Creating an effective gas supply network to Europe

This is the second of a two-part article in which David Wood* *and* Bill Pyke** *argue that the creation of an effective gas supply network to Europe requires the integrated development of both pipeline and LNG markets. Here, they look at the key LNG buyers in Europe and address potential gaps in future gas supplies.Part 1 of the article was published in the December issue.*

LNG will continue to provide market access opportunities to more distant producers that are too remote or geopolitically isolated for piped supplies to be a short-term option (eg Middle East).

Six member states of the European Union (EU) – France, Belgium, Spain, Portugal, Italy and Greece – imported 25.5mn tonnes (36bn cm) of LNG in 2003 (see Figures 1 and 2). In addition, Turkey imported 4.99bn cm in 2003, while the UK and Netherlands are likely to join the LNG importers in the next few years. France

For many years France was the number one importer of LNG in Europe. The country pioneered LNG trade with Algeria in the mid-1960s and has contracted LNG supplies continually since that time. Major suppliers of LNG include Algeria and Nigeria. In 2003 France imported 7.2mn tonnes, meeting some 24% of its national consumption.

Two receiving terminals are currently in operation. Montoir-de-Bretagne, near Nantes in Brittany, has a capacity of 3.3mn t/y. Fos-sur-Mer, near Marseilles, has a capacity of 7.3mn t/y. Construction of a third plant at Fos Cavaou on the Mediterranean coast is under way. It will accept LNG from Egypt (in 2005) and Qatar (in 2006) and will ultimately add a further 6mn t/y of capacity by 2008.

Spain

Spain is now the number one importer of LNG into Europe. LNG supplies some 63% of the country's gas consumption and imports have more than tripled since 1990. Spain is also the most diversified purchaser of LNG, receiving gas from nine exporting countries. In 2003 it imported 10.98mn tonnes. The major supply contracts are with Algeria, Nigeria and Trinidad. Smaller volumes are imported from Libya, the UAE, Oman, Qatar, Australia and Brunei.

Spain currently has four receiving terminals, with a further three under construction. The national gas supply company, Enagas, operates three of these terminals – located at Barcelona, Huelva and Cartagena – with an aggregate capacity of 10.3mn t/y. The fourth facility, in Bilbao – operated by a consortium of BP, Iberdrola, Repsol YPF and EVE – received its first LNG shipment from the UAE in August 2003. When fully operational, the terminal will have an annual capacity of 2.7mn t/y and will receive most of its LNG from Trinidad. New supplies from Egypt will be imported from 2005.

Italy

Italy is Europe's third-largest importer of LNG, with some 4.03mn tonnes in 2003 coming from Algeria (~40%) and Nigeria (~60%). LNG provides for 9% of annual demand. The country receives LNG through its terminal at Panigaglia, in the Gulf of Genoa. Enel has a 25-year supply contract with Algeria that runs until 2015. Imports to Panigaglia exceeded 4mn tonnes in 2003.

New terminal construction is ongoing at two sites. Edison has begun work on a $600mn LNG regasification terminal on the coast in the Adriatic Sea, to begin operations in June 2005. The project is linked to approval for an onshore pipeline to bring gas to the northeastern part of the country. The terminal will be supplied with 3.4mn t/y from Qatar's RasGas LNG facility. At Brindisi, in southeast Italy, a new terminal is being constructed to accept LNG from Egypt, commencing in 2007. Capacity will be designed to accept 6mn t/y, rising to 9mn t/y on final completion.

Belgium

Belgium's sole receiving terminal at Zeebrugge received 2.29mn t/y of LNG, mostly from Algeria, in 2003. LNG met 18% of national demand. The terminal is operated by Fluxys LNG, with most of the capacity contracted to Distrigas. The

