needs. A strategic emphasis on LNG is consistent with the recommendations of the European Council and the European Parliament.



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What is Liquefied Natural Gas?

Liquefied Natural Gas (LNG) is a way to store and transport natural gas (methane). Commercial operations for LNG have existed in Europe since 1964, initially to ship gas from Algeria to France and the UK. In liquid form, natural gas takes up 600 times less space than in a gaseous state, allowing for transport across long distances without pipelines. The liquefaction process involves an extensive chemical treatment to remove components that may freeze at low temperatures or damage liquefaction facilities. After treatment the gas is cooled at a temperature of −162°C and kept at high pressure. LNG can only be stored and transported in very cold (cryogenic) tankers, travelling by sea in double hull ships or by land in special vehicles. Both are known as LNG carriers. LNG carriers are off-loaded at import terminals (some located inland, others in the sea) where the LNG needs to pass through a regasification process that converts it back to a gaseous state, allowing it to enter the pipeline network. LNG can also be used directly in transport vehicles, such as boats or trucks, which need to be constructed or converted for this purpose. Compressed Natural Gas (CNG) is more commonly used in the transport sector. CNG takes up 100 times less space than uncompressed methane, so is less effective than LNG for long-distance transportation or as an alternative to pipeline supplies. However, CNG does not require costly liquefaction and regasification facilities, making it a far cheaper transport fuel, especially for public transport over reasonably short distances.

LNG is an indispensable source of supply for countries or regions not connected by pipeline to a major gas exporter or distribution network. Yet LNG can cost far more than importing natural gas via existing pipelines, especially if it requires the construction of new infrastructure. Only 28 countries in the world have regasification terminals, according to the International Gas Union, although others are developing them. High costs for LNG can be attributed to expensive liquefaction facilities; the need to use specially designed LNG carriers; storage of gas at low temperatures and under high pressure; and the need to build regasification facilities in the receiving country. Storage and transportation costs for LNG are considerably higher than for other fossil fuels, such as oil or coal. After regasification, supplies enter pipeline networks and can be exported to other countries. LNG supplies can provide a valuable alternative to pipeline gas imports, especially in times of exceptionally high demand or a major disruption of supply. The latter occurred in the EU when Russia suspended the supply of pipeline gas through Ukraine in the winters of 2006-7 and 2009. A future suspension of supplies is possible, although all parties reached an agreement to maintain gas supplies this winter.

Gas markets in the European Union

Falling Prices

The past 18 months have seen major changes in global gas markets, with strong implications for the EU as a net importer of natural gas. Of gas imports to the EU, 80-85% are delivered through pipelines, the remaining 15-20% in the form of LNG. Most pipeline supplies to the EU are not based on spot prices (i.e. market prices determined by trading in gas hubs) but rather tied to global oil prices in the form of long-term supply contracts between gas suppliers and European buyers. A considerable share of LNG to the EU is delivered through long-term supply contracts tied to the price of oil. The precise share of LNG imports sold at hub (spot) or oil indexed prices is difficult to assess and can vary considerably between years. In any case, oil prices have collapsed since June 2014, when they hit a price of US$110 per barrel of Brent. They reached a

trough of US$45 per barrel in January 2015, and now vary in the range of US$50-60 per barrel (i.e. roughly half the levels of June 2014). Gas prices under oil-indexed contracts tend to track oil prices with a six to nine month time lag, so these fell sharply over the course of 2015. Spot prices of gas in the first quarter of 2015 (Q1 2015) also declined by 11% compared to Q1 2014, due to abundant global supply and weakening global demand.

Production and Consumption

The EU gas market is characterised by growing divergence between production and consumption. Levels of consumption are much higher and declining more slowly than levels of production. According to International Energy Agency (IEA) data,[1] gas consumption in the EU fell from almost 477 billion cubic metres (bcm) in 2000 to under 412 bcm in 2014 (-13.7%), whereas gas production in the EU declined from over 264 bcm to just under 153 bcm (-42.5%) in the same timeframe. Gas production levels are declining or flat across all main EU producing countries (see Table 1), including the Netherlands and the United Kingdom (combined 70% of EU output). The IEA Medium-Term Gas Market Report predicts gas consumption will average 1.5% per year in the OECD Europe area (2014-20),[2] compared to global growth of 2%. The IEA predicts annual gas imports to OECD Europe will increase by 40 bcm in 2020, with 70% of these additional imports due to declining indigenous production.

