

# **The Role of Liquefied Natural Gas (LNG) in the European Gas Market**

**Clingendael International Energy Programme**

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## **Abbreviations**

bbbl	billion barrels
bcm	billion cubic metres
bcm/a	billion cubic metres per annum
EU-15	European Union – Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK
LNG	liquefied natural gas
LPG	liquefied petroleum gas
MMBtu	million British thermal units
mtpa	million tonnes per annum
TPA	third party access

# **The role of LNG in the European gas market**

## **Summary**

The purpose of this paper is to discuss the role that Liquefied Natural Gas (LNG) might play in the future EU gas market. LNG imports are not likely to have a place in the Netherlands soon, but they could make an important contribution to the volume and diversity of Europe's gas supplies.

An important characteristic of LNG is its inherently high costs, throughout the whole chain, from the wellhead to the market. These costs are considerably higher than the costs of bringing oil to the market. Cost considerations, in combination with the rigidity of the gas market, have led to the use of long-term contracts as a basis for the business, as is the case for the long haul pipeline gas business. Costs have come down considerably and further cost reductions are 'in the pipeline'. While this does not alter the fundamentals of the business it has nonetheless helped to extend the reach of LNG. LNG from the Middle East to Europe has now become economically feasible.

The high gas prices of recent years have further fuelled the expansion of the LNG business. Supported by a rapidly growing global economy at the turn of this century, many prospects are under development. The positive economic outlook has seen more speculative positioning in every segment of the LNG chain, while more vertical integration has been industry's response to market liberalisation.

The more recent slowdown of the market economies has created a surplus of LNG, which is finding its way onto the markets through short-term and spot transactions. The short-term business will grow over the next few years as more LNG and shipping capacity comes on-stream. However, given underlying high costs and limited flexibility, it should be expected that new projects, currently under consideration, will only be developed on the basis of long-term contracts, thus returning to a balance between supply and demand. For these same reasons, LNG will not likely develop the same the liquidity as that of the oil market.

The global LNG market is vibrant, offers considerable prospects for growth, and could contribute to meeting the EU's growing demand for gas. However, possibly even more so than for pipeline supplies, prospective LNG supply sources have alternative markets. Competition for supplies will drive part of the market. The US gas market, in particular, with its growing need for gas imports, could become a major magnet for LNG, in direct competition with the European market. Failure to recognise this in European energy and regulatory policies could limit Europe's ability to secure this gas for its own markets.



## **Introduction**

Liquefied Natural Gas (LNG) has earned a credible position as a commercially sound, technologically safe and reliable component of the international trade in natural gas. Through a process of cooling natural gas to a temperature of minus 160 degrees Celsius, it becomes a liquid, occupying approximately 1/600<sup>th</sup> of the volume of natural gas in gaseous state. As such it can be transported at normal atmospheric pressure by ocean-going ships to far away markets, where it is landed in a receiving terminal, regasified and distributed through pipelines.

Although the LNG business started in the Atlantic Basin in the 1960s, it grew most rapidly in the Asia Pacific region, with Japan as the main market. Today, world-wide sales of LNG are just over 100 mtpa (million tonnes per annum, equating to some 138 bcm per annum). LNG accounts for some 25% of the international gas trade with approximately 25 mtpa (about 34 bcm) landed in Europe (including Turkey) compared with approximately 75 mtpa sold in the Asia Pacific markets (BP 2002).

In recent years the LNG business in the Atlantic Basin has experienced an impressive increase in activity, mainly due to decreasing development costs, higher prices of gas and growing demand, which combined contribute to creating more opportunities for old and new supply sources closer to the region.

In the Asia Pacific region LNG has enjoyed a solid position as the sole carrier of gas. For Europe and the US, however, LNG must compete with pipeline gas. With some 16–18 mtpa of new LNG committed and more LNG earmarked for supply to Europe by 2010 (PE 2002), it is worth examining LNG's ability to compete and how it will impact on the European gas market.

## **LNG Technological Developments**

The elements of the LNG chain are liquefaction, shipping and regasification. For each, advances in technology and design have led to significant cost savings and efficiency improvements, which have enhanced the competitiveness of LNG as a credible option for gas supply.

### **Liquefaction**

The liquefaction process is expensive, but four decades of technological developments have resulted in a 50% reduction in liquefaction costs. As part of this process, the optimal size of a liquefaction unit (train) has increased from 1–1.5 mtpa to a projected 4.5–5.5 mtpa and beyond for the latest generation of trains (even train sizes of 7 mtpa are now being considered).

The cost of an LNG plant is currently of the order of US\$ 250/tonne/year for a one train plant. A second train yields improved unit costs through the sharing of common facilities, to an amount of approximately US\$ 200/tonne. Projections for further cost reductions of around 20%, through technological improvements, shorter construction times and increased train sizes are becoming realistic prospects.

### **Shipping**

LNG is transported in ships, especially designed and insulated to minimise loss and maximise safety. There are currently some 140 LNG carriers in operation. The size of these ships has increased over time. The capacity of a typical state-of-the-art carrier is some 145,000 cubic metres (m<sup>3</sup>) of LNG. Further increases in size to 160,000 m<sup>3</sup> and beyond (200,000 m<sup>3</sup> is being considered) and improved insulation systems are amongst the measures that could lead to further cost reductions. The cost of a new LNG carrier is about US\$ 170–190 million (for a 145,000 m<sup>3</sup> ship) (WGI June 5, 2002, p.3), a price, which varies with availability of building capacity in shipyards.

