NRRI 03-12

EXPLORATORY QUESTIONS AND ISSUES PERTAINING TO THE FUTURE ROLE OF LIQUEFIED NATURAL GAS IN THE U.S. MARKET

Ken Costello
Senior Institute Economist

The National Regulatory Research Institute
at The Ohio State University
1080 Carmack Road
Columbus, Ohio 43210-1002
Phone: 614-292-9404
Fax: 614-292-7196
www.nrri.ohio-state.edu

June 2003

This paper was prepared by the National Regulatory Research Institute (NRRI) with funding provided by participating member commissions of the National Association of Regulatory Utility Commissioners (NARUC). The views and opinions of the author do not necessarily express or reflect the views, opinions or policies of the NRRI, NARUC or NARUC member commissions. The author would like to thank Jeffrey Conopask, Bob Harding and Rod Lemon for their comments on an earlier draft of this paper.

INTRODUCTION

Background

According to the latest forecast of the U.S. Department of Energy (DOE), the demand for natural gas in the United States will rise from about 23 trillion cubic feet (Tcf) in 2001 to about 34.9 Tcf in 2025. DOE also predicts that, over the same period, domestic gas supplies will increase from 19 Tcf to 28.5 Tcf. While Canadian gas will make up most of the gap between U.S. demand for gas and domestic supplies, industry observers currently believe that supplemental gas supplies will be required to fill the difference.[1] Basically, the tightening of domestic gas supplies, partially caused by falling productivity from existing natural gas fields, along with growing demand for natural gas in the United States,[2] has contributed to the need for new sources of natural gas.[3] One source of gas energy, liquefied natural gas (LNG), is by most expert accounts poised to play a vital role in satisfying future gas demands in the United States.[4]

Events in the 1990s foretold of tightening natural gas supplies in the U.S. market and the possible need for supplemental sources of natural gas in the future. Between 1990 and 2000, the consumption of natural gas in the United States increased by over 20 percent, with domestic gas production increasing by less than 8 percent. Canadian imports filled most of this gap, as this source of natural gas more than doubled during the 1990s. An indicator of the depletion of gas reserves on existing sites was the dramatic increase in the cost per natural gas well during the 1990s. Over that period, the cost per natural gas well rose by more than 60 percent, which contrasts to the decline of over 10 percent of the same costs in the 1980s.

---

[1] Some industry experts project a lower level of Canadian gas imports in the future. Reasons for this include (1) diminishing product returns on capital expenditures related to further rig production in western Canada, with new gas supplies from eastern Canada not sufficiently making up that lost volume, and (2) increasing domestic demand for natural gas in Canada.

[2] According to DOE forecast at the time of this writing, U.S. demand for natural gas is expected to increase by 50 percent over the next 20 years.

[3] According to some accounts, it now takes about 2.5 times more active rig capacity to produce the same amount of gas than just eight years ago.

[4] Experts predict that it would take three to five years to expand existing LNG facilities. The development and construction of new LNG facilities may require five to ten years.

By way of background, LNG is gas cooled to about minus 260 degrees Fahrenheit, where it changes into a liquid state that can be stored as a liquid in insulated tanks. LNG is transported at atmospheric pressure in specially built ships. At the destination point, LNG is unloaded from ships to receiving terminals. These terminals store and regasify LNG for distribution to pipelines, marketers, or end-user consumers.

The traditional LNG project is often described as a "supply chain" with four major links to the chain: (1) gas field development, (2) the liquefaction process, (3) tanker transportation, and (4) the receipt/regasification terminal. Each stage of the chain is capital-intensive, with investments typically front-loaded in that revenues do not flow until the completion of the project. Table 1 lists some general facts about LNG. Unlike domestic gas, LNG projects are international ventures, subject to the laws and regulations of other countries. Currently, LNG arrives in the United States from Trinidad and Tobago, Qatar, Algeria, Nigeria, and Oman. In this country there are four LNG regasification terminals that are, or soon will be, operational. These terminals have a total baseload sendout capacity of about 2.3 Bcf per day, and a peak sendout capacity of about 3.2 Bcf per day. These numbers do not include possible expansions that could add another 1-1.6 Bcf per day of capacity by 2006. A number of additional LNG projects (13 at the time of this writing) are being planned around the country.

