



LNG To The Rescue?

Posted by [Dave Cohen](#) on November 27, 2006 - 6:27pm

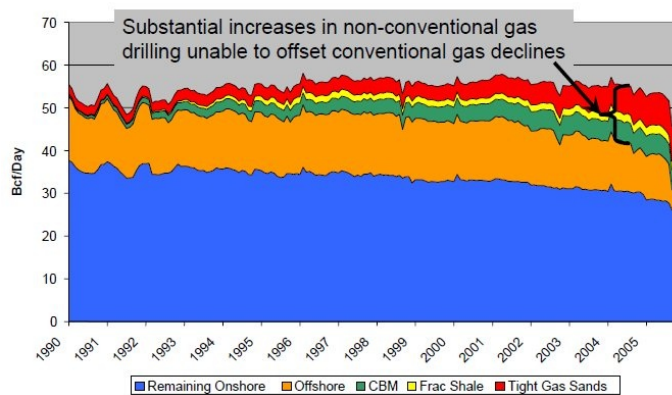
Topic: [Supply/Production](#)

Tags: [fungibility](#), [liquefaction](#), [lng](#), [lng market](#), [regasification](#), [shipping](#), [us imports](#)
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As even a casual reading of the story [The North American Red Queen: Our Natural Gas Treadmill](#) indicates, the importance of future [Liquefied Natural Gas \(LNG\)](#) imports to North America can hardly be overstated.

Historical Gas Production

By Resource Type – U.S. Lower 48 States



Declining U.S. Lower 48 Natural Gas Production

Source: [North American Oil & Gas Plays Focus on the Non-Conventional](#) (pdf) from IHS Energy

The decline in output is 2.2 trillion cubic feet (TcF)
off the 2002 baseline

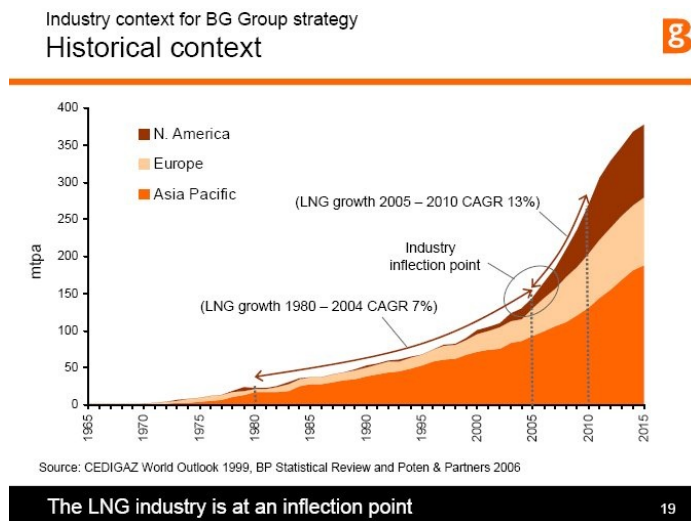
Figure 1 — [Click to Enlarge](#)

This story will discuss the emergence of a globalized LNG market and the ability of that market to supply the high volumes of LNG that the United State will need to avoid future shortfalls. Will such a globalized market really come to pass? What form will it take? What does the current LNG market look like? How will the United States become integrated into the expanding LNG trade? These are the questions we shall examine here.

1. The LNG Market — This Moment in History

In the grand scheme of things, the idea is that the globalized LNG market of the future will make natural gas a *fungible commodity* worldwide. Newbuild LNG requires huge capital expenditures for liquefaction trains, tankers and regasification terminals. Heretofore, transporting natural gas has been *mostly* constrained by the existence of pipelines, excepting the robust LNG trade in

