



Empire On the Edge--Betting On LNG **

Posted by [Dave Cohen](#) on January 23, 2006 - 12:15pm

Topic: [Supply/Production](#)

Tags: [lng](#), [lng terminals](#), [natural gas imports](#), [ngl](#), [regasification](#), [unconventional natural gas](#) [[list all tags](#)]

** -- Or, Everything You Wanted Know about LNG but Were Afraid to Ask

Liquified natural gas (*aka* [LNG](#)) involves cooling the gas to minus 160 degrees (Celsius). That shrinks it to about 1/600th of its original volume, allowing significant quantities of this LNG to be loaded aboard tankers for shipment overseas. When the gas reaches its destination at an LNG terminal, the gas is reheated (*regasification*) and shipped through pipelines to end users.

[ED: Dave's really put together an amazing post here...much to read under the fold.]

As most regular TOD contributors and readers know, the natural gas situation in North America is precarious and getting more so. HO has done a number of posts--for example [The problems of natural gas supply](#)-- on this subject over the last couple months spelling out various aspects of the situation. This crisis is due to five related factors.

- Natural gas can be transported globally from place to place using only two methods--via pipelines or by LNG tanker shipments to regasification facilities (LNG terminals). To emphasize this point, there is also what is called [Stranded Natural Gas](#) which can only be practically extracted by means of GTL (gas to liquids) technology as stated below.

Reserves of "stranded" natural gas--the stuff that's abandoned because there's no economical way to transport it--come to maybe 2,500 trillion cubic feet. If captured and converted [by a GTL process], the gas would make (after conversion losses) 250 billion barrels of synthetics [liquids], from clean-burning diesel to jet fuel.

However, there is no current large-scale effort being made toward commercially viable GTL operations at this time or in the near term future.

- North American domestic production is declining. No matter how many new wells are drilled, declines continue. See Peter Dea's [presentation](#) from ASPO-USA (ppt, slides 1 to 10). Slide 5 is similar to *Figure 1* (below the fold) while slide 3 asserts that a 63% increase in gas rigs has resulted in a production decline in the US of 2% since January of 2003.
- North America is geographically isolated with respect to imports. Overseas pipelines are impractical.
- US demand for natural gas continues to rise despite increasing supply shortfalls. Including hurricane disasters in the Gulf of Mexico, the price trend continues to rise just as the supply remains flat despite shorter term demand fluctuations due to warmer weather, seasonal adjustments and foreign demand reductions. Since North America is a "stranded" natural gas market, demand reductions overseas don't affect prices in the US much but *may* make

spot LNG imports easier to get. But lack of LNG regasification capacity doesn't change rising prices.

- Storing natural gas reserve stockpiles to mitigate short term shortages is much more technically challenging than maintaining crude oil SPR stock. It is, generally speaking, a matter of maintaining on-demand supply for natural gas via pipeline deliveries as opposed to oil storage. As HO said [here](#)

Gas differs from oil in that it is not stored domestically in the same way that oil can be, but instead comes through pipelines with only limited storage capacity.

One additional point which won't be discussed here is [unconventional sources of natural gas](#). The US *may* possess abundant unconventional natural gas resources, which include

- deep natural gas
- shale gas
- tight natural gas
- devonian shale gas
- coalbed methane
- gas from depressurized zones
- methane hydrates--a fantasy, of course. I am reminded of Frank Sinatra's song [Fly Me To The Moon](#).

As the cited article states, the issue for these sources is that "what is really considered unconventional natural gas changes over time, and from deposit to deposit. The economics of extraction play a role in determining whether or not a particular deposit may be unconventional, or simply too costly to extract". This post won't deal with these unconventional natural gas volumes and as far as I can see, only small volumes of coalbed methane are actually being extracted at the current time. Reserves for these sources mostly fall under the "undiscovered resources" (P5) reserves designation and won't be taken here as serious contributors to US natural gas supply in the foreseeable future. Nor will potential "stranded" natural gas deposits requiring GTL technology & investments be considered as major future contributors in the near term future out to about 2012.

