LNG industry in Europe beset by uncertainties

Over the past five years, the liquefied natural gas industry (LNG) has metamorphosed from a specialist niche business into a mainstream source of energy supply. It is currently by far the fastest-growing source of fossil fuel – and growth forecasts range from bullish (7%/year) to stratospheric (10%/year). However, the industry's future is beset by uncertainty, not least in Europe. Supply is tight, technical skills are hard to come by, and even future demand looks uncertain.

By Alex Forbes

RasGas heat exchanger.

Some weeks ago, a large, strangely shaped ship in bright orange and white livery anchored off the Skaw, off the northern tip of Denmark, on a special mission. There she awaited instructions to travel north of the Arctic Circle – to the Norwegian island of Melkøya in the Barents Sea – to pick up the first-ever commercial cargo of liquefied natural gas (LNG) to be produced in Europe.

Thus, in early October, did the Arctic Princess began her historic task. Having berthed at the Snøhvit liquefaction plant at Melkøya, she loaded her four spherical 45-metre-diameter storage tanks with LNG, cooled to a cryogenic temperature of -163ºC. She then prepared to sail to Spain, where a special facility called a regasification plant would turn the liquid methane back into natural gas for supply to the Spanish market.

Future cargoes from Snøhvit, the world's northernmost liquefaction plant, are likely to go primarily to the United States and Spain but they could in theory go anywhere that has a regasification terminal with the appropriate facilities for the type of tanker used. Norway, which for decades has been a major exporter of pipeline gas to Europe, will thus be able to export a proportion of its gas to any of the world's three major regional gas markets: Europe, Asia and North America.

This inherent destination flexibility of LNG has been a prime factor behind the industry's rapid growth of 7.7%/year over the past decade, and especially over the past five years. Indeed, in 2006, according to statistics published by the Paris-based industry association Cedigaz, LNG accounted for all of the 2.5% growth in international natural gas trade.

To some extent this was an accident of timing, in that little new cross-border pipeline capacity came on stream that year (two major new pipelines into the UK did not begin operation until the fourth quarter and their flows were offset

The Arctic Princess has a capacity of 147.000 cubic metres of LNG, sufficient to cover the yearly energy consumption of all households in a city with a population of 45,000 people.

by declines elsewhere). It does, however, underscore the increasingly important role that LNG is expected to play in world natural gas trade.

Moreover, this role will involve not just the movement of substantial and growing volumes of gas – LNG accounted for close to a quarter of all international gas trade in 2006 – but will also create price linkages between what were previously isolated regional markets. When people talk about the globalisation of natural gas markets, it is LNG that they have in mind as the main vector.

The basic principles behind LNG are straightforward: produce your natural gas. Cool it to below -162°C until it becomes a liquid. Ship it to market in large thermally-insulated tankers. Heat the liquid until it turns back into a gas. And feed the gas into a distribution pipeline network. It may sound simple, but until relatively recently the complexity and cost of the technology meant that LNG was a niche fuel.

The complexity of the hardware was matched by the complexity of the commercial arrangements put in place to ensure that billion-dollar investments would earn an appropriate return. These arrangements were underpinned by contracts with terms of 25-30 years, to match the expected life of the producing assets. So rigid were the terms of these contracts – particularly in specifying the destination of LNG cargoes – that LNG projects were sometimes described as 'virtual pipelines'.

So, for three-and-a-half decades from the beginnings of the industry in the mid-1960s, it remained a rather exclusive club. Then, in the early years of this decade, came a conjunction of circumstances that was to revolutionise the industry.

In the US and in the UK, natural gas demand was continuing to rise while indigenous production declined. Meanwhile, the LNG industry had been quietly evolving: technology costs were on a steady downward path; new players were entering the club; and a degree of flexibility was entering into the commercial arrangements as the industry began to mature.

By the time of the triennial LNG 14 conference – which took place in Doha, capital of Qatar, in 2004 – it was clear that the industry had reached a turning point and that LNG was on the verge of an era of unprecedented growth.

As far as Europe is concerned, LNG's attractiveness increased at the start of 2006 when Gazprom cut off its supplies to the Ukraine. The political repercussions of that event continue to reverberate today.

With Western Europe heavily and increasingly dependent on gas imports from Russia, there has since been much talk of the need to diversify energy sources. One consequence was a new enthusiasm on the part of several European countries to build regasification terminals to allow the importation of LNG. Another was renewed enthusiasm for nuclear power.