The number of ships needed for an LNG project depends on the distance to the market. For example, an LNG project in Nigeria requires 5.5 ships for the supply of 5 mtpa of LNG to European markets, whereas deliveries of the same volume from Algeria to Europe require only two ships.

### **Regasification**

Regasification takes place in a receiving terminal in the country of destination. Essentially a simple process, the unit costs of unloading LNG carriers, storing and regasification of LNG are considerably lower than those of a liquefaction plant. Further cost reductions have been realised through shorter construction times, larger storage units and design improvements based on rationalisation of safety measures. In addition, there are synergies to be found in developing on-site power generation, as lower air inlet temperatures can increase electricity-generating efficiencies by up to 10%.

### **LNG Costs and Supply Characteristics**

The high costs of an LNG project are a characteristic that LNG has in common with long-haul gas pipeline projects. It is difficult, however, to apply a standard cost estimate to LNG projects. Costs can vary considerably, depending on many factors such as location, availability of supporting facilities and the distance to market. For the purpose of this paper it suffices to give an indication of the cost dimension of LNG projects. For example, typical costs for a 4.5 mtpa LNG project from the Middle East, destined for the European market, could be of the order of US\$ 2.5 billion, including a regasification terminal (see Appendix 1). Similarly, the unit costs of LNG show the same spread, augmented by different assumptions regarding funding costs and costs of capital. Given this qualification and using the above project



development costs, the order of magnitude of unit cost could be as much as US\$ 2.50/MMBtu for the LNG process of liquefaction, transportation and regasification at the border of a receiving country. These costs exclude the costs of finding and producing the gas, and delivering it to the LNG plant. In the Middle East these can add between US\$ 0.50–0.80/MMBtu to the costs, but benefits of condensates and LPG recovered from the gas can make the net gas costs very low or sometimes even negative.

For oil developments, the costs of taking the production to the market are only a fraction of the costs for gas, including LNG. Combined with the rigidity of the gas chain (i.e. little elasticity and the limited number of buyers, terminals and ships), these high up-front costs create a very different risk profile for LNG projects than for oil projects. For many LNG prospects, costs and risks are too high to make a project economically viable in its own right. In those cases more supportive conditions are needed to make the project feasible, such as the associated production of oil and tax incentives from the host government. Even under these circumstances, the feasibility of the project in today's price environments depends highly on the assurances of a high, uninterrupted level of LNG supply. Given the current size of the market, it is difficult to envisage such assurances without supporting arrangements in targeted end markets.

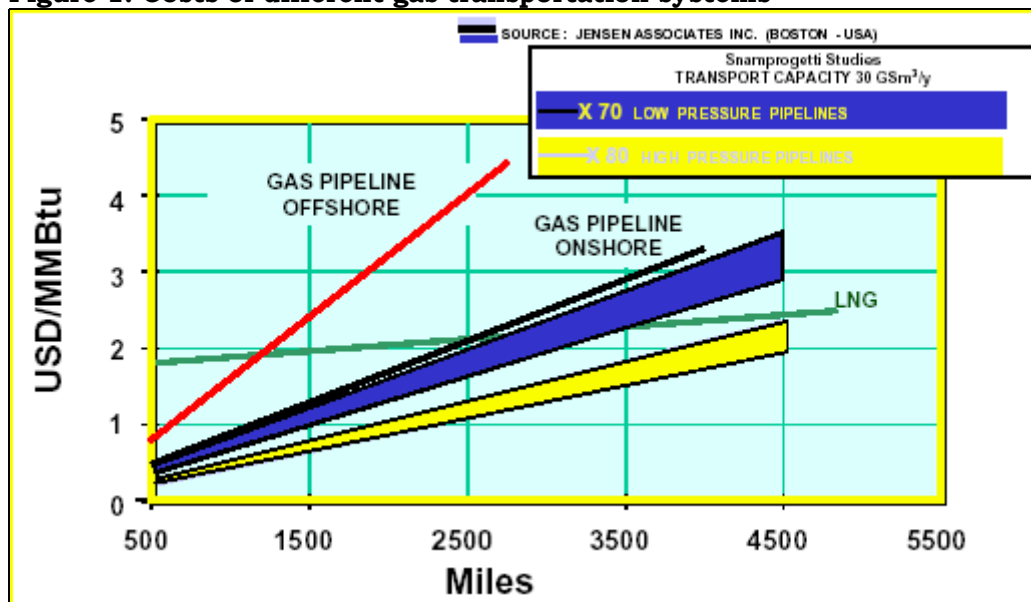
Contrary to oil, there is no global liquid market for LNG. Spot markets are developing but still represent only a small percentage of the total volumes. Moreover, this market is very sensitive to price differentials between markets and to the availability of spare terminal and shipping capacity. To achieve a high and steady off-take level, the LNG producer needs a deep understanding of specific potential gas markets, of the preparedness of buyers in these markets to purchase LNG for the long-term, and of the availability of the local infrastructure to take the LNG when production will start. This remains a key difference between gas supply and oil supply from remote locations: gas projects need the active involvement and (contractual) commitment of credit worthy buyers in the market to establish an economic and bankable basis for new supplies. The sensitivity of the economics to high off-take levels requires that investors and lenders (and participating host governments) create conditions for secure uninterrupted supplies, an aspect that is not needed in the same way for oil projects. Long-term contracts between LNG producers and buyers have thus produced efficient, well-tuned LNG chains and have provided that security to both the producing country and the receiving market.