In this story, we'll do an extensive analysis of the current LNG market along with the geopolitics and future problems associated with the ability of LNG to effectively increase future US natural gas supply and lower prices. The situation is very complex and becoming more fluid (no pun intended) as time goes by, so this post runs a bit long. Please bear with us here as we spell out this complicated and evermore worrying situation.

What North America (and the US in particular) is committed to is increased imports of LNG in the future to fill the supply/demand gap. This IHS Energy slide from a talk by Pete Stark entitled [Role of Mature Fields in Meeting the Global O&G Supply Problem](#) nicely illustrates the problem and policy.

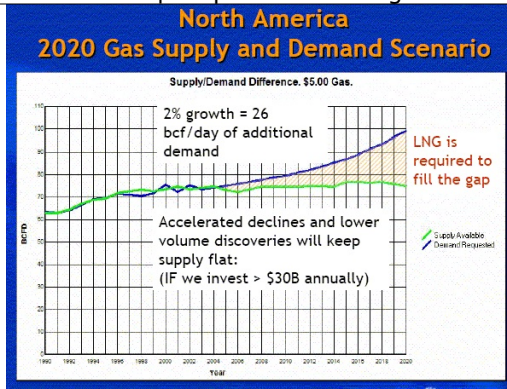


Figure 1 -- Click to Enlarge

A second graph using some [EIA data](#) from the Annual Energy Outlook 2006 illustrates the forecast for new natural gas supply in the US.

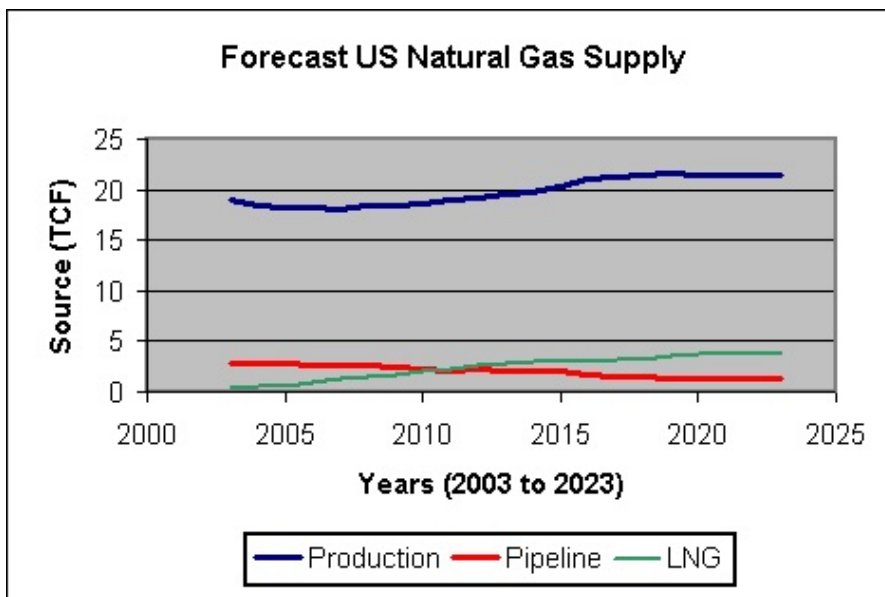


Figure 2 (TCF = trillion cubic feet)

Note: LNG includes any natural gas regasified in the Bahamas and transported via pipeline to Florida in the future. (see below).

As you can see, LNG imports are expected to surpass pipeline imports from Canada in 2011 while domestic production declines and doesn't surpass 2003 production until 2012. Pipeline imports continue to decline thereafter while LNG imports increase. After 2012, US production increases are expected along with greater LNG imports to make up overall demand shortfalls as shown in the IHS Energy *Figure 1* as pipeline imports continue to decrease in that timeframe. Obviously, the North American (and US) supply situation is precarious out to 2012 if the mysterious EIA predictions after 2012 can be trusted. Perhaps they assume increased volumes from unconventional dry gas resources after that date.