Eastern Asia. LNG is now at an inflection point, as shown in *Figure 2*

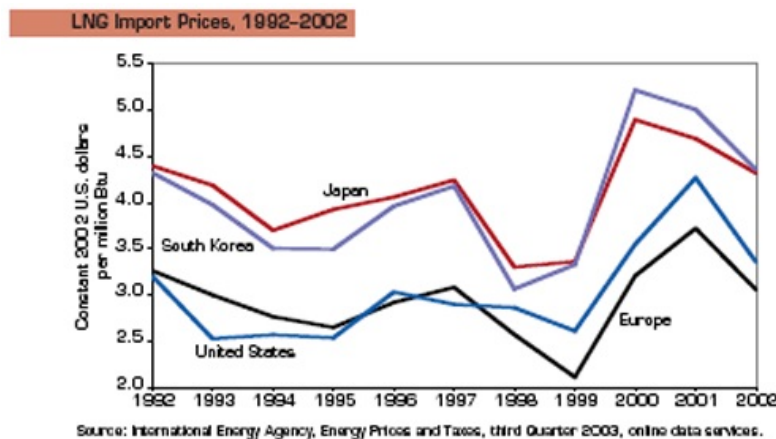


*An Inflection Point for the global LNG Market
A 13% compound annual growth rate (2005 to 2010)
From a presentation by the [BG Group](#) (pdf)
Figure 2 – [Click to Enlarge](#)*

As you can see, the global LNG trade is projected to expand about 150% by 2015 with a large share of new exports going to the United States.

2. The LNG Market – Past and Present

LNG trading is regional because it takes place in two large separate markets, the *Atlantic Basin*—west of Suez— and the *Pacific Basin*—east of Suez. As *Figure 3* from the EIA's [World LNG Market Structure](#) shows, prices & volumes have been historically higher in the Pacific Basin.



*Sample prices in the Atlantic and Pacific Basins
LNG prices are usually expressed in U.S. dollars per million
Btu (MMBtu) \cong 1,000 cubic feet of natural gas (Mcf)
Figure 3 – [Click to Enlarge](#)*

Because the Asian countries have little access to natural gas pipelines and have little or no domestic production, LNG [imports](#) have provided the bulk of their natural gas supply.

Three countries in the Pacific Basin - Japan, South Korea, and Taiwan - accounted for 68

percent of global LNG imports in 2002. Seven European countries received 28 percent of global imports, while the United States imported the remaining 4 percent.

Japan has long been the world's largest LNG consumer, importing 2.6 Tcf (54.6 million tons) of LNG in 2002. However, the Japanese share of the global LNG trade fell from 66 percent in 1990 to 48 percent in 2002.

Demand for LNG and prices fluctuate seasonally, particularly in the Atlantic Basin (Spain, the U.K., the U.S.) but also in some Pacific nations like Korea. As the EIA notes, past EU prices have been linked to competing fuel prices, such as low-sulfur residual fuel oil. In Asia, prices have been traditionally linked to the price of crude oil. In the United States, the EIA states that:

In the United States, the competing fuel is pipeline natural gas, and the benchmark price is either a specified market in long-term contracts or the Henry Hub price for short-term sales. Importers and exporters involved in U.S. LNG transactions are exposed to a significant level of risk given the high degree of price volatility in U.S. natural gas markets.

Here's an [example](#) of many of these factors at work, published on October 23rd of this year.

Shipments of liquefied natural gas (LNG) to Europe are running close to record levels as the continent prepares to meet peak demand in the cold winter months.

Import terminals in Spain, Belgium, Britain and elsewhere are operating at full capacity to take in cargoes attracted by European prices that remain higher than those offered in the US market, though not above levels in Asia.

"All the terminals are full," an LNG trading manager at a major energy company said. "European prices have been high since the summer, they are still very high. I think imports this year will probably be higher than last year."

"There are some spot cargoes coming in, but it's getting very difficult to find a place to put them (because of the squeeze on import capacity)," he said.

Another industry source said cargoes had recently been diverted away from Spain, Europe's largest importer of LNG, because of a lack of available storage space.

Obviously, there are price disparities in the LNG Atlantic Basin market and no global benchmark price exists.