## **LNG and Pipeline Gas**

Not every gas producer has the luxury to choose between LNG and pipelines to transport gas to export markets. Often there is only one option: either pipeline (e.g. when the source is landlocked or its seas freeze over) or LNG (e.g. in the case of intercontinental trade). But

where such a choice exists there is a marked difference in cost build-up versus distance to market (see Figure 1).

**Figure 1: Costs of different gas transportation systems**



Source: Commission for the European Union (2001), Green Paper – Towards a European Strategy for the Security of Energy Supply, COM (2000) 769 Final: p. 29.

An LNG project, along the chain from production to the market, has a high cost threshold, but distance to the market is not as crucial as for pipeline delivery. The costs of a gas pipeline project are highly sensitive to scale and the distance to the market. Where there is a realistic and politically acceptable choice between LNG and pipeline for bringing gas to a market, distance from the supply source to the market is a decisive economic factor. Southern Europe is the main market area for LNG as it lies at the far end of a long pipeline trajectory from gas supply sources into the north and the north-east of Europe (the pipelines from Algeria into Spain and Italy are relatively new); countries like Spain and Portugal rely on LNG to access competitive gas supplies (as well as for diversity of supply). North-western Europe has consistently found that pipeline gas provides a more economic option (for example, German gas companies own the site of a potential LNG receiving terminal but this site has yet to be developed).

Reducing costs of supply for LNG and pipeline gas and high gas prices at levels associated with oil prices of US\$ 20–25/bbl have improved the feasibility of gas projects. Thus more choice of supply prospects have been created, extending the economic reach of LNG and pipeline gas supplies. Another factor is the technological progress that has been made in off-shore pipe-laying, which has been demonstrated in

for example, the Trans-Magreb, Medgas and Blue Stream projects. The supply envelopes of LNG and pipeline gas are thus overlapping more than in the past. The stark distinction between LNG markets and pipeline markets, based on cost of supply has faded and more markets are now in a position to investigate both options.

Off-shore LNG terminals and on-board regasification processes are currently being discussed and developed as new ways to access markets. These are virtually always more expensive and certainly have more supply limitations than on-shore terminals. Their main attraction is that they may allow the market to get around permit problems, which are amongst the main obstacles for LNG terminals.

Costs are not the only determinant for the choice between LNG and pipeline supply. Other factors include:

- Pipelines may have to cross many countries, whereas LNG trade normally only involves the supplying and the receiving country. The absence of transit negotiations and treaties (and possibly high transit costs) simplifies the project development process in the case of LNG and makes for shorter development times (and may offer an additional cost advantage).
- ‘Security’ aspects are complex. An extended pipeline system, transiting many countries, poses supply security issues. For LNG these are more contained, as transit through other countries normally does not occur. The security exposure of ships as ‘moving parts’ of an LNG project, on the open seas or in harbours, is a different aspect which to-date has not given rise to major concern.
- Diversity of supply is yet another aspect of ‘security’. For a number of markets LNG offers a realistic alternative to a single dominant supply source.
- As the LNG market grows, so does its ability to offer flexibility of supply between markets: if a market cannot take delivery of a cargo, the ship can be redirected to another terminal. If a supply source experiences a problem, a cargo can be shipped to the market from another source (in a well-developed market like Europe this flexibility is also available from pipeline gas).
- The current economic LNG supply size is of the order of 3.5 mtpa (5 bcm/a) although this figure is still rising: long-haul pipelines need throughput volumes, and hence a market, of up to four times this volume to achieve competitive economies of scale. This can be a disadvantage in view of the capacity of markets to absorb incremental supplies of this size, unless markets (and hence buyers) can combine to acquire the supply from one pipeline.

- It has become increasingly difficult in many countries to obtain the necessary permits to build an LNG receiving terminal. This could become a serious impediment to growth.

From an environmental perspective LNG 'losses' (i.e. own use of gas) are of the order of 8–11% for the whole chain over a distance of 3000 kilometres compared with 10–11% for pipeline gas transported over the same distance. With regards to safety performance, LNG has a very good track record. Further, extensive research has established that the effect of any at sea shipping accident would not be catastrophic and would have only a limited environmental impact.

## **Commercial Developments**

The business model for the LNG industry has been the same for the last 30 years as that of for international pipeline trade. Long-term contracts of some 20 years, including take-or-pay commitments at around 90% of contractual quantities (for Europe at or close to 100%) were concluded prior to the development of the project to provide the supplier with protection of the volume risks and hence the security for the recovery of the high up-front investment costs. Prices were generally indexed to oil at different degrees, in order to protect the competitiveness of supplies in the market for the buyer.

In recent years some new developments have taken place which may affect this commercial structure and the corresponding risk balance around LNG projects. These include the following points.

### **A very bullish business climate**

The late 1990s have seen a surge of LNG activity. More gas reserves became economically viable through lower development costs and relatively high gas prices. For most of these, LNG was the only export option. A buoyant world economy foreshadowed a steep growth in demand for electricity, for which gas would be the logical fuel and LNG the supply source.

### **LNG sellers and buyers taking more risks**

In an increasingly competitive LNG market, host governments and producers have felt the need to make bolder moves and to take more risks, with the objective of managing these differently to get ahead of the competition. In a few instances (notably in the case of Malaysia Tiga) LNG liquefaction units were constructed before the full capacity was sold under long-term contracts. This occurred largely because of concerns that competing prospects might get ahead in securing markets and was helped by lower development costs and the perception of a rapidly growing market for LNG, which abated the economic risks. Downstream from the plants, positions were also taken on LNG terminal capacity for not yet secured supplies, and new LNG ships were ordered, not as part of specific project chains, but to support LNG trade in general.