Three years on from LNG 14, at LNG 15 – which took place in Barcelona in April of this year – it was fascinating to look back at how far the industry has travelled in just three years. It has become larger and more commercially sophisticated; Qatar has overtaken Indonesia as the largest producer; regasification capacity is booming, especially in the Atlantic Basin; the number of LNG ships on order is at an all-time high; and several new countries are on their way to joining the LNG-producing club. Equatorial Guinea began exporting LNG in May, Norway will do so this month, and Russia, Yemen and Peru will start in 2008, 2009 and 2010, respectively.

'There are now serious concerns that there will be a supply crunch by 2010'

It remains true that the industry is dominated by long-term contracts and will continue to be for the foreseeable future. But contracts have become increasingly flexible, particularly as regards destination, and spot and short-term trading is on the rise. In 2006 it accounted for some 12% of LNG trade, enough to send price signals between regional markets as traders seek the best deals.

A common message at recent international gas conferences has been that the industry expects LNG demand to grow rapidly over the coming decade-and-a-half. Growth projections have ranged from the bullish (7%/year) to the stratospheric (10%/year).

In 2006, LNG trade grew to 211 Bcm or 159 million tonnes, 11.7% up on 2005, according to provisional figures published by Cedigaz. Moreover, adds Cedigaz, over the past decade, the LNG industry's output has grown on average by 7.7%/year.

Taking 211 Bcm in 2006 as the base figure, growth of 7%/year – the average projection made by Cedigaz's Secretary-General, Marie-Françoise Chabrelie – would take demand to 388 Bcm (291 million tonnes) in 2015, and to 544 Bcm (409 million tonnes) in 2020. In fact, Chabrelie forecasts a growth range of 6.5-7.5%.

Growth of 10%/year – a projection made by Shell's ceo, Jeroen van der Veer, at the World Gas Conference in June 2006 – would take demand to 498 Bcm (374 million tonnes) in 2015, and to 801 Bcm (602 million tonnes) in 2020.

In a review of natural gas markets published in mid-2007, the International Energy Agency projects that LNG production capacity will rise to 500-600 Bcm/year by 2015, equivalent to annual average growth rates of 7.5-9%, adding yet more support to the 7-10%/year consensus.

However, these forecasts tend to assume that supply will not be an issue, which no longer looks realistic. It was clear at LNG 15 that many in the industry are concerned about its ability to deliver such large volumes in the prevailing business environment – and these concerns have only intensified in recent months.

At LNG 15, Mohamed Hassan Marican, president and ceo of Petronas, Malaysia's national oil company – one of the major-league LNG exporters – stressed that there had been few new project launches in recent times. Contrary to expectations at the start of 2006, the only green-field liquefaction project to reach final investment decision last year was Peru LNG. Moreover, several projects currently under construction are facing long delays. 'There are now serious concerns,' said Marican, 'that there will be a supply crunch by 2010'.

What really concerned Marican was that buyers' confidence in the LNG industry should not be undermined. 'Security of supply is of paramount concern to buyers,' he stressed. 'Should the global LNG industry appear in any way to be unable to provide the comfort of supply, we are certain to face a credibility and reputational problem. The LNG industry will need to confront a major issue of potential buyers losing confidence in LNG and turning to alternative sources.'

Yet even today, LNG supply has become so tight that there is unmet demand because consumption is being constrained by the availability of LNG cargoes.

This is readily apparent in the market for spot and short-term LNG, notably in Europe, where several existing regasification facilities have been little used this year because cargoes have been diverted to more lucrative markets. In recent months this has meant primarily Japan, still by far the largest market for LNG, where problems in the nuclear industry have led to Japanese utilities being happy to pay $12-12.50/MMBtu for spot LNG cargoes so that gas-fired power stations can make up the shortfall caused by the shut-down of nuclear electricity generation capacity.

As the industry goes into the winter, the big unknown is what the South Koreans intend to do. Korea Gas Corporation (Kogas), the world's largest single LNG buyer, has a habit of leaving things to the last minute. But Korean winters tend to be bitter, so that peak winter demand can be five times the summer minimum. This notorious level of swing has made managing the national natural gas supply and demand balance a major challenge for Kogas. If it does decide to get into the spot market in a big way, buyers elsewhere, including Europe, may well find Kogas outbidding them for much-needed winter cargoes.