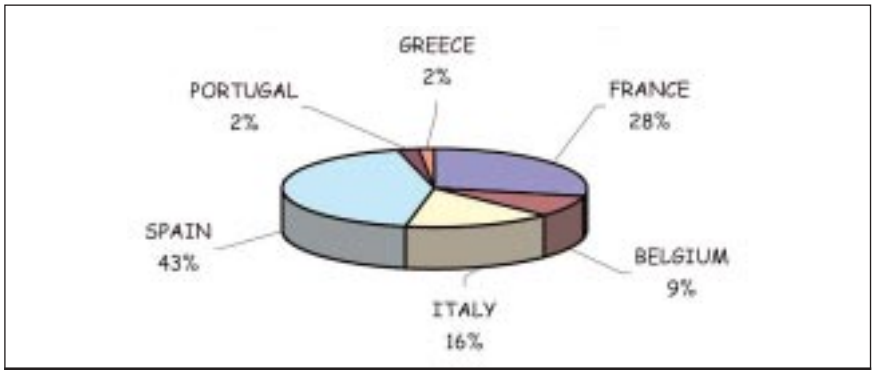

Figure 1: Share of EU LNG imports in 2003 by country

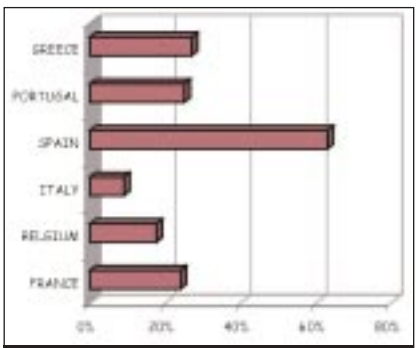

Figure 2: LNG's share of national EU gas markets in 2003

capacity of the terminal is in the process of being doubled by 2007.

Greece
Greece began importing LNG in 2000, under a 21-year contractual agreement with Algeria. In 2003 it imported 0.4mn tonnes. LNG met 27% of national demand that year. Greece's sole LNG terminal at Revithoussa, near Athens, has a capacity of 2mn t/y.

Portugal
Portugal began receiving LNG in 2002, under a 20-year contract with Nigeria LNG. LNG was initially regasified in Spain and piped into Portugal until October 2003, when the Sines terminal went online. The Sines plant has a capacity of 3.3mn t/y.

UK
The UK pioneered commercial LNG trade with Algeria in 1964. A regasification terminal was constructed at Canvey Island, east of London. LNG was imported in tankers with small capacities of 12,000 tonnes, which shuttled 58 cargoes annually between Algeria and the UK. UK gas demand in the early 1960s was 1bn cm/y and LNG supplied 10% of that demand. The 15-year supply contract from Algeria lapsed in 1979 and the Canvey Island terminal was decommissioned in the 1980s.

However, once again the UK is about to become a net gas importer. As part of its medium-term security of supply strategy it is in the process of developing three LNG receiving terminals – one sited near London and two in Milford Haven, West Wales. Transco's Isle of Grain site, east of London, will have a receiving capacity of 4bn cm/y and a storage capacity of 200,000 cm, with start-up scheduled in 2005.

The Petroplus/BG/Petronas Dragon terminal at Milford Haven will have a receiving capacity of 6bn cm/y, a storage capacity of 330,000 cm and start-up scheduled for 2006. Centrica announced in August 2004 a 15-year contract with Petronas to import 3bn cm/y of LNG through the Dragon facility. A further site at Milford Haven's Herbranston terminal will be operated by ExxonMobil/Qatar Petroleum. Receiving capacity will be developed in two phases up to 20bn cm/y, with start-up staggered between 2006 and 2008. The two Milford Haven sites are located on decommissioned refineries where construction is yet to commence. These strategic locations will provide valuable supply to the western demand centres of the UK independently of the main pipeline and storage network focused on the North Sea coast.