### **More vertical integration across the value chain**

The old dividing lines which clearly distinguished the 'upstream' sellers and the 'downstream' buyers, have become blurred. This is partly due to the globalisation and liberalisation of the gas industry, and the quest for new supplies and markets. New LNG supply prospects are now on the drawing board with 'downstream' participants who earmark part of the LNG for their own use or sale in their own market. Similarly, producers are now becoming increasingly engaged in developing their own market outlets for new LNG.

In a number of developing countries private industry is invited to build and operate power stations, to develop the necessary gas infrastructure and to provide the gas as fuel for these plants. Often LNG imports offer the only viable option. To secure these markets LNG sellers move 'downstream', participating in the construction of LNG terminals and even in the development of these power plants. Similarly, in the competitive, more mature markets of the US and Europe, producers increasingly look to developing their own markets for LNG, as well as for pipeline gas.

The contractual framework and the risks around these vertical interests are significantly different from the traditional ones in which buyers and sellers have separate interests.

### **More spot sales from LNG projects**

Under their contractual agreements, buyers of LNG have a limited flexibility to take lower (or higher) volumes than the contracted quantities without incurring any additional costs. The 'take-or-pay' conditions apply to off-takes below this flexibility, normally to around 90% of contractual quantities.

The consequence of the economic slowdown in the Asia Pacific region has been a lower contractual off-take by a number of regular buyers. The resulting spare capacity of the LNG plants in this region and in the Middle East has led to a growth in the short-term market for LNG, with spot sales to other buyers around the world, including Europe and the US. However, so far most of this trade has no longer-term viability. The outlets for spot sales offer a positive marginal return for surplus LNG production capacity that would otherwise stand idle, but the revenues do not necessarily cover the full costs of LNG production. Spot trading is useful in the way it can respond to short-term ripples in the market, such as the current seasonal (winter) shortage of LNG in Korea, the temporary outage of nuclear capacity in Japan and occasionally high gas prices in the US. In Europe most of the spot sales are destined for Spain. Currently spot sales make up some 8% of LNG trade.

### **More flexibility in LNG sales and destinations**

Increasingly, buyers and traders acquire LNG with flexible destination options, which allow them to take LNG to markets of their choice. A concern of host producer governments and producers is the potential loss in the economic rent of their resource, as this is normally priced for specific target markets. For buyers it reduces the stranglehold arising from high take-or-pay commitments in a market that is performing below expectations.

### **The emerging potential of the US gas market**

The US gas market is finally beginning to see its indigenous supply potential run out of steam; gas prices are rising and LNG imports offer an increasingly viable and necessary supply option. The size and structure of the market, its liquidity and pricing mechanism allow it to become a 'sink' for LNG supplies. LNG receiving terminals in the US are being re-activated and plans are being made to build new ones. If sufficient import capacity can be realised, the opening of this market could have a profound effect on the total LNG market, as it may well absorb all available capacity.

### **Market liberalisation in Europe**

It is still too early to determine how significant the impact of market liberalisation will be upon the gas business. It is clear that it has altered the balance between risk and reward for buyers and sellers of gas. Both the market and the supply industry are striving to adapt to the evolving business environment. Yet, despite new opportunities that the new business environment offers, some harmful effects on the growth potential of the business must also be taken into account.

For example, a spin-off of the liberalisation of the European gas market is that LNG receiving terminals will be open to third party access (TPA). If new LNG terminals are to be subjected to regulatory intervention around TPA, tariff levels and obligations to oversize LNG terminals, this could reduce the appetite of buyers and sellers of LNG to invest. However, a growing acceptance by the authorities regarding the need to support long-term contracts and to use derogation options should help to remedy any adverse consequences for future supplies.

The costs of LNG projects are such that financing is generally a requirement. In most cases this is done through project financing, where long-term contracts (and the credit rating of the buyers) serve as an essential part of the security for the provider of third party funding. It can be expected that financial institutions will continue to look for long-term contracts with buyers as a condition for financing LNG projects. How they will discount the lower credit rating of traders and unbundled marketing companies and the (higher) market risks is still to be determined.

## The LNG supply Outlook for Europe

In order to analyse these changes in the LNG business and their implications for Europe, it is necessary to put current and potential LNG supplies into perspective of the total gas market in Europe.

Currently Europe (EU-15) is supplied with LNG from Algeria, Nigeria, Libya and Trinidad, in addition to various short and medium supplies from Oman, Qatar and Abu Dhabi.

Total supplies in 2001 amounted to around 21 mtpa (29 bcm/a) or 7% of the total EU gas market. The import situation of the EU-15 is illustrated in Table 1.

**Table 1: EU-15 LNG imports, 2001**

Importing country	mtpa	Share of domestic consumption (%)
EU-15	20.8	7
France	7.6	26
Belgium	1.7	16
Italy	3.8	8
Spain	7.1	54
Portugal	0.2	10
Greece	0.4	26

Source: British Petroleum (2002). *BP Statistical Review of World Energy*, June.

By 2010 a further 16–18 mtpa (22–25 bcm/a) is committed for supply from existing and long-term supplies from the Middle East (Qatar and Oman) and from new sources like Egypt and Norway. These are mainly destined for Spain, but will also go to Portugal, France and Italy, raising the share of LNG in the total European gas market to between 10–12% by 2010. For Spain the share of LNG will have increased up to 70%.