What's the Longterm Plan for LNG?

A [good but oversimplified view](#) of the current and future LNG situation comes to us from David J. Lynch, a reporter for USA Today (not one of my usual sources, reprinted at mywesttexas.com). Concerning the longer term view over the next 25 years, we learn that

Once global gas trading becomes more commonplace, U.S. natural gas prices should sink.

"As we're able to bring more supply into this country prices will, in fact, be lower," says Stacy Nieuwoudt, an analyst at Pickering Energy Partners in Houston...

As the gap widens between surging demand for natural gas and plateauing production from domestic wells, the scene at Cove Point [Maryland, an LNG terminal] will be repeated around the USA. LNG imports are expected to rise from about 1 percent of total gas usage in 2002 to 15 percent by 2015 and 21 percent by 2025, according to the Energy Information Administration (EIA). That year, total imports are expected to be almost seven times the current figure.

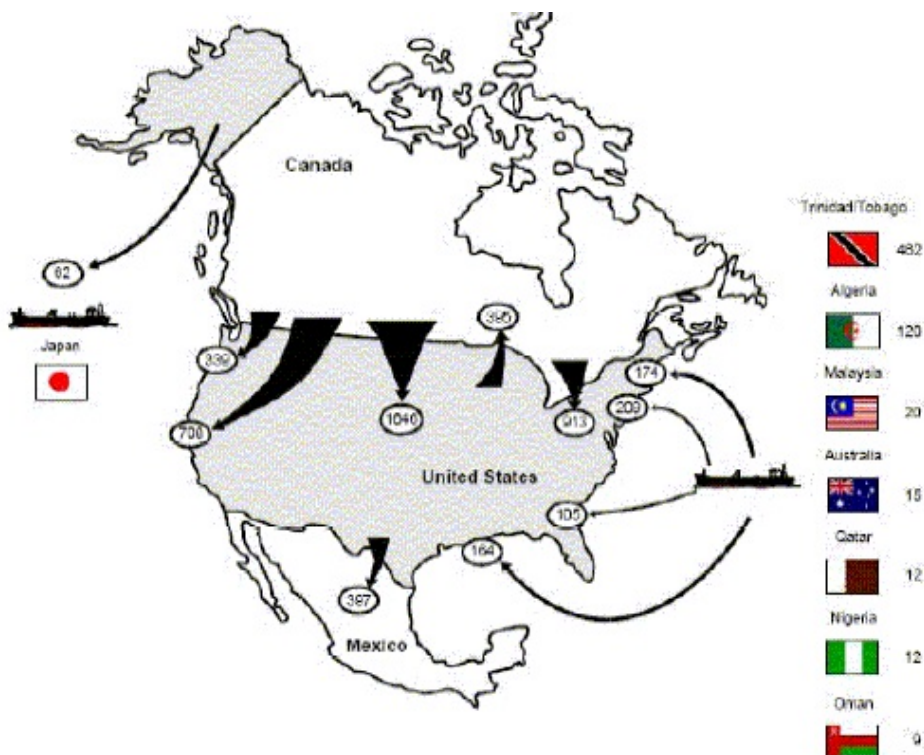
Energy companies have submitted dozens of proposals for new terminals along all three U.S. coastlines to receive the expected shipments, which will give the United States greater flexibility in meeting its energy needs. Dominion is awaiting government approval to almost double Cove Point's capacity by 2008.

"A global natural gas market will evolve to look very similar to the oil market. But it's not going to happen in the next five years. It just takes a lot of time," says Nieuwoudt.

The longer range plan is clear. There will be a build-out all over the world by suppliers to build LNG liquefaction plants just as natural gas consumer nations will carry out a large-scale build-out of LNG terminals for regasification and shipment by pipeline to meet demand. Thus, the natural gas market will eventually more and more resemble the global market for crude oil. It is this globalized plan for natural gas that the US is counting on to alleviate future supply shortfalls.