In the medium to long term, the industry faces four main challenges: access to natural gas reserves; cost inflation in both raw

LNG Exports – 2006

Country	Ranking	Exports	
		Bcm	Mt*
Qatar	1	31,09	23,4
Indonesia	2	29,57	22,2
Malaysia	3	28,04	21,1
Algeria	4	24,68	18,6
Australia	5	18,03	13,6
Nigeria	6	17,58	13,2
Trinidad & Tobago	7	16,25	12,2
Egypt	8	14,97	11,3
Oman	9	11,54	8,7
Brunei	10	9,81	7,4
UAE	11	7,08	5,3
USA	12	1,72	1,3
Libya	13	0,72	0,5
Total		**211,08**	**158,7**

Source: Cedigaz (provisional figures)

Notes:
* Figures converted from billion cubic metres (Bcm) using the formula 1 Bcm = 0.752 Mt
Equatorial Guinea became the 14th exporter of LNG in 2007, while Norway is just will become the 15th in October 2007. Three other countries are constructing their first liquefaction plant: Russia (due on stream in 2008), Yemen (2009) and Peru (2010).

LNG Imports – 2006

Country	Ranking	Imports	
		Bcm	Mt*
Japan	1	81,86	61,6
South Korea	2	34,14	25,7
Spain	3	24,42	18,4
USA	4	16,56	12,5
France	5	13,88	10,4
Taiwan	6	10,20	7,7
India	7	7,99	6,0
Turkey	8	5,72	4,3
Belgium	9	4,28	3,2
UK	10	3,56	2,7
Italy	11	3,10	2,3
Portugal	12	1,97	1,5
China	13	1,00	0,8
Mexico	14	0,94	0,7
Puerto Rico	15	0,72	0,5
Greece	16	0,49	0,4
Dominican Republic	17	0,25	0,2
Total			**158,8**

Source: Cedigaz (provisional figures)

Notes:
* Figures converted from billion cubic metres (Bcm) using the formula 1 Bcm = 0.752 Mt
Small volumes imported by Norway to commission Snøhvit plant are not included.
Countries currently constructing their first LNG regasification facility include Canada (due on stream in 2008) and Chile (2008).

The rim land policy that was practised during the Cold War is still applied. Although, especially on the Western border, the line has come closer to Moscow: heartland has become front land here. New in the geopolitical game are the two 'strategic axis's' developed by Moscow with Beijing and Teheran. These axis's determine the means applied to defend interests in these regions, especially in resource rich Central Asia.

materials, such as steel, and contractors; the availability of contractors able to handle large engineering, procurement and construction (EPC) projects; and the availability of skilled operating staff, in the case of onshore projects, or qualified seafarers, in the case of shipping.

Gaining access to gas reserves is becoming more difficult because most such reserves are controlled by national oil companies (NOCs) rather than international oil companies (IOCs). This means that if IOCs want to gain access they need to partner up with a NOC. A recent upsurge of what has become known as 'resource nationalism' has made such partnerships more difficult to put together.
This is especially true in the two nations that hold the largest reserves of natural gas: Russia and Iran. Both have ambitions to develop large LNG export industries but neither has yet made much progress, with the exception of Russia's Sakhalin Energy project. That project began its life without Gazprom involvement, something the Russian state belatedly felt it had to address, leading to a politically messy deal that gave Gazprom a controlling interest. Relationships between IOCs and NOCs have been the subject of much debate at energy conferences over the past two years.
The issue is complicated by the fact that while IOCs tend to have similar characteristics, NOCs vary enormously. At one end of the spectrum are mature NOCs, such as Norway's Statoil and Malaysia's Petronas, which share some characteristics of IOCs. At the other are fiercely nationalistic companies such as the National Iranian Oil Company (NIOC) and Petróleos de Venezuela SA (PDVSA).

Moreover, competition for access to reserves is emerging within many resource-rich countries as domestic demand grows faster than expected. This is especially true in the gas-rich regions of the Middle East and North Africa, where rapid economic development and population growth have sent demand for gas soaring. Countries now struggling to meet growing domestic demand include Iran (a net importer), the United Arab Emirates (about to become a net importer), Saudi Arabia (no plans to export gas for the foreseeable future) and Egypt (also struggling to find enough gas to expand its two LNG projects).
Even Qatar, which is ramping up LNG and pipeline gas exports rapidly, has said that when its current moratorium on further development of the North Field is lifted, the need to satisfy burgeoning domestic demand will take priority over more exports.