There are additional prospects on the drawing board from countries such as Egypt, Nigeria, Qatar, that are partly or fully aimed at the EU market. The sales and subsequent investments are still to be confirmed. If all these projects were to materialise, the total supplies to the EU would add up to a total of 85 bcm in a market of around 520 bcm by 2010.

## The Future Role of LNG in Europe

### A market perspective

Contrary to the Asia Pacific gas market the European gas market is dominated by pipeline gas. With a modest share in the EU-15 gas market of some 7%, LNG is essentially a price-taker in Europe. If all prospective supplies were realised by 2010, the share of LNG in the total European gas market would rise to some 16%. At the EU level, this would not materially change the balance between LNG and

pipeline gas. However, on a regional basis the share of LNG is more significant and growing for countries in the Southern European belt and particularly in the Iberian Peninsula. In these countries, where further pipeline gas supply potential is constrained by economic or security reasons, LNG prices could well become more independent of pipeline gas prices, even to the extent of commanding a premium over pipeline supplies, of course within the limits allowed by any competitive headroom of alternative fuels. Buyers of gas in these countries have an interest in encouraging the development of competing LNG supply options to create a buyers' market for LNG (and governments of these countries should have an interest in ensuring that sufficient terminal capacity is built in order to allow supply diversification at competitive prices). Indeed, various Spanish companies, with a reasonably secure outlet for gas, are aggressively pursuing such tactics, with a number of them also taking equity positions in LNG projects. This could well lead to a situation of over-supply in the medium-term, depending on the growth of the economy.

Lower LNG production costs and strong gas prices have not only led to a significant increase in viable LNG prospects, but have also enlarged the radius of LNG supply potential. Not only has it become conceivable to supply LNG to Europe from as far away as the Middle East, it is equally conceivable to supply LNG to countries further north than Southern Europe, such as the UK.

There are many factors that will influence the range of decisions underlying the choice of new supplies to a market.

From a supplier's perspective these include considerations such as the higher costs of supply to northern markets, the availability of lower cost markets, diversification of outlets, the long-term outlook for gas prices in different markets and the 'security of demand', which in turn depends on the competitive scene of the potential markets, the willingness of market parties to commit to purchase under long-term contracts, the regulatory regime and the availability of terminals and pipelines.

From a buyer's perspective, considerations will include the availability of competitive pipeline supplies, many security of supply issues, price competitiveness of LNG, the availability and costs of terminal and pipeline capacity, as well as the costs and conditions of building new infrastructure. Also, there can be transportation cost advantages inside the market if LNG supplies enter the market away from the main entry points for pipeline gas imports.

In the context of these complex decision-making processes, the LNG option is gradually reaching new markets in Europe. Indeed, the LNG option is now being developed in the UK.

As can be expected, the case for LNG in the UK gas market is not immediately evident. With its self-sufficiency coming to an end and a



supply gap opening up, it is logical that a full array of supply options, including LNG, comes under consideration.

The UK lies at the outer fringes of LNG supply costs for most LNG sellers, despite the fact that the transportation cost advantage in the UK from LNG entering the country on the western side plays a role in the equation. In terms of competitive supplies and availability, the UK market seems to be well positioned to take more pipeline gas from Norway and the Netherlands<sup>1</sup> to cover its needs in the medium-term (although LNG tanks could well be seen as an expensive, but valuable source of supply flexibility in the UK). Supply diversification, an important reason for LNG imports, is not nearly as big an issue for the UK as it is for those European countries that are fully dependent on imports. Supplies of Russian gas also cannot be ruled out if Russian suppliers are interested (and permitted under the evolving rules of liberalisation) in selling into the UK at market-competitive prices.

In the longer run, the situation of the UK becomes more complex. Imports of increasing quantities of pipeline gas from long haul sources east of the EU will eventually become a necessary consideration. In those circumstances the UK will find itself at the end of a long supply line. LNG should be compared with the costs of pipeline gas supply from Russia or Iran as part of evaluating cost-competitiveness of the long-term supply options. Particularly if EU policies on gas supplies and the EU market response lead to the creation of a hub in East Europe with a single price for all supplies to the West, the cost of importing such gas into the UK could well be higher than LNG imports. However, this question of long haul imports will not arise until well after 2010.

Nevertheless, early development of LNG supplies to the UK could very well happen. After all, gas supplies are competing on the basis of price rather than costs. It is possible that LNG receiving terminals will be built in expectation of relatively high UK gas prices or alternatively of a glut in LNG production creating low-priced LNG cargoes. In the latter circumstance LNG producers may be prepared to match pipeline gas prices. Finally, LNG exports to the UK may be driven by vertically integrated supplier interests, i.e. producers in need of a market for their LNG. These developments around LNG imports may well be supported by a security of supply sensitive government policy.

### **A supply perspective**

There are indications that the LNG business is going through a significant and irreversible transformation due to the forces of the changing markets and fierce competition between current and

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<sup>1</sup> Centrica bought 80 bcm of Dutch gas from Gasunie, due for delivery in 2005 over a period of ten years. A new pipeline landing in Bacton for delivery of these supplies is on the drawing board, further increasing interconnection with the European mainland (WGI, June 26, 2002, p.1).

prospective LNG producers in the region. In the new business environment producers will have found ways to accept more volume and price risks, and a substantial short-term market will exist in combination with an independent LNG commodity price.