Table 1: Natural Gas Production in the EU, million cubic metres (mcm)

Member State	1990 (mcm)	2000 (mcm)	2010 (mcm)	2014 (mcm)	1990-2014 % change	2000-2014 % change
Austria	1359	1904	1810	1244	- 8.5	- 34.6
Croatia	1983	1659	2727	1713	- 13.6	+ 3.3
Denmark	3137	8153	8219	4612	+ 47.0	- 43.4
France	2857	1878	777	15	- 99.5	- 99.2
Germany	18919	22049	15069	10063	- 46.8	- 54.4
Hungary	4874	3194	2900	1854	- 62.0	- 42.0
Ireland	2318	1186	285	252	- 89.1	- 78.8
Italy	17296	16633	8406	7149	- 58.7	- 57.0
Netherlands	76249	72821	88510	69969	- 8.2	- 3.9
Poland	4095	5224	6079	6080	+ 48.5	+ 16.4
Romania	28366	13750	10855	11006	- 61.2	- 20.0
Spain	1471	171	51	24	- 98.4	- 86.0
UK	49672	115386	59776	38518	- 22.5	- 66.7
TOTAL	**213 439**	**264 460**	**205 901**	**152 931**	**- 28.3**	**- 42.2**

Source: International Energy Agency, Natural Gas Information

The European Commission estimates in its Quarterly Report on European Gas Markets that EU gas consumption in the first quarter (Q1) of 2015 increased by 12% on an annualised basis. However, the volume of pipeline imports from outside the EU fell by

9%, notably from Russia (-30%) and North Africa (-18%), two of the three main sources of pipeline supplies to the EU. Norwegian deliveries increased (+13%), making Norway the largest gas supplier to the EU in 2014 (in previous years Russia had been the largest supplier). Geo-political tensions with Russia and civil strife in Libya, falling EU gas production and growing import needs have led the IEA to predict that LNG imports to Europe will double between 2014 and 2020. According to estimates by the European Commission, LNG imports to the EU already increased annually by 25% in Q1 2015.

Long term uncertainty

The longer term picture for LNG is more uncertain and could be affected by reductions in gas production, particularly if sustained low prices curtail future investment. The IEA Medium-term Gas Market Report predicts that many proposed liquefaction projects will not be realised because current prices do not allow a recovery of capital costs. This situation has already curtailed LNG projects in Canada (which struggles to compete against US shale gas), Russia (affected by investment restrictions due to trade sanctions) and East Africa (high political risk and associated costs). Several Asian countries have prioritised coal capacity expansion to limit their dependence on imported gas, take advantage of indigenous reserves or benefit from extremely low global coal prices. If Japan restarts most of its nuclear reactors then its gas demand could fall sharply and this will impact global gas markets. As the world's largest importer of LNG, Japan accounted for 37% of global LNG demand in the three years after the Fukushima accident (2012-14), rising from a 31% share in 2011. The ongoing construction of the Southern Gas Corridor should allow gas from Azerbaijani reserves in the Caspian Sea to reach EU Member States by 2020, providing an alternative source of pipeline supply. However, initial predicted volumes of supply reaching Europe from the Caspian Sea are only 10 bcm (compared to 160 bcm from Russian pipelines), so this new pipeline may not have a transformative effect on European gas markets in the medium term.