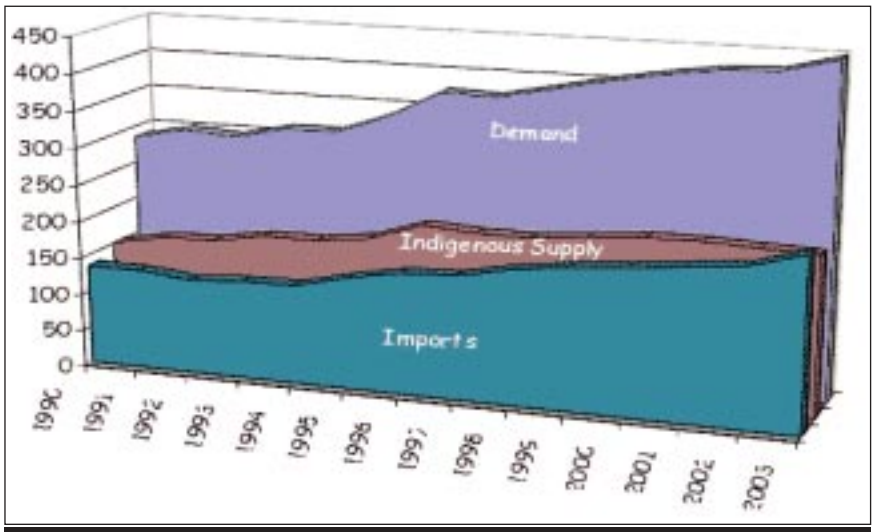

Figure 3: Gas demand, supply and import trends for EU

Figure 4: Gas demand, supply and import trends for EU, including modest growth for gas imports from 2003 to 2025

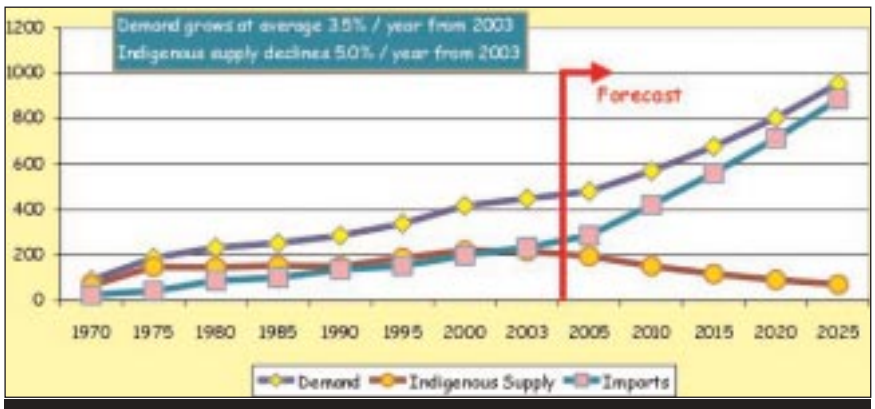

Figure 5: Gas demand, supply and import trends for EU, including high growth for gas imports from 2003 to 2025

The Netherlands
The Netherlands is currently evaluating the feasibility of an LNG import terminal at Eemshaven to bolster its long-term gas supply needs.

LNG suppliers to Europe

Some eight countries – Algeria, Nigeria, Qatar, Libya, Oman, Abu Dhabi, Trinidad & Tobago, and Australia (listed here in order of volumes supplied) – shipped 26.2mn tonnes (34.98bn cm) of LNG to Europe in 2003, representing 20.7% of global LNG trade of 126.4mn tonnes (168.84bn cm). These countries supplied an additional 4.99bn cm to Turkey in 2003.

Many of these existing LNG suppliers are in the process of expanding their

Country of Supply	2003 Total Gas	2010 Total Gas	2010 %	2010 LNG Component	2020 Total Gas	2020 %	2020 LNG Component
Russia	107.6	140	39%	0	170	37%	5
Norway	68.4	90	25%	3	100	22%	5
Algeria	53.2	75	21%	30	90	20%	40
Nigeria	9.2	15	4%	15	15	3%	15
Egypt	0.0	12	3%	12	25	5%	15
Qatar	1.9	10	3%	10	15	3%	15
Libya	0.8	11	3%	1	35	8%	10
Oman	0.3	0	0%	0	0	0%	0
UAE	0.2	0	0%	0	0	0%	0
Other Atlantic Basin	0.1	2	1%	2	5	1%	5
Other Pacific Basin	0.1	0	0%	0	0	0%	0
Totals	242	355		73	455		110
LNG % of Total Gas	14.5%			20.6%			24.2%
EU25 Gas Demand Forecasts (see Table 2)							
Low Growth		280			349		
Mid-Case Growth		317			437		
High Growth		420			714		
Additional Gas Required to Supply High EU25 Gas Demand Growth Scenario							
Azerbaijan	0	15		0	30		0
Turkmenistan	0	10		0	50		0
Iran	0	0		0	30		0
Iraq	0	10		0	20		0
Shortfall from Russia	0	30		0	129		0
High Growth Totals	242	420			714		