***Acceleration could drive a change process***

There is indeed an unprecedented wave of activity around the development of new LNG prospects. Lower development costs and a relatively strong gas price have made LNG developments from gas reserves around the Atlantic and Mediterranean potentially attractive. Even LNG supplies from the Middle East to Europe are becoming an economically viable option; although not necessarily a market of first choice, the stagnating market in the East has made Europe a plausible alternative. Virtually all countries with LNG export potential are being courted by traditional and aspiring LNG producers and explore their LNG options.

These producer countries are further encouraged by strong buyers' interest, coming from a wider range of potential buyers than before: not only the traditional gas companies, but also power generators and other new entrants interested in taking trading positions. Driven by concerns of being left behind in the competitive positioning between LNG producers, and comforted by the outlook of a US supply deficit that can serve as a safety net for surplus LNG, a number of these prospects may well go ahead through their own momentum, not fully covered by dedicated, long-term supply contracts with end-markets. Conceivably, this could create a supply capacity exceeding the EU market demand and a market with an increasing volume of short- and medium-term contracts. Given the perception of impending supply surplus and hence the availability of short- and medium-term sales, buyers could become less inclined to commit to new supplies under long-term contracts. For new LNG supplier candidates, the options in such a market are limited. They can choose to wait or join the fray and accept the higher risks and uncertainties.

***But there may be a back-peddling reaction***

There are however counteracting forces, which could dampen the acceleration process.

Subsequent to the euphoria of the 1990s, producers now have to deal with sagging market economies and uncertain demand projections in the Atlantic region. Even though global long-term projections of growth in demand for gas can continue to be strong, demand projections on a national, or even regional basis can be dramatically less accurate and may well be disappointing over the short- and medium-term. In this environment it can be envisaged that host governments, producers and financial institutions become more concerned about the risks of committing to build new LNG plants without a solid outlet for the gas. In an oversupplied market losses will be incurred quickly if an LNG plant ends up producing below

capacity. Also, if in such a market intense LNG price competition were to bring prices down, host governments could see the economic rents flow away from their resource base into the downstream market. Altogether, the current 'headroom' between prices and costs for a number of prospects would be reduced. Security of demand, i.e. long-term assurances of supply off-take could therefore be reinforced as an essential precondition in the LNG business. Today, host governments and producers are offering participation in LNG projects to those who can deliver a market for the LNG.

If these aspects and sentiments persist, only those LNG prospects with already secured markets will be developed.

Likewise, downstream of LNG production, some of the bolder players could well find themselves seriously exposed with regard to speculative positions taken in segments of the LNG chain, in anticipation of growth and a proliferation of LNG supply sources. If it turns out that these expectations of business prospects and their timing do not fully materialise, a shakeout of the market is likely to follow. In such a case the LNG business would further concentrate in the hands of a limited number of 'super-majors' (integrated power and gas companies and oil majors) with significant vertical control of the business.

### **Could LNG become a game-changer?**

Initially, during the next few years, the LNG market around Europe will see a further increase in spot cargoes and short-term sales from existing and committed supply sources, with surplus LNG looking for available market outlets. LNG terminal capacity in the US will remain limited for a while. Development of new terminals in the US or Mexico will take a bit longer, given lead times and permitting processes. As regards Europe, new terminal capacity is being built in Spain, but this country may suffer from over-supply in the short- to medium-term. Other European terminals have some spare capacity, but these markets are all well endowed with contracted pipeline gas. Therefore there does not appear to be a structural shortage around Europe in the medium-term so surplus LNG will be offered to markets on a spot/short-term basis. This process will be helped by the available shipping capacity: over 50 ships are under construction (WGI June 5, 2002, p.3) and a substantial number of these are not assigned to a specified project. When these ships appear on the market, the LNG shipping capacity will be well over requirement, another ingredient for a growing spot market.

It is this prospect that will cause the wave of new potential producers to act cautiously. The LNG market is still, and will continue to be, relatively small in number of players and outlets. Producers can and will monitor (and influence through supply contracts) the available terminal and shipping capacity at least to obtain early warnings of imbalances.

Other structural factors make it unlikely that LNG will easily develop the liquidity as exists in the global oil market:

1. *The costs of handling LNG* – LNG spot markets, and particularly one of its perceived drivers, i.e. location arbitrage, will need the availability of spare shipping and terminal capacity (in addition to liquefaction capacity). There may always be temporary imbalances, but traders willing to invest in capacity for this purpose will need relatively high expectations of price differentials to justify the costs of maintaining spare capacity. In spite of all the cost reductions, the costs of producing, shipping and storing a unit of LNG are an order of magnitude higher than what they are for a unit of oil. LNG project economics being what they are, the costs of idle capacity in the LNG chain would be a serious burden, far more than is the case for the oil market. It is unlikely that expectations of price differentials will be sufficiently high for any party to invest in spare capacity. More likely, the high costs will compel the parties investing in LNG production, shipping and regasification assets to aim for organised, efficient supply chains, with a minimum of spare capacity. To achieve this, the LNG business will continue to seek full load supply conditions under long-term arrangements. Any supply flexibility that the market requires is generally more economically provided downstream of the LNG receiving terminal (storage of LNG is the most expensive form of gas storage).
2. *The requirements for project financing* – Apart from the need for long-term contracts, a condition for project finance may well be that LNG contracts do not contain any conditions precedent, i.e. that buyers must have terminal and shipping capacity in place. This will further serve to cement the supply demand balance.
3. *The growing European gas market and the growing gas deficit in the US* – Whatever regional and imbalances occur between supply and demand over the short- and medium-term, these tend to be redressed so long as the EU and US markets realise the projected strong growth. The expected average growth of the EU gas market is some 10 bcm/a (IEA 2002, p.187). Similarly the US expects a growing gas shortage. On this basis, a surplus of LNG capacity of, say, 10 bcm (the equivalent of two LNG trains), would be short-lived. Of course the regional impact could be different and could lead to serious economic pain but it would still be a matter of relatively short time for a growing market to deal with the effect of over-supply situations.