Additional consumption of LNG in the United States -- currently, imports of LNG account for about 0.5 percent of U.S. natural gas consumption -- means increased dependency on a foreign source of energy, in addition to new environmental, security, and safety concerns. Over the past few years, imports of LNG to the United States have steadily increased but are currently being constrained by in-place import terminal capacity, which effectively limits the amount of gas that can be received and regasified.

TABLE 1

Features of Liquefied Natural Gas:
• Delivery of LNG requires what is called a "supply chain," comprising of different stages in the process of producing, liquefying, transporting, storing, and regassifying LNG • Most of the "supply chain" processes are highly capital intensive • LNG costs have declined over time • LNG is sold in the world market • LNG represents a non-traditional source of gas supply in the U.S. gas market • The economic attractiveness of LNG in the U.S. gas market is highly dependent upon the availability and price of traditional gas supplies • Abundant LNG supplies are potentially available in the world market, • LNG has been shown to be a proven technology

Source: Author's construct

One potential source of LNG is Alaska, where LNG is currently transported from the southern part of Alaska by tankers to Japan. Since almost all of the natural gas produced in association with oil recovery in Alaska is re-injected back into the oil wells, this is potentially a major source of natural gas or LNG for the U.S. market. While LNG seems to be economically attractive under a scenario of high-priced U.S. and Canada gas supplies, it is less likely to be if ample domestic supplies become available at prices below today's market prices. Could it be déjà vu, where the optimistic outlook for LNG in the U.S. gas market back in the 1970s was superceded by falling gas prices and the gas "bubble"? Specifically, the first LNG imports into the United States occurred in 1972; LNG sales collapsed during the 1980s and 1990s,[5] and did not return to their 1979 peak until 2000.[6] Overall, starting in the early 1980s, LNG was not considered a cost-effective source of natural gas in the U.S. market until rising natural gas prices in 2000-2001 and growing domestic demand started to spark renewed interest in LNG.

[5] LNG was not competitive in the U.S. gas market in the 1990s largely because the average wellhead price was just over $2 per MMBtu.

[6] In fact, in the early 1980s three of the four import terminals were mothballed because of the uncompetitiveness of LNG, most of which originated in Algeria.

Policy Considerations

U.S. policymakers need to address several questions and issues before concluding LNG is a vital source of gas supply in the U.S. gas market for the near or longer term. Certainly, the increased interest in LNG is warranted by recent events. Over the last few years, the natural gas industry has come to realize that conventional gas supplies are not likely to keep pace with growing demand. Few experts expect a gas "bubble" in the near term; rather, they see tight gas supplies continuing to hold prices up for the foreseeable future. Also, the cost of LNG has dramatically declined over the last several years from a combination of innovations and improved technology, economies of scale,[7] and the willingness of LNG-exporting countries to substantially lower the prices that they are willing to accept.[8] In light of these developments, LNG is deservedly being given more attention at this time.

The enthusiasm for LNG to play an important role in meeting future U.S. demand for natural gas must be tempered by reality. One reason is that LNG represents a source of energy that the United States must import -- some of which originates in politically volatile regions of the world.[9]

Another concern is that LNG may pose environmental, safety and security problems. Constructing new LNG terminals in the United States has been hampered by perceived safety concerns of the general public and government regulatory bodies, which may result in the future siting of terminals in Mexico, the Gulf of Mexico or the Bahamas. Some of these concerns may be more perceived than real. The acceptance of LNG will require proponents, however, to convince the many policymakers and the general public of this.

A third concern is that if domestic and Canadian supplies of natural gas turn out to be higher than currently projected, then the United States may be at risk for relying on a source of gas supply that would (*ex post*) be uncompetitive in terms of price. This

[7] Both improved technology and economies of scale have in particular lowered the capital and operating costs of tankers and terminals. Additionally, lower interest rates have reduced the financing costs of tankers and terminals. According to some estimates, the delivered price of LNG into the U.S. gas market has decreased about $1 per MMBtu over the past decade.

[8] Increases in the world demand for LNG could drive up the netback price under the condition that LNG would still remain competitive with other sources of natural gas.

[9] Much of the needed LNG imports could come from the Western Hemisphere (e.g., Trinidad), however.

is especially true if contracts for LNG allow for little flexibility in price and other terms and conditions, in response to changed market conditions, resulting in the possibility that its price would be in excess of the prices for other sources of natural gas sold in the U.S. gas market. For many industry observers, this last issue lies at the heart of the debate over whether, and to what extent, U.S. policymakers should promote imports of LNG.