LNG trading has always been dominated by long term contracts and low liquidity. Despite the rare story about an LNG tanker bound for the U.S. which is diverted to Spain, the spot market is miniscule. However, there is great flux in both contracts and pricing. Despite many new players—both importers such as [India](#) (Dahej regasification terminal) and exporters such as [Egypt](#) (Idku liquefaction plant)—entering the market, new contracts, while more flexible than in the past, are still mostly long term deals, though there are now some shorter term (1 year) contracts. BG Group's [LNG Top to Bottom -The Pure Play Perspective](#) presentation indicates that approximately 12% of the 2005 LNG trade consisted of short term & spot contracts

Although one would think that many new players in the LNG market would put downward pressure on price, demand is high and supply is tight—it is a sellers market. For example, China just inked a 25 year, \$25 billion deal with Petronas (Malaysia) for LNG delivery to start in 2009. [The Australian](#) recently reported on the situation.

Malaysia's government-owned Petronas has signed a contract to supply Shanghai with liquefied natural gas for 25 years, at the rate of \$US 6.34 (\$8.25) per million British thermal units [mmbtu].

This is below today's market price but still more than double the \$US 3.10 the Australia LNG consortium is receiving through its 25-year contract to supply Dapeng terminal in Guangdong, which started in June.

The only other LNG contract signed by China - all are through the state-owned China National Offshore Oil Corp - is with BP's Tangguh project in Indonesia's Papua province, to supply the southern province of Fujian from early 2009.

The price originally agreed for Tangguh's LNG was even lower than that from Australia's North West Shelf: \$US 2.49/million btu.

It is noteworthy that, unlike in the past, these Asian contract prices are *not tied* to the crude oil price. BG Group (Egyptian LNG) expects the market tightness to hold until at least 2012, as shown in *Figure 4*.

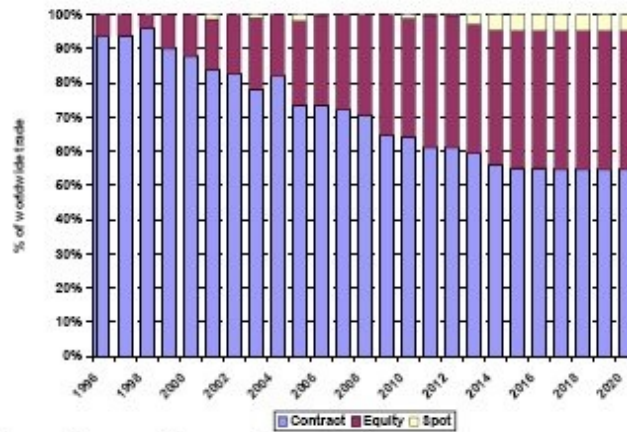


LNG Supply & Demand
Figure 4 -- Click to Enlarge

Supply tightness in the Pacific Basin has been aggravated by [declining production](#) in Indonesia—the world's largest LNG supplier—and, in the Atlantic Basin, delays in bringing Norway's [Snohvit LNG](#) liquefaction capability onstream.

According to the Simmons & Company report [Liquefied Natural Gas](#) published in April of 2005, spot sales will continue to be negligible, but there will be a growing *equity* trade as shown in *Figure 5*.

Worldwide LNG Trade Mix



Source: Simmons & Company International

The LNG Trade Mix – Projected Long-term Contracts, Equity Positions and Spot Market
 Figure 5 – Click to Enlarge

Growth in worldwide LNG portfolios and deregulation in European and U.S. LNG import markets have enabled the recent emergence of a revised, "integrated" LNG strategy. Whereas Japanese LNG markets continue to operate under take-or-pay contracts with regulated utilities as buyers, the U.S. and European markets appear to be evolving on the basis of tolling-style arrangements whereby suppliers of LNG can obtain access to the deregulated natural gas end market by paying an operating fee to the regasification terminal owners and still maintain rights to the gas at the other side of the terminal... As an alternative to the tolling arrangement structure, some large integrated players are taking equity ownership interests in new [regasification] terminals. This has become a more viable option in the U.S. following the FERC's Hackberry decision, which set a precedent for closed-access terminal structures, which, unlike rules for pipelines, allow terminal operators to restrict access to imports through their facilities.

Note: Prior to the FERC's [Hackberry decision](#), open access to U.S. LNG regasification terminals was required. As the Simmons report notes, "... rather than being forced to operate on a spot basis in the delivery of LNG volumes to the U.S., and therefore subject to competition-driven price risk, LNG traders can lock-in contractual rights to deliver to a specific terminal or build their own dedicated facility."