Altogether it seems improbable that the LNG market will develop into a liquid market. A spot market will continue to overcome short-term imbalances, helped by the growth of the business, by the flexibility created by vertical integration, and by additional future terminal capacity into the US market. But the market will try to avoid longer-term surpluses in capacity to facilitate short-term trade.

When expected growth does not materialise, the market dynamics can change dramatically. This is what happened to the oil market and to the US gas market. For the oil market growth continued for a very long time and was taken for granted. Year after year additional capacity throughout the oil chain was built in anticipation of further growth in demand. After the first oil shock, the oil market became stagnant. Since then, an abundance of surplus capacity in oil tankers, storage and refining capacity has changed the structure of the market, the spot market being one of the changes. Similarly the gas market in the US experienced a major loss of demand in the 1970s and '80s when the energy market moved away from gas due to ever rising gas prices. For a long time the market operated under surplus production and pipeline and storage capacity, the ideal conditions for the development of a spot market. A similar fate could await the European gas business if demand for gas were to come to a standstill (or decline).

With regards to the question of a possible spill-over effect into the rest of Europe of an over-supply of LNG in Spain, created by over-aggressive buying, the lack of considerable transportation capacity between the Iberian market and the rest of the EU will tend to limit such effect to the regional market.

### ***A single market price or tailored prices?***

Prices of LNG have always been dictated by the market and have historically been set at 'market value', based on the principle that prices should not be higher than what the market can bear, in order for the gas to remain competitive in the markets. This has resulted in price indexing with oil or oil products in practically all long-term LNG contracts. If this principle continues to be followed for long-term supply contracts, producers and buyers most probably will agree to price formulae with price criteria and indexing specific to the competitive environment of the market for which the LNG is sold.

In future, in the Atlantic region the US spot price could well play an important role in future supply contracts. Today, the US gas prices are higher than the EU gas prices. Whatever way LNG producers will use to get access to the US market, be it through short-term sales or long-term contracts or buying US terminal capacity, there will be considerable LNG traffic and possibly new LNG developments using the US spot price as their marker price. If US gas prices are consistently higher than those in Europe, this could drain future LNG supply potential away from EU markets into the US. This would require that the US build adequate import capacity.

If there were ample terminal capacity in both the US and European markets, this would tend to lead to a short-term market and could equalise price levels between the two markets. However, it looks as though the growth of receiving capacity on both sides will be slow. In these circumstances it should be possible for a buyer in the EU to lock in LNG supplies on terms competitive with other European

supplies, even if the US market offers a higher price outlook (provided the buyer can develop secure, long-term access to new terminal capacity). To ensure that supplies remain locked for use by the European markets (security-of-supply), the continuation of long-term contracts will be essential. This may imply continued price linkage to oil products, but could also mean that prices are linked to other indicators like coal, notably in the case of supply to power generators (or to NBP in the case of the UK).

Is it conceivable that different pricing regimes exist in different long-term contracts in the same Atlantic LNG market? To some extent this would not be a new phenomenon. However, whether buyers and sellers would be willing to accept this exposure in a liberalised market is uncertain and best left to be tested in the market. Arbitrage processes could to some extent help to balance price differences.

Convergence of LNG prices to a single (spot) price in such a case would be unlikely. Without sufficient liquidity in the market and given relatively high arbitrage transaction costs, it would not be possible to establish a reliable marker price.

Moreover, so long as coal and nuclear are real alternative options for new power plants, many power generators in Europe may be less willing to use LNG as the fuel for future power generation, if they do not have minimum assurances of competitiveness with coal-fired generation, by means of an agreed price formula for the longer-term.

### **How can European Policies Influence LNG Supply?**

Although pipeline gas will continue to dominate the EU gas market, LNG has an important role to play both in enhancing diversity of supply and meeting future growth in demand.

Given the objective to maximise the use of gas as the 'bridging' fuel to a sustainable energy system, it is in Europe's overall interest to encourage the development of new LNG supply sources around the Atlantic Basin and ensure the delivery of the LNG to European markets. This cannot be taken for granted. For the new LNG sources in the Middle East, Europe is not necessarily the most attractive market. If the Asia Pacific market picks up momentum, LNG suppliers from the Middle East are likely to focus on this more lucrative market, rather than on Europe with its regulatory uncertainties.

For LNG sources in the Atlantic Basin, there are the emerging markets in Latin America and particularly the large US market, which could offer more attractive alternatives.

The US market could become both a blessing and a threat for Europe. As a 'sink' for LNG supplies it will enhance the volume, if not the flexibility, of supply in the Atlantic Basin with the resulting high level of LNG developments possibly benefiting Europe. But the US could also become a major magnet for new supplies if its prices and

conditions are more favourable than those in Europe and if sufficient new LNG receiving terminal capacity is built. Realising the need to facilitate imports of LNG, US regulatory authorities are now revising their position on open access for LNG terminals, and have opened the door for 'closed access', allowing parties to build and operate terminals for their own use.