In any event, looking retrospectively at the roller-coaster-like U.S. natural gas market over the last three decades, policy makers take some risk if they assert the importance of a new source of energy supply in view of the high unpredictability of events that will ultimately drive its fate. If anything, our past energy policies have taught us to take a judicious posture. This paper delineates the crucial questions that face policymakers as they consider the ramifications of increased imports of LNG.

SPECIFIC POLICY QUESTIONS

As sketched above, U.S. policymakers will need to deal with many questions and issues before determining the appropriate role of LNG in the future U.S. natural gas market. A list of pertinent questions is presented below.

Supply and Demand

1. What are the principal reasons for the current interest in LNG? What recently has made LNG more attractive to the U.S. gas market? For example, conventional supplies are forecasted to lag behind growing demand, with expected high gas prices for the foreseeable future caused by tight gas supplies. As another factor favoring LNG, the costs associated with the "supply" chain of LNG have dramatically declined from the combination of improved technology and economies of scale.
2. Can the U.S. gas market accommodate LNG, and if so, how much? DOE and other forecasts predict that LNG can help fill the "supply gap" caused by the expected slowdown in Canadian imports and the decline in U.S. gas-production capacity. On the other hand, a more optimistic forecast for

traditional U.S and Canadian gas supplies may diminish the need for LNG over the next several years.

3. What is the risk to the U.S. gas industry committing to LNG now if traditional gas supplies turn out to be ample and low priced?
4. What are the major economic and other conditions favorable to the importing of LNG?
5. What is the world market for LNG, and will U.S. natural gas prices remain high enough relative to prices in foreign markets to attract long-term investors and suppliers to the U.S. gas market? Japan, Korea and Taiwan together currently make up about 70 percent of the world's LNG import market. The prediction is for rapidly growing LNG demand and supplies. For example, worldwide trading of LNG could double by 2010 and triple by 2015. China and India offer the possibility of large new markets for LNG.
6. What do the economics show? Can LNG compete with traditional gas supplies? Under what scenarios and presupposed conditions would this occur? The American Gas Association (AGA) believes that LNG can be competitive in the U.S. market when prices for traditional gas supplies rise above the range of $3.25-$3.50 per Mcf, which is far below expected gas prices over the next several years. According to some experts, LNG costs are currently around $3.50 per Mcf, which makes LNG economically viable within the U.S. gas market given the current forecasts. This price is expected to remain around $3.50 level for the foreseeable future because of abundant LNG supplies around the world.
7. What is the relevance of the spotty history of LNG in the United States? As mentioned above, historically, LNG has been uncompetitive in the U.S. market. Currently, LNG holds a very low share of the U.S. natural gas market, with imports of LNG only accounting for about 0.5 percent of U.S. natural gas consumption.[10] How realistic is it to believe that, over the next several years, LNG's share in the U.S. gas market will increase much from

[10] According to the AGA, the four import terminals handing LNG as a whole are operating at less than 25 percent of their original design capacity.

this historically low level? Some analysts predict faster growth of LNG consumption in this country after 2010.

8. What are the forecasts of LNG imports? For example, DOE predicts that half of the increase in U.S. imports over the next two decades will come from LNG. By 2020, DOE projects that LNG will account for about two percent of U.S. natural gas consumption. DOE also predicts that by 2025 LNG imports will constitute over 25 percent of total gas imports. What are the underlying assumptions of the DOE and other forecasts?[11]

Market Structure and LNG Supply Arrangements

1. Who will be the marketers of LNG?
2. Who will be the buyers/consumers of LNG? Will they be marketers, gas utilities, or large gas users? What, if any, relationship exists between LNG terminals (and storage facilities) and the U.S. electricity industry?
3. What will be the nature of LNG transactions? Will spot, medium-term, or long-term arrangements dominate?[12] What will be the typical terms and conditions of contracts? Will LNG prices be deregulated or regulated? How sustainable is the historically typical LNG sales and purchasing agreement in the competitive U.S. gas market (for example, 20-year supply, minimum take-or-pay obligation, price indexing based on oil prices or conventional-gas prices)?
4. How can LNG be integrated with the competitive U.S. gas market with regard to pricing and other contractual terms and conditions, and in light of open-access requirements for selected FERC-jurisdictional facilities?