LNG markets and their impact on EU

New Suppliers

LNG supplies to EU Member States arrive mainly from Qatar (currently the leading LNG exporter in the world), Algeria and Nigeria. More supply options are emerging as new countries invest heavily in LNG export capacity, particularly Australia, USA and Papua New Guinea. These countries and others made substantial investment decisions in LNG when gas prices were much higher and anticipated global demand was greater. The IEA expects global supply capacity to increase by 164 bcm between 2014 and 2020, with 90% of additional LNG production coming from North America, Asia and Australasia. Australia is developing several large liquefaction projects, with most coming on stream between 2014 and 2017. Australia is expected to overtake Qatar as the world's biggest supplier of LNG by 2020, although distance and transportation costs mean it is unlikely significant volumes will reach European markets. The exploitation of shale gas reserves in the USA (see EPRS briefing) already had a transformative effect on global gas markets by virtually eliminating US demand for LNG. Once the USA completes several liquefaction facilities to develop its LNG export capacity, its competitive producers will be in a position to place significant volumes of LNG onto global markets. The IEA predicts that the USA will become the third largest exporter of LNG by 2020, and could potentially export significant volumes of LNG to the EU.

US Shale Gas

According to a research paper by the Congressional Research Service (CRS), the USA will become a net exporter of natural gas by 2016. In 2013, US natural gas exports were almost entirely by pipeline to Canada and Mexico. CRS predicts that over 60% of US gas exports will eventually be in the form of LNG. In the 1970s the USA built several LNG import terminals (mainly on the East coast), and expanded some in the early 2000s to manage an expected growth in gas imports that never materialised. With exploitation of its shale gas reserves, US gas production was able to meet its domestic needs and the LNG import terminals became redundant. Some are being converted into liquefaction facilities to export LNG from 2016 onwards. All gas exports from the USA remain subject to federal approval and are directed largely (but not exclusively) to countries that have a Free Trade Agreement with the USA. Asia is likely to become the largest market for US LNG, especially if the recent agreement on the Trans-Pacific Partnership (TPP) facilitates US gas exports to Japan and other signatories (including Malaysia, Vietnam and Singapore). Most LNG in the world is sold through long-term contracts tied to oil prices, in order to encourage producers to invest in costly liquefaction facilities. However, a significant share of US exports will be based on hub prices. A research paper from Columbia University argues that US LNG exports may not eliminate EU dependence on pipeline gas supplies from Russia, but could provide an important diversification of supply, providing adequate infrastructure is in place to facilitate LNG imports. US LNG exports should create a more liquid global market for gas since much US supply is not bound to long-term contracts. Availability of alternative LNG supplies could also assist EU buyers to negotiate better terms with Gazprom over pipeline gas supplies from Russia.

LNG supplies to Europe

Both the IEA and the European Commission predict that new LNG export projects will create an abundance of global supply in a moment when economic growth is fragile, keeping gas prices on the low side and encouraging LNG shipments to the EU. The bulk of LNG exports have generally gone to Asia and Latin America, where most countries rely heavily on imported LNG for their gas supply, leaving Europe as the residual market. High demand from rapidly industrialising or developed manufacturing economies, low indigenous gas reserves, and limited pipeline infrastructures between states have traditionally accounted for a price premium favouring LNG exports to Asia (known as the 'Asian Premium'). Japan has low indigenous gas production and now relies almost entirely on LNG for its gas supplies. Since the Fukushima nuclear incident in 2011, Japan sharply increased its volume of LNG imports to compensate for the temporary closure of its nuclear power plants. The recent slowdown in economic growth across Asia and Latin America, together with global increases in LNG capacity and the recent plunge in gas prices, has made LNG a competitive alternative to pipeline gas in Europe, prompting a diversion of LNG supplies originally intended for Asia. The Commission's Quarterly Report on European Gas Markets finds there is no longer any price premium favouring LNG exports to Asia, with LNG even cheaper than pipeline supplies in some EU Member States. This can be illustrated by IEA statistics on import prices for EU Member States that use both pipeline and LNG supplies. In December 2014, Italy paid an average of US$9.61 per Million British Thermal Units (MBtu) of natural gas through pipelines, but only US$9.01 for the equivalent in LNG supplies. Spain paid an average of US$10.02 per MBtu of natural gas through pipelines (mainly from Algeria and Norway) but only US$8.97 for the same amount of LNG supplies. Only the UK paid more for LNG (US$7.43 per MBtu) than pipeline supplies (US$6 per MBtu) from nearby Norway.