Table 1: Gas supply forecasts to EU25 for 2010 and 2020

Gas Balance for EU15, EU25 and EU30						Gas Imports from Non-EU					
Country	2003 Total Gas Consumption	2003 Total Gas Production	2003 Pipeline Gas Imports	2003 Pipeline Gas Exports	2003 Pipeline Net Gas Imports	2003 Pipeline	2003 LNG	Actual 2003 Pipeline +LNG	Forecast 2010 Low Pipeline +LNG	Forecast 2010 Mid Pipeline +LNG	Forecast 2010 High Pipeline +LNG
Germany	85.5	17.7	86.8	30.3	76.4	59.6	0.0	59.6	65	74	90
Italy	71.7	13.7	65.9	0.0	65.9	48.2	5.5	53.7	58	64	78
France	42.8	0.0	31.8	0.8	31.0	23.0	9.9	32.9	36	40	46
Spain	23.8	0.0	8.7	0.0	8.7	8.7	15.0	23.7	26	30	40
Belgium & Lux.	16.0	0.0	14.7	1.6	13.1	5.9	3.2	9.0	11	12	21
UK	95.3	102.7	7.5	15.2	-7.7	6.6	0.0	6.6	15	20	35
Austria	6.6	0.0	7.4	0.4	7.0	6.5	0.0	6.5	8	8	10
Finland	4.5	0.0	4.8	0.0	4.8	4.8	0.0	4.8	5	6	7
Netherlands	39.3	68.3	12.9	42.2	-29.2	4.3	0.0	4.3	5	6	10
Rep of Ireland	4.1	0.0	3.7	0.0	3.7	3.7	0.0	3.7	4	4	6
Portugal	3.0	0.0	2.5	0.0	2.5	2.5	0.9	3.4	4	5	8
Greece	2.3	0.0	1.5	0.0	1.5	1.5	0.6	2.1	3	3	4
Denmark	5.2	7.9	0.0	3.6	-3.6	0.0	0.0	0.0	0	0	1
Sweden	0.8	0.0	1.3	0.0	1.3	0.0	0.0	0.0	0	0	1
Total EU15	403.9	250.3	239.5	74.0	165.4	175.3	35.0	210.3	240	272	360
Czech Rep	9.0	0.0	9.7	0.0	9.7	9.7	0.0	9.7	11	12	15
Hungary	13.0	0.0	10.3	0.0	10.3	8.8	0.0	8.8	10	11	15
Poland	12.5	4.0	8.6	0.0	8.6	8.6	0.0	8.6	10	11	15
Slovakia	7.1	0.0	7.3	0.0	7.3	7.3	0.0	7.3	8	9	12
Slovenia	0.0	0.0	1.1	0.0	1.1	1.1	0.0	1.1	2	2	3
Sub-total 6 EU	41.6	4.0	37.0	0.0	37.0	35.6	0.0	35.6	41	45	60
Sub-total "EU25"	445.5	254.3	276.5	74.0	202.5	210.8	35.0	245.8	280	317	420
Turkey	21.0	0.0	16.2	0.0	16.2	16.2	5.0	21.2	24	28	35
Romania	18.4	12.6	5.8	0.0	5.8	5.3	0.0	5.3	6	8	10
Bulgaria	2.9	0.0	2.8	0.0	2.8	2.8	0.0	2.8	4	5	6
Switzerland	2.9	0.0	2.9	0.0	2.9	0.4	0.0	0.4	1	2	2
Norway	4.3	73.4	0.0	68.4	-68.4	0.0	0.0	0.0	0	0	0
Sub-total	49.5	86.0	27.7	68.4	-40.7	24.6	5.0	29.6	34	43	53
Sub-total EU30	495.0	340.3	304.2	142.4	161.8	235.5	40.0	275.5	314	359	473