Integrated players like [Shell](#) increasingly seek and establish equity trade arrangements.

Royal Dutch Shell plc has announced two major additions to its global Liquefied Natural Gas (LNG) portfolio. In Qatar, the company has joined forces with Qatar Petroleum (QP) in the development of the large scale Qatargas 4 LNG project, while in the United States Shell has agreed to acquire additional capacity at the Elba Island LNG import terminal in Georgia.

Because of the huge capital expenditures for newbuild LNG, long term contracts (like the China Petronas/Malaysia deal) or integrated equity arrangements will continue to dominate the LNG market. As Dave Hughes (Canadian Geological Survey) said to the author in personal communication, "Simmons is right on the issue of a spot market for LNG for the near future - nobody spends \$12 billion on a liquefaction, transport and regasification chain without long term

Platts summarizes the current LNG market in an article with the misleading title [LNG trade helps foster a global gas market](#).

Liquefied natural gas is one way of removing price differentials between gas markets but, there are still big regional differences. A lack of liquidity makes trading the preserve of the asset owners. This was one of the conclusions drawn at the [CWC World LNG Summit](#) in Rome mid October.

So far, the companies making the most noise about LNG trade have been those with the upstream reserves and access to cargoes.

Pure trading outfits on the other hand are kept out by the lack of commodity and capacity at different stages of the supply chain.

This suggests a degree of immaturity where the incumbents control enough to keep out new entrants. One trader told delegates that what he was primarily concerned with was not prices but volume and churn, and he did not see either of those in the LNG cargo market.

"Traders won't touch LNG, it's a waste of time." Another agreed that the world was still a long way away from a fungible LNG market.

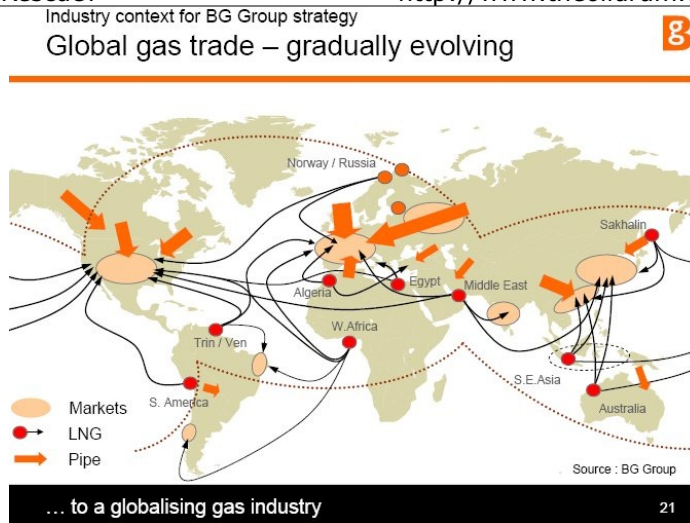
"The bid-ask spread in the Atlantic is too wide to guarantee any return unless you have a unique advantage," he said.

The prices agreed in these cases would not be likely repeatable, and so they would be of little value in establishing a benchmark.

The Platts conference report, which is worth reading, reveals just what an unstructured, chaotic mess the LNG markets are at this time. Right now, integrated equity players with access to large, dependable upstream natural gas supplies and midstream (liquefaction, tankers) or downstream (regasification) assets have the advantage. Independent "pure" traders looking for arbitrage opportunities, as they exist in the oil markets, are at a disadvantage. So, as the anonymous trader said, *the world [is] still a long way away from a fungible LNG market*. Let us now turn to the future.

3. The LNG Market — The Future

The standard story about the future LNG trade is that it will evolve toward the kind of markets that exist for crude oil and other commodities today, with global benchmark prices similar to those set at the Nymex and Brent indices. Furthermore, this global price smoothing *must develop* as theory dictates because of the large number of new players coming into the LNG market, especially from the *MENA* (Middle East & North Africa) nations, as shown in *Figure 6*.



The Evolving LNG Trade – the Atlantic & Pacific Basins with the Middle East in the Middle
Figure 6 – Click to Enlarge

The Petroleum Economist gives us the [standard view](#) (flash website).