[11] In March 2003, the President and CEO of the AGA testified before Congress that LNG "could account for 10-15 percent of domestic gas consumption 15 to 20 years from now if pursued aggressively and if impediments are reduced." He identified the siting of LNG offloading terminals as "the most time consuming roadblock for new LNG projects."

[12] Although it is uncertain how much LNG will be sold in spot markets, LNG should help to bring the European and North American gas markets closer together. Although spot sales for LNG have somewhat increased, it is likely that LNG developers will continue to favor long-term contracts (perhaps as long as 20 years) at a price sufficient to cover their capital costs and debt service in addition to producing sufficient profits.

5. What are the major obstacles to LNG supplies in the United States? Do they include FERC policies, other government policies and inherent market/business risks?
6. Is the Boston/New England market for LNG a singular situation featured by high pipeline cost for traditional gas, no underground storage, and LNG terminals close to the market area? As a region, New England has been the largest consumer of LNG, which has played a critical role as a source of daily peak supply in the winter.
7. What are the prospects for proposed new terminals? As of this writing, 13 new terminals are being proposed in the United States (currently there are four terminals). How many of these announced terminals can we expect to be actually built? Most of these projects are in the initial stages of development and some experts predict that many, if not most, will not be built.

National Energy Security

1. What is the political risk associated with importing LNG? Most LNG imports into the United States come from foreign and third-world countries. Currently, imports into this country arrive from Trinidad and Tobago, Qatar, Algeria, Nigeria, and Oman. Where will future supplies come from? What is the security of those supplies? Would foreign ownership of such facilities be an issue for national security?

Safety, the Environment and Security

1. Can there be a political resolution of the issues associated with LNG pertaining to *safety,*[13] *the environment*, *security* (post-9/11), and *siting*[14] (NIMBY)? What are the public perceptions, and how do they differ from real-

[13] There have been two serious incidents in this country involving LNG facilities in Cleveland and Staten Island. One account of the Cleveland incident reported that proper precautions were not taken. With regard to the Staten Island disaster, the New York City Fire Department concluded that the accident was a construction accident, rather than a LNG accident. Most experts believe that existing technology has made LNG much safer today than when these accidents occurred (1944 and 1973, respectively).
[14] Some proposals call for the building of off-shore import terminals or the siting of terminals on LNG transport tankers, which could reduce siting concerns.

world and scientific evidence? Proponents of LNG development have argued that LNG terminals are safer, for example, than comparable petroleum installations.

Financing

1. What are the financing requirements for investors? What are the project risks?
2. What are the major pricing issues, domestic and international? How does this influence the ability to attract project developers and capital?
3. Who will develop and own new terminals and regasification facilities in the United States?

Federal Issues

1. What is the appropriate mix of federal, state and local jurisdiction over LNG? DOE, for example, currently authorizes the import of LNG concomitant with U.S. energy policy. What should be the jurisdiction of FERC, DOT, EPA, other federal agencies, and state/local authorities?
2. What are the current federal government policies affecting LNG? (for example, DOE's energy policy, FERC's " open season" and open access requirements for LNG terminals, rates and tariffs, safety and environmental requirements, siting, construction and operation of LNG terminals) How, if at all, should these policies change to accommodate LNG imports?[15]

State Issues

1. Why should state public utility commissions take an interest in LNG? One reason that immediately comes to mind is that the cost of LNG could be passed through to retail consumers in a local gas utility's purchased gas

[15] In a recent case before FERC involving a petition to approve the Hackberry LNG project, FERC ruled that it would not require regulated cost-based rates or an open access tariff for the new LNG terminal. FERC reasoned that consumers would not be affected by the project's costs since the sponsors would shoulder the entire economic risk of the project. If constructed, this facility would be the first new LNG terminal in this country in almost 25 years.

adjustment mechanism, and if a gas utility owns the LNG facility, the capital, operating, and maintenance costs of the facility might be recovered from retail consumers in a rate case. Another reason is the concern of state regulators over adequate and reliable future gas supplies.

2. What are the current state government policies and regulations affecting LNG with LDC-owned LNG terminals, with respect to rates and tariffs, gas supply planning, safety and environmental requirements, siting, construction and operation of LNG terminals? Are these policies and regulations similar or different with respect to LDC-owned propane-air and LNG peak-shaving facilities? How, if at all, should these policies change to accommodate LNG imports?
3. What are the risk exposures for suppliers and consumers? Should LDC contracts for LNG-based supplies receive different levels of review, relative to other sources of gas supplies, from state public utility commissions?