Table 2: 2003 gas balances and 2010 non-EU import demand forecasts for European countries and EU groupings.7 Countries within EU groupings are ranked in descending order of non-EU gas imports in 2003.8

liquefaction capacity, most notably Algeria (despite its setback with the Skikda accident in January 2004), Libya, Nigeria, Qatar and Trinidad. The total liquefaction capacity of Europe's eight traditional LNG supply countries therefore seems set to expand by some 77%, to approximately 178bn cm of gas, by 2008. They are developing much of this additional liquefaction capacity primarily to service other markets – in particular the US and China – but will also face additional competition to supply European markets from new suppliers.

For example, Egypt and Norway have liquefaction plants at an advanced stage of construction, while Angola and Equatorial Guinea seem set to sanction projects to build their first liquefaction plants. These four countries will be looking to market at least some LNG to Europe. Meanwhile, Brazil, Iran, Russia, Venezuela and Yemen also have ambitions to become LNG suppliers – although their focus is more on non-European markets. The giant South Pars gas field development projects involving LNG have progressed slowly after much delay in Iran, but once operational will also be looking for opportunities to market some LNG to European customers.

Details of the liquefaction capacities and development of existing and potential LNG suppliers to Europe are beyond the scope of this article, but are provided elsewhere.1 An important question is: 'Can Europe's demand growth for LNG sustain such massive growth in supply?' The answer is probably no, particularly when competing supplies from additional pipeline capacity is taken into account. The new projects that enter the market earliest are likely to be successful, resulting in delays/postponements to the development schedules of the latecomers.

Gaps in future gas supply

Gas demand from the EU25 countries[2] reached some 449bn cm in 2003, having grown from 285bn cm in 1990 and averaging an annual growth rate of 3.6%/y over that 13-year period.[3] That growth rate in gas consumption had slowed to average 2.5%/y since 2000, but from 2002 to 2003 consumption growth increased again to 4.6%/y.

How demand will grow is open to speculation and forecasts from a range of analysts vary from less than 2%/y to greater than 4%/y on average to 2025. Analysis of individual country growth trends and energy strategies suggest to us that growth in EU_{25} gas consumption during this period will lie between 1.5%/y (622bn cm by 2025) and 3.5%/y (956bn cm by 2025), depending upon the range of factors influencing market development outlined above. If EU_{25} gas consumption were to reach 1,000bn cm/y in 2025 this would represent a 3.7% average annual growth rate from 2003.

As part of the overall gas demand growth, LNG supply to the EU increased from 18.7bn cm in 1996 to 35bn cm in 2004 (14.5% of all gas imports) at annual rate of 9.4% (or 9.6% if Turkey is included).[4] This growth rate is 50% higher than the growth in global LNG demand over the same period. This represents three times the average annual growth in overall gas demand. If LNG imports to the EU25 grow at an average rate of 10%/y from 2003 to 2025, annual LNG imports would amount to 285bn cm (some 30% to 45% of our total EU gas demand forecast). Based upon the planned LNG projects due to come onstream by 2008, a 5%/y average growth forecast to 2025 seems

pessimistic, but would raise EU_{25} LNG imports to 102bn cm. These two growth rates will probably bracket the growth in LNG imports that materialises over that 22-year period.[5]

The supply gap to be filled by gas imports in the period up to 2025 depends not only upon demand growth but also on how indigenous supply declines. **Figures 3, 4** and **5** illustrate the historical and future forecast gas supply, demand and import positions on which Europe's potential gas supply gap is based. The rapid increase in gas imports in 2003 (**Figure 3** – 10%) is perhaps a foretaste of the short-term trends. Our mid-case import growth forecast (**Figure 4**) leads to 437bn cm of imports by 2020. This is similar to DG Tren's low case forecast of 410bn cm by 2020.[6] However, our high import growth forecast (Figure 5) predicts imports of 714bn cm in 2020 compared to 542bn cm for the DG Tren high case forecast. Our high case assumes combined rapid demand growth with steep decline of indigenous supply.