The Current LNG Situation

The situation for [U.S. Natural Gas Imports and Exports: 2004](#) (pdf) is shown in this nice graphic plotted from EIA data.



As you can see, there are currently only 4 LNG terminals serving the US and these are

- Cove Point, Maryland (# 209)
- Everett, Massachusetts (# 174)
- Elba Island, Georgia (# 105)
- Lake Charles, Louisiana (# 164)

The US *exports* some natural gas to Japan and Mexico-- even some back to Canada---this was a surprise. All imports come via pipeline from Canada and the very small percentage of LNG imports come from the countries listed in *Figure 3*. Note that Trinidad, Qatar, Nigeria and Algeria are on that list--see below. In the [Bahamas](#), a number of regasification LNG terminals are under construction or proposed. See also [Exxon Mobil Finds New Way Into US Market Via Bahamas Terminal](#). These would receive LNG from Trinidad & Tobago, Qatar and other suitable suppliers and then transport the gas to the US via pipelines to Florida.

The Nitty-Gritty Details About the LNG Future Market

This is the point where this post gets long but what follows also constitutes the most interesting part. A brilliant, thorough and expert examination of the LNG industry, [Limited Availability for 'Cheap' LNG to the US](#), was written back in October of 2004 by Harold York, director of Reliant Industry. Let's summarize that article and state his conclusion first.

There is little hope the U.S. is able to import "cheap" LNG into the U.S. as a way to put downward pressure on domestic natural gas prices. Recent trends indicate Henry Hub prices must exceed \$3/MMBtu to make it commercially attractive to bring spot LNG cargoes into the U.S. However, given the tight supply/demand balance in the U.S., current U.S. LNG regasification effective capacity is unlikely to deliver incremental volumes sufficient to displace the need for natural gas to price high enough to encourage demand conservation sufficient to balance the market.

Importantly, York is referring to the LNG market including only the 2004/2005 timeframe. However, it is reasonable that his assumptions and assertions made in 2004 about LNG constitute a fair characterization of the situation today. Furthermore, until the economic globalization of the LNG market really gets off the ground and these markets evolve to resemble world oil markets--over the next 5 to 10 years--it is plausible that what he says will mostly hold true up to the 2012 period or so. Hold onto your hats, here's a summary of what he says, the nitty-gritty details.

As York notes, the world has entered a new era in natural gas pricing. Historically, Henry Hub prices must be above \$3/MMBtu to make LNG imports attractive. As of this writing (1/20/06), the Henry Hub spot price is \$8.78/MMBtu. So price is no object. However, just as for oil, the LNG supply/demand balance is tight with little or no spare capacity. There are many constraints on importing LNG into the US as listed below.

1. LNG markets are dominated by long term contracts and the tight demand & supply balance in the market. There is a worldwide shortage of LNG liquefaction capacity and, in the US, of LNG regasification capacity.

As long as LNG pricing in Asia and Europe continues to be on an oil basis (crude in Asia and residual fuel oil in Europe), high crude oil prices should prop up delivered

prices to all three markets [including the US]...

Because of the regulatory structure of European gas markets in the past, regasification developers had the financial ability to back signing long-term firm supply contracts. Demand conditions (e.g., mild weather, slow economic activity) in Asia and Europe play a key role in determining supply availability for the U.S.... [The] demand conditions allowing Europe and Japan to release cargoes for spot sale in the U.S. are typically in the spring and summer.

Spot (shorter term contractual) import volumes are determined seasonally or by foreign demand drops but are generally hard to come by on the world market.

2. As York asserts, **A Price Differential is Rarely Sufficient to Divert Cargoes to the US.** In shipments to Asia and Europe, where prices have been historically higher than US import prices

There usually were no competing supplies (e.g., no pipelines or indigenous supplies) so a long-term contract did not force the gas marketer to forego other supply options. The project also was selling into a tightly regulated (and physically short) market so delivered LNG prices into Asia and Europe tended to be higher than in the US... LNG pricing in Asia and Europe continues to be on an oil basis (crude in Asia and residual fuel oil in Europe), high crude oil prices should prop up delivered prices to all three markets [including the US].