The world's dependence on MENA natural gas is set to increase "because that's where the gas is" [quoting Willie Sutton]. But the MENA nations also benefit from their location – midway between the large gas markets of Asia-Pacific to the east, and North America and Europe to the west.

Once consequence of this is that distances to markets are generally large, making liquefied natural gas (LNG) an increasingly competitive option when compared with pipeline supply. In some cases – such as Qatari exports to the US – it is the only feasible option...

A second consequence is that the increasing contractual flexibility of LNG – not just in the still-small spot market, but also in long-term contracts – means MENA LNG will play an increasing role in the globalization of what are presently regional gas markets. LNG tankers leaving Qatar, for example, could choose at short notice to go west rather than east, or *vice versa*.

As the International Energy Agency (IE) stresses in a recent [review](#) of the world's natural gas markets: "Middle East LNG, in particular, will link Atlantic and Pacific markets, transmitting price signals between them ... Increasingly, LNG will end up in places that provide the highest netback." The result will be that gas prices in Tokyo and Seoul will increasingly be influenced by what is happening at [the] Henry Hub in the US.

It seems impossible to reconcile this view with that of Simmons and the nature of the LNG trade as described just above. Consider Simmons' three large barriers to access in the LNG market – quoted from page 4 of their report.

1. Barrier 1: Access to reserves. We estimate that, in order for an LNG facility to return its full capital investment under target conditions, a source gas field, or fields, holding at least 10 Tcf of reserves is typically required.

2. Barrier 2: A big balance sheet. A typical 7.5 mmtpa [million tons per annum] LNG project requires approximately \$6 billion of capital investments, including \$1.6 billion in upstream capex, \$2 billion for a liquefaction facility, \$1.6 billion worth of ships and a \$0.8 billion regasification facility (unless another option for a secure long-term market can be found).
3. Barrier 3: Destination for the gas. The high degree of capital investment required for the LNG business makes a secure market for the product a strategic imperative. Historically, this has occurred through direct take-or-pay contracts with end-market consumers (the prime example being the Japanese utilities). Going forward, we expect that the end market will increasingly come in the form of equity sales into deregulated markets in North America and Europe, whether through tolling arrangements or in some cases through outright ownership of regasification terminals.

In light of these barriers, the strong trend toward long-term or equity LNG contracts (as shown in *Figure 5* above) now makes sense. An integrated equity arrangement is not flexible *ie.* tending toward spot sales — the whole idea is to control as much of the entire supply chain (upstream gas field to downstream regasification terminal) as possible in order to create a secure, long-term source and sales destination for the natural gas. Without a substantial spot or short-term sales market, it is hard to see how a truly *fungible* market can ever be achieved. The standard view — expressed by *LNG tankers leaving Qatar, for example, could choose at short notice to go west rather than east, or vice versa* — flies in the face of reality. Furthermore, in a tight LNG market, importers will also want to lock-in the best price they can get by guaranteeing a long-term buyer commitment, as demonstrated by the deal between China and Petronas (Malaysia).

There are two markets for LNG —the Atlantic and Pacific basins — and, most likely, there always will be. Moreover, Qatari LNG is a long way from almost anywhere. We can refer to this as the LNG price *distance premium*, which will be discussed in the section below regarding the United States. It is 6,480 nautical miles from Qatar to Japan. To Portugal, it is 3,307 miles. To the US Gulf Coast, it is 9,687 miles. India is the clear winner — it is only 1,290 miles away. (Average distances from Simmons.) How can there be a benchmark LNG price, even in the Atlantic Basin, if the U.S. Gulf Coast is 6,380 miles farther away from Qatar than Portugal is?

In conclusion, the LNG market would seem to be *sui generis*, unlike any other — the standard view is a simplistic analogy. Newbuild capital expenditures are huge since they involve three separate, expensive components — liquefaction, shipping and regasification as shown in *Figure 7* below.