Because of the emergence of the US market and the liberalisation of the EU markets buyers and sellers will be looking for new ways of sharing and absorbing risks. The common drivers will be to enhance the efficiency of the industry and to achieve a satisfactory allocation of risks where these are best managed. In so doing the LNG will flow to those markets where the business can find that new equilibrium.

It is essential therefore for Europe to create a business climate that allows its market to lock in new supplies at competitive terms ahead of competing markets. This could imply that the fundamentals of the business model of long-term contracts hold over the long-term. It means that, if the market so requires, it needs buyers of substance, capable of entering into long-term contracts and providing credit support for project financing. It also means that the regulatory framework (and the EU price environment) needs to lead LNG producers to consider Europe an attractive market for their LNG and allow European buyers to compete effectively for the LNG supplies. A European market in which LNG sellers and buyers encounter a regulatory environment subject to change and uncertainty, or creating higher costs, or forcing a higher level or a different allocation of risks than available elsewhere, will compare less favourably with other markets.

In the emerging LNG business environment, in which three major markets and a number of emerging markets compete for the same commodity, EU policies and market players must co-operate to create the best opportunity to secure the supplies.

### **What policies should be pursued to support the imports of LNG in Europe?**

To support future projections of demand for gas as a transition fuel, Europe will have to import an additional 250 bcm/a of natural gas by 2020.

With some 50 bcm/a of new LNG supply prospects currently identified, LNG will not be able to replace the need for more pipeline gas in the EU, but it could make an important contribution to the growth of the EU gas market. EU markets and policy-makers should take advantage of the wave of LNG developments. LNG is increasingly seen by producing governments as a way to generate revenues around OPEC quota and as a viable business with growth potential. For Europe, proliferation of LNG supply sources enhances security of supply and competitiveness.

There does not appear to be a pressing need for specific encouragement of existing and prospective LNG producer countries to consider new supplies to the EU. However, 'consideration' may not be enough: given the choice of market outlets, these producers could turn elsewhere with their LNG supplies. Recognition of the long-term community of interest in matching 'security of supply' and 'security of demand', sought by EU and the supplying countries will be an essential precondition for positioning Europe in the race for supplies. This implies appreciation and, where possible, accommodation of the main supply conditions that matter to the producing countries and to the prospective buyers of LNG. Measures that are likely to harm such conditions include:

- Obstacles to long-term LNG deals;
- Obstacles, both from an economic and a regulatory perspective, to creating cost-effective LNG terminal capacity capable of taking new supplies under long-term capacity contracts to match LNG supply contracts; and
- Uncertainties around the regulatory regime, such as the risk of significant changes affecting the risks and/or the economic rent of the supply chain after the producer and buyer have become captive players.

More terminal capacity will be key in attracting more supplies. Particularly in view of the competition with the US for future LNG, European decision-makers, when setting the regulatory environment for investment in terminals in the EU, will need to take into account the new conditions for new terminals in the US. In line with the direction followed in the US, 'closed access' for European terminals, combined with the assurance of a stable regulatory environment, may have to be among the enabling measures.

To the extent that these conditions compromise the envisaged measures around the liberalisation of the market, it should be considered that they might well outweigh the perceived benefits of liberalisation.

Too often, however, the discussion around securing future supplies starts in a different arena from the one where the efforts are co-ordinated to further restructure the gas market around the liberalisation theme. The result is often seen as rear-guard action, uneasy patchwork and compromises around a mental model of a competitive market. What is needed is that the aspects of long-term security of gas supply are embedded in a vision that can be integrated with the vision of the market economy. This vision should be owned by the same parties that are now rolling out the latter in order to obtain a balanced, long-term policy basis, that is shared between regulating bodies and the gas industry and that will be understood and appreciated by those countries on whose future supplies the EU will depend.



Finally, it should be the industry, i.e. the market that serves as the conduit for the LNG business with governments providing supporting framework regulation. Government-to-government involvement in deal making (e.g. as was the case with the first Algerian LNG exports to Europe) has the capability to distort market conditions for a long time.

## **Conclusion**

The LNG market has evolved within a few years from a predominantly regional market to an international market. This development offers opportunities for previously stranded gas to be exploited and brought to new markets or markets that could earlier only be reached by pipeline gas. For oil exporting countries, the development of gas exports could provide the much needed diversification of income from oil exports and the accompanying long-term contracts could provide the countries with a certain degree of income stability.

The expansion of the LNG market has brought new challenges and opportunities to gas consuming countries as well. In the right regulatory environment it offers both the possible expansion of the gas market and the possible diversification of source and origin. These are important energy policy objectives for many governments of consuming countries. The benefits of expanding the gas market have been discovered by many consumer countries. Europe, if interested in developing this market potential, must take competition from these other markets and the particular characteristics of the LNG business into account, if it wants to realise these potential LNG imports.



## Appendix: Investment costs of an LNG project

Typical costs for a 4.5 mtpa project from the Middle East, destined for the European market, exclusive of upstream gas development could be of the order of

	Costs (in million US\$)
Liquefaction	900 – 1200 (depending on the location / port availability)
Shipping	850 – 950 (typical cost of 5 ships required for a plant based in ME (e.g. Oman) serving Spain)
Regasification	300 – 400
Total	2050 – 2550

Assuming a throughput of 90% or more of capacity, typical unit costs for LNG from the Middle East to Europe would be:

	\$/MMBtu
Upstream gas costs	
Liquefaction	1.00 – 1.20
Shipping	0.80
Regasification	0.40 – 0.50
Total	> 2.20 – 2.50



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