Historically, US import prices have been lower than those in Europe (and Asia/Japan) but have surpassed European prices since 1999 for two reasons. 1) Rising US natural gas prices and 2) Reductions in its [Europe's] use of residual fuel oil and so its [natural gas] price relative to crude declines.

However, the most important determinant making spot shipments to the US difficult to obtain is *proximity* to the LNG production facilities. Quoting York, "the sailing time and shipping costs for liquefaction facilities farther away than Trinidad make spot deals into the U.S. even tighter to fit into firm contract obligations". So, longer LNG transport distances affect the bottom line for LNG exporters. And add to this that there is a worldwide "*shortage of spot LNG charter vessels [that] is likely to continue into the foreseeable future*". For both these reasons, the Henry Hub price--even if it is attractive to exporters on the spot market--is not sufficient to increase shorter term spot contracts allowing the US to import greater volumes of LNG. So, this is one reason why LNG regasification terminals run at less than so-called *nameplate* capacity. But this is not the only reason, it gets worse. See the next item #3 below.

3. Again, as York states, **Contractual and Technical Issues Limit Spot Cargoes to US Terminals.** There are two main issues here. First, from the contractual point of view, "smaller spot (merchant) players have to work with long-term US [regasification] holders to secure the necessary logistical arrangements to secure short-term [spot market] deals". This often means that these merchants must make contractual arrangements with LNG liquefaction operators in foreign countries *if* they can secure some spot market supply from a tight worldwide market.

But more importantly--this came as a surprise--there are technical constraints on what LNG can be imported to the US.

Technical issues surround physical characteristics of an LNG cargo from a specific liquefaction facility to a specific regasification terminal. The heat content of LNG can range between 1,000 and 1,162 Btu per cubic foot (York's Figure 7). **High heat content is incompatible with many U.S. appliances and industrial processes.** Thus major interstate pipelines have a heat content specification of 1,035 Btu per cubic foot, with a range of plus or minus 50 Btu.

On a spot basis, only three operating liquefaction facilities (Trinidad and Skikda, Algeria in the Atlantic Basin plus Alaska in the Pacific) produce LNG with a heat content within current U.S. gas pipeline quality specifications. Given that all four U.S. regasification terminals are in the Atlantic Basin and assuming Skikda is not operational, there is about 150 MMcfd of spare liquefaction capacity meeting U.S. natural gas specifications. Nitrogen or air injection processes diluting higher heat content cargoes at Everett and Cove Point allows the inclusion of spare capacity in Nigeria (100 MMcfd) and Qatar (100 MMcfd). So of the 2,200 MMcfd of spare liquefaction capacity in the world, at best 350 MMcfd (15%) could meet current U.S. quality specifications.

In 2004, the Skikda LNG liquefaction plant in Algeria was damaged by an explosion and fire--these [troubles](#) continue there. But the bottom line conclusion is that currently *only a few suppliers produce LNG that can be regasified in the few US terminals capable of the processing the liquids.* Qatar and Nigeria along with the other suppliers shown in *Figure 3* are the only options. And the situation is even worse. Look at this image from York's article.

Figure 8: Effective Capacity At Regas Terminals Is Less Than Nameplate

Issue	Nameplate Capacity	Constraint	Impact
Logistics			
• Everett, MA (Tennessee, Algonquin)	1,150 MMcfd	600 MMcfd (pipe); 100 MMcfd (trucks)	• Because of send-out capacity constraints, the effective capacity of most LNG regas terminals in the U.S. is much less than nameplate
• Cove Point, MD (Transcontinental, Columbia)	1,000 MMcfd	450 MMcfd	
• Elba Island, GA (Southern)	675 MMcfd	550 MMcfd	
• Lake Charles, LA (Trunkline)	1,000 MMcfd		
Btu content			
• Everett, MA		1,080 Btu/cf	• Over 2/3 of LNG supply has Btu content exceeding U.S. receiving constraints
• Cove Point, MD		1,135 Btu/cf	
• Elba Island, GA		1,065 Btu/cf	
Berthing			
• Everett, MA		Safety concerns from passing major bridge and Logan Airport complicates logistics	• Berthing does not de-rate capacity, but complicates spot transactions
• Lake Charles, LA		Ship channel congestion	