LNG imports in EU Member States

According to the European Commission, LNG import capacity in the EU stood at a total of 197 billion cubic metres per annum (bcm/a) in 2014, although only around a quarter (45 bcm/a) was actually used. The rate of utilisation is highest in Italy (35%) and lowest in the Netherlands (4%). Total pipeline import capacity in the EU stands at 490 bcm/a, and its utilisation rate is much higher than for LNG. Yet pipeline capacity is difficult to increase in the short and medium term. New pipelines are costly investments that take several years to build. Government and regulatory approval needs to be obtained from all countries involved and transit fees agreed. International pipelines often get rejected on a combination of geopolitical and commercial grounds, as occurred with the proposed South Stream and Nabucco pipelines. This makes increasing LNG imports a flexible short-term solution to meeting higher gas import needs in the EU.

Existing access to LNG Imports

The vast majority of LNG supplies to the EU are delivered to only five Member States (Spain, UK, France, Portugal, and Belgium). Spain and Portugal rely on LNG for close to half their gas supply, whereas LNG accounts for between a quarter and a fifth of gas supply to the UK (see Table 2). Most EU Member States in Central and (South) Eastern Europe, as well as the contracting states of the Energy Community, do not have LNG import terminals and can rarely access LNG supplies through the distribution network. These countries are heavily dependent on Russian pipeline supplies and face the greatest risk of supply disruption, a view confirmed by stress tests for security of gas supply. The stress tests were directed by the European Commission in 2014 and found that countries with access to alternative LNG supplies were at much lower risk of supply disruption. Relying on a single supplier can lead to monopolistic pricing in gas markets, so the option of competitively priced LNG imports can help to reduce the cost of pipeline supplies. The recent construction of the Klaipeda LNG import terminal helped Lithuania to negotiate lower prices with Gazprom for its pipeline supplies from Russia.

Table 2: LNG Imports in million cubic meters (mcm) and as % share of total gas imports, 2013. Number of fully operational LNG import terminals in the EU-28, 2014

EU Member State	LNG imports mcm, 2013	LNG as % of total gas imports, 2013	Number of LNG Import Terminals fully operational and in use, 2014
Belgium	1,549	8.1	1 (Zeebrugge: being expanded)
France	8,513	17.8	3 (2 are being expanded; 4th terminal under construction in Dunkerque)
Greece	610	15.8	1 (Revithoussa: being expanded)
Italy	5,620	9.1	3 (Further 4 terminals are planned)
Netherlands	994	3.7	1 (Rotterdam: being expanded)
Portugal	1,887	42.9	1 (Sines)
Spain	15,472	43.6	5 (6th terminal operational but not in use. 7th/8th terminals are being built)
United Kingdom	9,414	19.2	4 (Further 2 terminals are planned; 1 existing terminal may be expanded)

Sources: Data on LNG imports from International Energy Agency (EPRS calculations), Data on LNG import terminals from Gas Infrastructure Europe

Challenges of Interconnection

France and Spain have four and eight LNG terminals respectively, which are heavily under-utilised. In theory these could be used to help diversify gas supplies throughout the EU. But it is currently impossible for significant volumes of LNG supply to move eastwards. Existing gas infrastructure is largely designed for east-west gas flows, while there are specific bottlenecks and network constraints between Spain and France, as well as related north-south problems in the French network. According to a CEPS paper, weak interconnections between Member States are a major obstacle preventing LNG from diversifying supply across the EU. Low interconnection rates and capacity constraints are being addressed via EU Projects of Common Interests (PCIs) in the energy field, financed primarily by the Connecting Europe Facility, including projects to improve the problematic France-Spain and intra-France gas connections. Another PCI proposes to develop a new LNG terminal on the island of Krk (Croatia), part of a broader North-South gas corridor that would allow LNG supplies to flow into the Balkans and Central Europe. The only operational LNG terminal in the south-eastern region is Revithoussa (Greece), which serves domestic energy needs in Greece. This LNG import terminal is being expanded and upgraded with EU regional funds, including enhanced storage capacity, while a related PCI project aims to improve gas interconnection between Greece and Bulgaria. A long term aim of both projects is to allow gas supplied to Greece as LNG to be distributed throughout South-Eastern Europe via pipeline networks.