The issue of cost escalation has also been a major theme of all recent energy

No longer such an exclusive club

During the early decades of LNG development, the industry was a rather exclusive club. There were only a handful of producing nations, a handful of importing nations, and everyone knew everyone. That began to change during the late 1990s as the number of producing and importing nations began to grow. By the end of 2006, there were 13 producing nations and 17 importing nations, and the numbers continue to rise.

Equatorial Guinea joined the producers club when it shipped its first cargo in May while Norway shipped its first cargo in October. Russian's Sakhalin Energy Project is due on stream next year, while Yemen LNG is now expected to come on stream in 2009, to be followed by Peru LNG in 2010 – at which time there will be 18 LNG-producing nations. A decade ago the two largest producers were Indonesia and Algeria, but both have fallen behind newer producers. Qatar, which exported its first cargo just over a decade ago, is now the largest producer, while Malaysia has moved into third place. Algeria, which suffered a huge explosion at its Skikda plant in 2004, has slipped into fourth place. Meanwhile, Indonesia is struggling to find sufficient gas to utilise all its production capacity and to meet domestic demand, so is likely to continue slipping down the league table.

So far as growth is concerned over the coming decade, the nations to watch are Qatar, Nigeria, Australia and Libya. Iran, which has the world's second-largest proved reserves of natural gas, has long had ambitions to become a major LNG producer, but is still years away from exporting its first drop of LNG.

conferences – not just gas events – because it is leading to postponement or even cancellation of projects. Mohamed Hassan Marican's concerns about a looming 'supply crunch' are largely based on this issue: 'We currently have a situation,' he said, 'where LNG demand will continue to register strong growth, while on the supply side, rising costs of building new LNG facilities will curb and cap growth. Although technological innovations have contributed to lower capex due to improved economies of scale prior to 2004, new LNG projects are expected to cost much more. Capex for a tonne of capacity is today estimated at US$1,000 compared with US$200 in 2000.'

The award to engineering company KBR a few months ago of a $2.8 billion engineering, procurement and construction (EPC) contract for a new 4.5 mtpa liquefaction 'train' in Algeria gave an interesting insight into how capital costs of liquefaction plant have evolved. It came in at a specific capital cost of $620/tonne of annual capacity.

Concerns about supply are now being joined by concerns about demand

Availability of contractors has become another big issue. It was interesting to see, for example, that the EPC contract for Peru LNG went to Chicago Bridge & Iron (CB&I) – a company better known for constructing regasification terminals and storage tanks – rather than one of the usual gas liquefaction EPC contractors. CB&I has experience of mechanical erection of LNG liquefaction plants in Malaysia, Nigeria and Australia, and a good reputation as a competent EPC contractor. There are, however, concerns that if the contractor shortage continues, less reputable and competent firms may end up in charge of major LNG projects.

There is also the issue of the availability of people with the skills to operate complex projects and ships. As James MacHardy of the Society of International Gas Tankers and Terminal Operators (SIGGTO) commented in Barcelona: 'Never before has the global fight for sea-going technical talent been tougher.'

Concerns about supply are now being joined in some markets by concerns about demand. In Europe numerous proposals for new regasification projects have been put forward and several large projects are currently under construction. It is no longer clear that there will be sufficient demand to fill all the proposed capacity even without taking into account the tightness of supply.

The UK is a case in point. It already has two new LNG terminals, one at Isle of Grain, and another at Teesside (the GasPort project), while a third, Dragon is due on stream before the end of the year, and a fourth, South Hook, is due on stream next year. However, a combination of high prices in other markets and the coming on stream of major new pipelines from Norway and the Netherlands have meant that Isle of Grain has been little utilised in recent months. Moreover, Petronas recently cancelled a contract with Centrica for gas that was to utilise the Dragon terminal, while Qatar has been seeking alternative markets for much of the gas that was supposed to be imported at South Hook.

The now-commonplace volatility of natural gas prices, worries about medium to long term LNG supply, and the uncertainty that surrounds many large pipeline projects proposals (such as Europe's Nabucco venture) have all combined to make the future for LNG in Europe highly uncertain. For the coming decade at least, it is likely to be a white-knuckle ride – not for the faint-hearted. ■

Marc Verwilghen, the Belgian Minister of Economic Affairs, shakes hands with Abdullah Bin Hamad Al Attiyah, Minister of Energy of Qatar, at Zeebrugge, where they welcome the first delivery of Qatar's LNG to the Fluxys Terminal in Belgium.