TYPICAL NEWBUILD LNG ECONOMICS											
	Capital		Variable Costs		Required Return		Breakeven	E&P Returns		All-in Returns	
	\$MM	\$/mmbtu	\$MM/yr	\$/mmbtu	\$MM/yr	\$/mmbtu	\$/mmbtu	\$/mmbtu	%	\$/mmbtu	%
Upstream	\$1,844	\$0.30	\$55	\$0.15	\$247	\$0.68	\$1.13	\$2.50	11%	\$2.50	9%
Liquefaction	1,950	0.18	91	0.25	158	0.43	0.88	3.50	17%	3.50	11%
Shipping	1,572	0.22	60	0.18	128	0.34	0.72	4.50	25%	4.50	12%
Regasification	877	0.08	55	0.15	70	0.19	0.42	5.50	45%	5.50	14%
	\$6,042	\$0.77	\$261	\$0.71	\$598	\$1.64	\$3.13	3.13	15%	3.13	10%

*Assumes a 7.5 mmtpa, 1 bofd project and a worldwide average 6,500 nautical miles to market.
 *Breakeven calculated on an assumed 15% return requirement in E&P and an 8% return requirement on Liquefaction, Shipping, and Regasification.
 *Returns are calculated as revenue less variable costs over capital employed on a pre-tax basis.
 *E&P returns are calculated after subtracting an 8% required return for Liquefaction, Shipping and Regasification.
 Source: Simmons & Company International

LNG Newbuild Economics — from Simmons

Figure 7 — Click to Enlarge

MENA LNG will be sold under long-term contracts or equity arrangements in both the Atlantic & Pacific markets. The spot market for this new gas will remain small. The LNG trade will never be

fungible in the same way crude oil is. Let us now turn to the prospects for the United States in the world we have just described.

Integrating LNG Exports into the U.S. Market

If we build it, will they come? —paraphrase of a famous quote from a [baseball movie](#).

Let's review the problem facing the United States as North American natural gas production declines continue going forward. *Figure 8* is from Dave Hughes' [presentation](#) from ASPO-USA.

LNG Logistics
COVERING PROJECTED U.S. SHORTFALLS OF 4-11 TCF/YEAR WITH LNG WOULD REQUIRE **NEARLY DOUBLING TO TRIPLING THE WORLD'S PRESENT LNG CAPACITY** (the U.S. will also be in competition with many other countries for LNG supplies). **EXPANSION OF NORTH AMERICAN LNG CAPACITY TO 11 TCF/YEAR WOULD REQUIRE ON THE ORDER OF:**

- 200 New 3bcf capacity LNG Tankers
- 30 New 1bcf/day North America-based receiving terminals
- 56 New Foreign-based 200 bcf/year liquefaction trains
- Capital investment in the order of \$US100-200 Billion
- Time to Build Total Capacity = 10-20+ Years
- **OVERCOMING THE NIMBY SYNDROME IN LOCATING NEW TERMINALS**
- **ACCEPTING THE GEOPOLITICAL IMPLICATIONS OF DEPENDENCY ON OFFSHORE SUPPLY SOURCES**

*The LNG Logistics Problem — from Hughes
Figure 8 — Click to Enlarge*

Hughes estimates that the North America faces natural gas shortfalls of between 4 and 11 trillion cubic feet (tcf) per year in the future. As argued in the preceding sections, that new supply will not come from a large LNG spot market. Rather, the both the U.S. must have long-term contracts or equity deals in place with foreign suppliers like [Qatar](#).

April, 2006

Marking the beginning of the execution phase for two of the world's largest liquefied natural gas (LNG) developments, Qatar Petroleum (QP), ConocoPhillips and Royal Dutch Shell plc (Shell) bore witness today as H.H. Sheikh Tamim Bin Hamad Al-Thani, Heir Apparent of the State of Qatar laid the foundation stone for the Qatargas 3 and Qatargas 4 projects. Combined, the projects are expected to generate approximately 2.8 billion cubic feet per day of natural gas, the majority of which is targeted for delivery to the United States....