New LNG import capacity

The Baltic Sea region is heavily dependent on Russia for gas supplies but already starting to diversify. An LNG terminal in Lithuania became operational in 2015 and received several LNG shipments from Norway. A new LNG terminal in Poland has just become operational and could reduce dependence on Russian gas supplies. The CEPS paper notes that interconnections in the region are very low and this can prevent LNG imports from reaching neighbouring states. There is some progress on this front, such as the new Poland-Lithuania gas pipeline. LNG terminals are being planned in several European countries, while many existing LNG terminals are being expanded to cope with the projected increase in imports or to enhance storage facilities. No EU country at present has liquefaction facilities. These have been proposed in Cyprus as a means to exploit substantial gas reserves discovered in its coastal waters. However, expected volumes of production and current gas prices are not yet high enough for the commercially viable construction of an LNG terminal in Cyprus, although this situation may change.

Position of the European Parliament

The European Parliament (EP) emphasised, in its resolution of 12 June 2012 on Energy policy cooperation with partners beyond our borders, that the EU should create 'real competition among sources of gas supply by increasing the EU's share of LNG and by reaching new and remote suppliers'. The EP resolution of 21 November 2012 on industrial, energy and other aspects of shale gas and oil recognises that with 'the growth of production of natural gas from shales in the US, more LNG supplies are now available for Europe, and that a combination of increased domestic supply of natural gas and greater LNG availability provides attractive options for gas supply diversity'.

The European Parliament resolution of 25 November 2010 on Towards a new Energy Strategy for Europe 'encourages and supports the construction of LNG terminals and

interconnections, notably in countries most vulnerable to disruptions of gas supply.' The European Parliament resolution of 6 July 2010 on the European Union Strategy for the Baltic Sea Region and the role of macro-regions in the future cohesion policy 'stresses the need to reduce the region's dependence on Russian energy ... (with) more interconnections between Member States in the region and greater diversification of energy supplies; calls in this regard for increased support for the creation of LNG ports.'

Towards an EU Strategy

The European Commission held an open consultation on developing an EU strategy for LNG and gas storage in 2015, and expects to communicate its strategic document in January 2016. An LNG strategy for the EU is envisaged as part of the Energy Union package, alongside a proposed revision of the Security of Gas Supply Regulation. It also relates directly to the European Energy Security Strategy. The decision to develop an LNG and gas storage strategy for the EU is consistent with the European Council conclusions of June 2014, which call for a 'diversification of energy suppliers and routes' as well as 'better use of regasification and storage capacity in the gas system'.

Main references

American Gas to the Rescue? The Impact of US LNG Exports on European Security and Russian Foreign Policy, J. Bordoff and T. Houser, Columbia SIPA Center on Global Energy Policy, 2014.

Consultation on an EU strategy for liquefied natural gas and gas storage, DG Energy, European Commission, 2015.

Europe's LNG Strategy in the Wider Gas Market, Centre for European Policy Studies (CEPS), Policy Brief, October 2015.

Medium-Term Gas Market Report, International Energy Agency, 2015.

Quarterly Report on European Gas Markets, Market Observatory for Energy, DG Energy, European Commission, Volume 8 (issue 1; first quarter of 2015)

U.S. Natural Gas Exports: New Opportunities, Uncertain Outcomes, Congressional Research Service, 28 January 2015.

Endnotes

[1] According to data obtained from the IEA Natural Gas Information statistical periodical. 2014 figures are based on IEA estimates. Consumption figures do not cover Latvia and Lithuania (where 2014 estimates were unavailable). These countries account for around 0.3% of EU-28 consumption and do not produce any volumes of natural gas.

[2] The OECD Europe area covers 23 EU Member States (all except Latvia, Lithuania, Malta, Cyprus, Croatia), Norway, Iceland, Switzerland and Turkey. Gas consumption growth in the OECD Europe area is actually under 1% (2014-20) if Turkey is excluded from the calculation.

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