Billion-dollar business dominated by a small Gulf emirate

When it comes to the production and export of LNG, one country has emerged as overwhelmingly dominant. That country – Qatar in the Gulf – is one of the world's smallest. By 2010 it is expected to have a population of around a million people, of which fewer than a quarter will be native Qataris. And yet it expects to be exporting some 77 million tonnes per annum (mtpa) of LNG, between a quarter and a third of total projected supply. This will make Qatar the richest nation on earth, on a per capita basis.

It is ironic therefore that Qatar's gas development took a long time to get going. Qatar's LNG business is founded on a huge gas resource called the North Field, the world's largest non-associated gas field. Its 900 trillion cubic feet (Tcf) of natural gas make Qatar the world's third-largest holder of proved gas reserves, after Russia and Iran. The North Field was discovered in the early 1970s but Qatar did not ship its first cargo of LNG until January 1997. To begin with Qatar had ambitions to export gas within the region via a network of pipelines. However, the politics of the region would have made constructing such a network difficult and there was little demand for such projects.

Ironically, times have changed and several of Qatar's neighbours – such as the United Arab Emirates, Bahrain and Oman – urgently need to step up gas imports. Earlier this year substantial amounts of North Field gas started to flow to Abu Dhabi through the new Dolphin Energy Pipeline.

However, says Dr. Ibrahim B. Ibrahim – economic advisor to the Emir and Vice-Chairman of RasGas, one of Qatar's two sister LNG companies – back in the 1980s and early 1990s, Qatar's neighbours, awash with oil, did not see a need to import natural gas.

Qatar therefore turned towards LNG as an export option. However, that too presented daunting obstacles. To make the most of the North Field reserves, 'Qatar needed to become a world-scale supplier' says Dr Ibrahim. But its location meant that, given the economics of the LNG business at that time, only Asian markets such as Japan and South Korea looked within its reach.

Even these markets were sceptical when Qatar first approached them, he says. At that time Qatar had gas, but no port, no gas liquefaction technology and no commercial LNG expertise.

Undaunted, the Qatari government invested in constructing a port at Ras Laffan and set out to woo partners that could bring technology and experience of the LNG business.

'It took a lot of courage from the government to build a port that cost more than a billion dollars with no assurance from the market,' says Dr. Ibrahim.

Won over by guarantees on return on investment, Total and Mobil (which later merged with Exxon to form ExxonMobil) became the major foreign investors in Qatar's nascent LNG industry, along with a number of Japanese companies. 'We made a lot of sacrifices to get started,' says Dr. Ibrahim.

By 2000, Qatar had become a significant supplier to Japan and South Korea, with gas to Japan coming mainly from three 2 mtpa trains at Qatargas, and gas to South Korea coming from two 3.3 mtpa trains at RasGas. That gave Qatar a combined export capacity of 12.6 mtpa.

But this was nowhere near enough, says Dr. Ibrahim, given the scale of the North Field reserves, and so Qatar began working on a strategy that would enable it to reach markets outside Asia in Europe and North America. So what was this strategy?

'Two things,' says Dr. Ibrahim, 'Cut on costs. And then sell the brand name, rather than gas. So what does 'brand name' mean? It means a lot of things. It means you have to be on time every time. And we proved this. You have to be flexible with your long-term partners. So if they need something you give it to them. You have loyalty to them. And you have to respond to the market quickly. Many times we beat our competitors because we could deliver earlier.

'And we cut costs by achieving economies of scale. We did this in the LNG trains, going from 2 mtpa to 3.3 mtpa to 4.7 mtpa to 7.8 mtpa. And in ships we went from 135,000 cubic metres (cm) to 145,000 cm to 210,000 cm to 270,000 cm.

'The size we have helped us do it – but at the same time we took risk on this in every aspect of it. That, we realised, was the only way we could become a world-scale supplier.' Today Qatar has eight LNG trains in operation with a combined capacity of 30.7 mtpa, more than enough to make it the world's biggest producer. Another six trains, each with capacity of 7.8 mtpa, making them the world's largest, are due on stream by 2010/11. ■

The first of Qatar's six 4.8 mtpa mega-trains is under construction. Each of these huge installations is about one kilometre long.

A tanker loading a cargo at Ras Laffan Industrial City in Qatar. Photos: Alex Forbes.