Qatargas 4 volumes are intended to flow into natural gas markets in the eastern U.S. For this purpose, Shell, as a sponsor of Qatargas 4, has entered into agreements with Southern LNG Inc. and Elba Express Pipeline Company LLC to acquire additional capacity at the Elba Island LNG import terminal as well as in a new natural gas pipeline. Both projects will be filed with the U.S. Federal Energy Regulatory Commission (FERC) for approval in the third quarter of 2006.

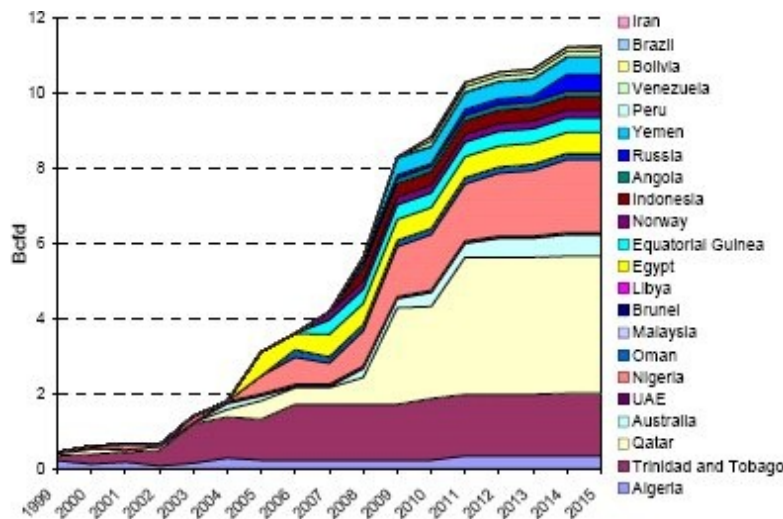
In December, Qatargas 3 executed a sales and purchase agreement with ConocoPhillips for the full train output which will be marketed primarily in the U.S. ConocoPhillips is one of the leading marketers of natural gas in the U.S. and following its acquisition of Burlington Resources, it will become the largest natural gas producer in North America.

Some of the Qatargas 3 LNG will be shipped to the new regasification terminal at [Freeport, Texas](#), as we learn [here](#).

ConocoPhillips has taken a 30% interest in Cheniere Energy's proposed Freeport LNG project on the Texas Gulf Coast. Freeport, with a 1bn cf/d receiving terminal, is scheduled to start operations in 2007. ConocoPhillips will pay plant construction costs of up to \$450m and plans to use LNG shipments from Qatar, Nigeria and Venezuela, where it has stakes in LNG projects or gas fields.

Other agreements are in place. [ExxonMobil and Qatar Petroleum Progress LNG Project](#) indicates that LNG from Qatar's RasGas liquefaction trains 6 & 7 will be "delivered to the target markets, principally the United States" to the [Golden Pass](#) receiving terminal in Sabine, Texas. The terminal is "expected to be 70 percent owned by an affiliate of Qatar Petroleum, with affiliates of ExxonMobil and ConocoPhillips each owning a share in the balance of the interest in the terminal". Thus, some equity arrangements are already in place for LNG exports to the United States. Read the *Company Exposure to LNG* part of the Simmons report for more details.

As implied by *Figure 7*, the problem is simply this: *Is sufficient LNG going to be imported soon enough to meet U.S. demand in the face of continuing domestic natural gas production declines?* The [Simmons LNG report](#) (cited link repeated) predicts that the U.S. will be importing 11 bcf/d (billion cubic feet/day) by 2015 from the sources shown in *Figure 9*.



Sources: Simmons & Company International.

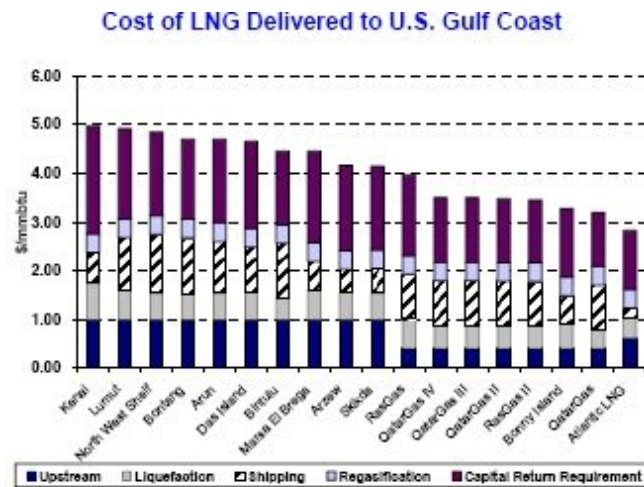
U.S. LNG Imports by Source (Bcf/d)
Figure 9 — Click to Enlarge