We have also developed a low growth case (see Tables 1 and 2), which involves 1% growth in demand and 1% decline in indigenous supply, and results in an import requirement of just 349bn cm in 2020. If such a forecast materialised almost no new gas supply projects sanctioned after 2005 would be required.

Details of our low, mid-case and high import forecasts for years 2010 and 2020 and a country by country breakdown of how we see supply distributed are given in Table 1. How gas demand might develop in specific countries if demand lies between our mid-case and high growth forecasts is indicated in **Table 2**.

The 2010 country forecasts in Tables 1and 2 are in line with projects sanctioned in 2004 and suggest that if only mid-case import growth materialises then there is likely to be a supply glut (ie 355bn cm supply versus 317bn cm demand for EU_{25}). The LNG component of supply in any event is likely to rise to between 20% and 25% of total gas imports. On the other hand, if high import growth materialises, by 2010 there is likely to be a supply shortfall, and imports from Central Asia, Iraq and Iran, plus additional supply from Russia, would be required to achieve meet demand. Our forecasts suggest the EU_{25} diversifies its supply with the percentage contribution from Russia falling below 40%. However, Russia remains the dominant supplier and in the high import growth case it becomes the key swing producer, increasing its market share to meet supply shortfalls.

Significant development of gas supply by pipelines from the Central Asian Republics, Iran and Iraq is only required to meet the high import growth case. If this materialises then the geopolitical importance of these countries to the EU_{25} is significant, along with the Turkish gateway to Europe for their gas. Although this outcome is only a possibility, it seems prudent that the EU should address the geopolitical issues of Russian and Iranian control over movements of Central Asian gas by supporting the establishment of direct import routes through Turkey (ie Trans-Caspian route) in the next five to ten years if a potential EU gas supply crisis, with over-dependence on Russian gas in the period 2010 to 2020, is to be avoided.

Conclusions

The period 2007 to 2010, when major new LNG and pipeline gas projects are scheduled for completion, will be a critical period in gas-to-gas competition. Gas supply from the new development projects is chasing finite gas demand in Europe. Those projects that manage to underpin their operations with long-term contracts early in this period will have the best chance of achieving sustained economic success. Traditional linear gas supply chains to Europe are likely to evolve into networks and ultimately into a complex supply web by 2020 integrating both pipeline and LNG gas sources.

The pace of expansion of the European gas market is subject to risk and uncertainty. It will depend on commitments to large capital investments and the continued pull from the power sector. Such commitments themselves depend upon the EU's ability to agree and successfully implement strategy, internal political wrangling over energy mix (eg nuclear, renewables versus gas) and, in the case of pipeline supplies, overcoming some significant external geopolitical hurdles involving Russia, the Central Asian Republics, Iran, Saudi Arabia and Turkey.

The very large investments required to create gas supply infrastructure (both LNG and pipeline) will continue to be supported by long-term purchase agreements, with share price and volume risks between sellers and buyers. However, as a more integrated and complex web of gas supply evolves in Europe, short-term trading, spot markets and contractual flexibility will undoubtedly grow and exert more influence on regional prices. ●

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Footnotes

1. Pyke & Wood, *LNG Journal*, Nov/Dec 2004, in press.
2. The 25 countries that make up the European Union from 2004. EU country groupings commonly used for energy supply and demand analysis are shown below.

3. *BP Statistical Review*, June 2004.
4. Ibid.
5. See David Wood, *Petroleum Review*, February 2004, p38 for detailed discussion of growth in global LNG market.
6. *European Energy and Transport Trends to 2030*, European Commission Directorate-General for Energy and Transport (DG Tren), January 2003.
7. Some of the smaller EU_{25} member states (eg Cyprus, Malta and Baltic States) are omitted from Table 2 on the basis that gas consumption and import potential are small.
8. Note that the 2003 actual EU_{25} non-EU gas import volume of 245bn cm quoted in Table 1 is higher than 242bn cm supply volume quoted in Table 1. This is due to re-export to non-EU_{25} countries of small volumes of gas not accounted for in Table 1. Both sets of figures come from *BP Statistical Review*, June 2004.