* Able to take richer LNG cargoes with the addition of a 2% nitrogen (up to 1,080 Btu/cf) and 4% air (up to 1,117 Btu/cf) injection systems in early 2004. Source: Wood Mackenzie; FIRA.

What is this chart showing us? First, and importantly, the total *nameplate* processing capacity of the few existing LNG terminals is constrained by the downstream pipeline *send-out* capacity coming from the terminals. Otherwise, the problem is that only some LNG liquefaction facilities like Trinidad meet the lower Btu heat content required by the US. The conclusion is that there is little actual spare capacity at existing LNG terminals in the US and these are under-utilized as a result.

So, none of this is very good news. This is the current situation and does not bode well in the near term for increased supply from LNG imports, let alone cheaper prices for natural gas in the US or North America as a whole. But, what of the future?

Geopolitics And Future Projects

In the [The Geopolitics of Natural Gas](#), Michael Klare (writing for The Nation magazine) lays out a thorough and insightful analysis of the how the world is creating that wide-open, flexible natural gas market that mirrors the world oil market. Everybody is doing deals with everybody. Axis of Evil nations like Iran--with the 2nd largest natural gas reserves in the world--is doing deals with its Asian & Pacific partners. China & India are making deals with anyone it can including, of course, Iran. The US is dealing with Qatar, which has the 3rd largest untapped reserves. As we can see from the text above, dealing with Qatar and other countries like Algeria and Nigeria is critical. These are the countries that can currently supply LNG to the US based on the constraints outlined above in the York article. Supplier countries are starting to build out LNG liquefaction facilities like there's no tomorrow just as consumer countries like the US and the Asia & Pacific nations embark on expansion of their LNG terminal receiving capacity. The market is expanding and wide-open. There's a lot of information to absorb here, so read Klare's article to get a good handle on the full story.

Beyond the geopolitics of natural gas, the Lynch [article](#) (link repeated from above) gives us other reasons for concern especially regarding expanding LNG regasification terminals in the US. Among these concerns are

- There is "local resistance to new LNG terminals [nimby], steep capital (investment) requirements and even a shortage of tanker crews"
- LNG terminals are seen as terrorist targets in this age of paranoia.
- Approved new terminals are being built in the Gulf of Mexico (*aka hurricane alley*). Others are early on in the licensing process though there are many proposals on the table for building new regasification facilities. However, it is unclear how many LNG terminals will actually get built. Naturally, it takes some years to license, finance and build these LNG terminals given the political, economic and physical constraints involved. Many proposed projects will never come to fruition.

As Congressman Don Sherwood, republican from Pennsylvania says (quoted by Lynch)

"By setting our future policy, basing it on LNG, then we will be subject to the same forces that we're now subject to in oil supply - in other words, foreign disruptions, political events, growth of the energy sector in Asia," said Rep. Don Sherwood, R-Pa., at a congressional hearing last month.

So, given the greater dependence on foreign sources for a very important energy source and all the market & technical difficulties mentioned above in this post, it would appear that depending on LNG to meet the US natural gas demand/supply gap is very risky business and unlikely to be smoothly successful in the future. Congratulations if you've read this post and made it this far. In conclusion, these are the LNG prospects as far as I can see. The facts do not inspire confidence

The Oil Drum | Empire On the Edge--Betting On LNG ** <http://www.theoil drum.com/story/2006/1/18/19751/8136>
that LNG supplies of natural gas in North America--and particularly in the US--will meet demand
in any timeframe we are concerned about. I see many years of hardship as we go forward in time.



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