If all goes well —this is a big *if*— the U.S. will manage to import 4.015 trillion cubic feet of additional gas supply from LNG by 2015—right at the low end of Hughes' range. As *Figure 9* indicates, all the supply comes from the Atlantic Basin or the Middle East with the exception of Australia. It is unclear if the Russian exports will come from Sakhalin II (Pacific Basin) or whether

the Simmons report is dated, written before the Russian decision to send [Shtokman gas](#) from the Barents Sea by pipeline to the EU rather make it available for LNG exports to Europe and the United States. By far, the largest export shares are from Qatar and Nigeria —excluding on-going exports from Trinidad & Tobago. For all this to work, all the requisite liquefaction trains must be operating in the exporting countries in the envisioned time frame and long-term or equity contracts must be in place.

The Hughes slide (*Figure 8*) points out the huge build-out necessary to support exports of 11 Tcf to the North America, as well as the NIMBY problem with location of new regasification terminals. A look at Hughes' slide #21 (link above) reveals that there is ample new capacity coming on-stream to support imports of 15 bcf into the U.S. by 2015. However, almost all of the new receiving terminals are on the Gulf of Mexico coastline. The [NIMBY issues](#) have prevented approval of new terminals on both the East & West coasts. The Northeast will be partly served by new Canadian receiving terminals such as [Bear Head](#) in Nova Scotia. The great concentration of regasification facilities in the Gulf coast area will require a large build-out of new gas storage in this region as well as alter the U.S. gas distribution network.

A number of other issues (*eg.* natural gas energy content and processing) are covered in the *Developing U.S. Market* section of the Simmons report. One final issue to look at is the *distance premium* as we have termed it in the previous section. Obviously, North America is a long way from where the gas is, while Europe is closer. Consider *Figure 10* below from Simmons, where you can see that LNG transport is a significant factor in deliveries to the United States.



Sources: Simmons & Company International.

Figure 10

The Simmons report calculates that the total LNG shipping cost per nautical mile/mmbtu (cents) is 0.0133 for tankers holding 138,000 cubic metres of gas and 0.0111 for larger tankers holding 216,000 cubic metres. Recently, there was an [inaugural voyage](#) of Qatari gas to Mexico.

Ras Laffan Liquefied Natural Gas Company (RasGas) made its first delivery of liquefied natural gas (LNG) from the shores of Qatar to Mexico on October 8, a press release issued by RasGas said. This historical event followed a spot sale to Shell Western LNG B V by Ras Laffan Liquefied Natural Gas Company (II)...

The voyage of 22 days over a distance of 9,915 nautical miles was routed through the Suez Canal and the Straits of Gibraltar to the Terminal de LNG de Altamira, Mexico. Terminal de LNG de Altamira is the first LNG receiving terminal in Mexico and came

into operation only in August of this year...

The vessel was built in the Samsung Heavy Industries, Korea, and has a cargo capacity of 138,000 [cubic metres]

A simple, rough calculation shows that the journey added approximately \$1.32/mmbtu to the cost of the gas. As previously noted, distance is yet another factor that will discourage a world gas price or perhaps even an Atlantic Basin benchmark price.

Conclusion

The more one delves into the future LNG trade, the more complicated the situation looks. A lot of factors must come together to make much larger globalized markets a reality. Pertinent LNG issues will be addressed at the 7th Annual [LNG Summit: Trials and Tribulations of Integrating LNG in the U.S. Market](#) to be held January 18th & 19th in Houston. Reading the presentation abstracts gives you a sense of what the LNG industry is worried about.

This report is meant to give some insights into what will happen and needs to happen for the LNG trade to meet expectations, not only in the United States, where domestic production is in exponential decline, but all over the world.



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