

Liquefied Natural Gas As a Global Energy Option

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Liquefied natural gas (LNG) will play an increasingly important role in meeting the world's growing need for energy. Although a broad range of views exists concerning the future of LNG, it appears to be transforming the global energy landscape in ways yet to be fully understood. But one thing is clear: The strong link between economic growth and energy use shows that the world's economies will continue to need reliable and affordable energy supplies to sustain their growth.

In fulfilling its mission to provide those vital supplies, the oil and gas industry will play a central role in helping to sustain economic growth at least through the middle of this century. I have every confidence that we will be equal to that responsibility as we meet any future challenges.

Mark Twain said that there are two times in a man's life when he should not speculate: when he can't afford it and when he can. In the spirit of that observation, this article focuses on the more salient facts about energy markets and LNG as seen from an ExxonMobil perspective.

Looking ahead, we expect the global economy to grow at an average rate of about 3 percent for the next 20 years. Worldwide energy demand should grow at about 2 percent per year, and hydrocarbons – oil, gas and coal – will still account for 80 percent of energy supply by 2020. Worldwide natural gas consumption, which 50 years ago stood at about 10 percent of overall energy use, will continue to rise through 2020, as gas captures about one-third of all incremental energy growth.

By 2020, gas will supply about one-fourth of global energy demand, second only to oil's 35 to 40 percent contribution. Fortunately, abundant gas supplies exist to meet its share of the expected demand. In fact, according to the U.S. Geological Survey, nearly 14 quadrillion cubic feet of recoverable gas are available worldwide. Estimates from Cedigaz are even higher: enough to satisfy global demand for 175 to 200 years at today's consumption levels.



The environmental benefits of natural gas make it attractive for both the manufacturing sector and for power generation throughout the world. To realize those benefits, however, new gas supplies will be needed to satisfy growing world demand and to replace inevitable declines in existing production.

A significant share of these newer gas supplies is located great distances from the major consuming regions, requiring large investments in infrastructure to bring these remote resources to the markets where they will be used. LNG is poised to play a central role in that process.

An Expanded Role for LNG

Historically, natural gas, including LNG, has been widely viewed as a regional supply resource in the world's energy landscape. But with a pace few thought possible until recent years, economic growth, changing energy markets and advances in technology have combined to transform LNG into an increasingly global energy option.

To fully appreciate this transformation, consider the projected role for LNG in the gas outlook for the three largest consuming areas: Asia Pacific, Europe and North America.

In the Asia Pacific region, gas demand is expected to rise on average between 4 and 5 percent. The bulk of the supplies filling that new demand will come from an expansion of LNG imports from within the region and from the Middle East, where Asian markets will compete with Europe and North America for supply. Major gas discoveries offshore Australia have also created new opportunities for LNG that will expand supply options for the region.

In Europe, after significantly exceeding Gross Domestic Product (GDP) growth in the last decade, gas demand growth has slowed moderately to 2 to 3 percent. New gas supplies to the region will include pipelines and LNG imports from the Middle East, North Africa and West Africa.

In North America, the growth in annual demand for gas is expected to average about 1 percent. However, multiple sources of new supply will be necessary to meet demand as production from mature North American supply sources continues to decline. Greater energy efficiency and conservation can help, but neither will be sufficient to close the widening gap in the balance between supply and demand. Demand in the United States will increasingly be met by gas from distant sources, supplied by LNG and pipelines from Canada and perhaps Alaska.

According to the recent U.S. National Petroleum Council natural gas study, there has been a fundamental shift in the North American natural gas supply/demand balance that has led to higher, more volatile prices. Gas will gain a growing share of the total global energy mix at a cost near parity with other fuels. But as developments in the U.S. market have shown, if gas prices rise above those of competing fuels, some consumers will seek alternatives. For others, however, the range of options is more limited. For example, because power generators and industrial users are more dependent on gas-fired equipment, they have less flexibility to respond quickly to higher gas prices in the short term – a condition that could also affect their competitiveness.

One industry observer described the situation succinctly: "If North American natural gas markets are to function with the flexibility exhibited by oil, unlimited access to the vast world reserves of gas is required. Markets need to be able to effectively adjust to unexpected shortfalls in domestic supply. Access to world natural gas supplies will require a major expansion of LNG terminal import capacity. Without the flexibility such facilities will impart, imbalances in supply and demand must inevitably engender price volatility."

The industry observer I just quoted was Federal Reserve Board Chairman Alan Greenspan, who forcefully underscored the importance of the natural gas supply issue in testimony delivered to the U.S. Congress earlier this year. In my view, Chairman Greenspan's insightful comments about the North American energy challenge were both timely and correct.

In a very real sense, the natural gas supply picture in North America brings into sharper relief the larger issues of healthy economies, the well-being of people and the reliable and affordable energy supplies that remain essential to both.

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Most of the gas that we will be consuming in North America six years from now is not yet in production. Across North America, and especially in the United States, consumers need all the gas they can get from all the sources they can. Meeting that need requires economic development of diverse supplies.

Challenges to Harnessing LNG's Full Potential

In that context, harnessing LNG's full potential will require that a number of important challenges be successfully managed. Foremost among these will be the need to address operations integrity, transportation, technological and infrastructure issues, producer and host country relationships, and regulatory requirements.

An important issue affecting the future of LNG in North America is ensuring safe operations, just as we do in the rest of our business. Here, let me say clearly that we recognize and appreciate that some have concerns about the safety of LNG ships and terminals. We need to acknowledge and address those concerns. And we must be unceasing in our efforts to further improve our safety performance.

With anything new, there is a degree of uncertainty for some people. This is understandable. Moreover, because LNG technology is not well understood by most people outside our business, we must help educate them about the issues related to its increasing use throughout the world.

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Nothing is more important to our industry than the safety and health of our employees and the people with whom we come in contact in the conduct of our business. We need to communicate that message to the public, make clear our commitment to operating safely and discuss the management systems we have in place to ensure that the highest standards are met.

Another issue of critical importance to LNG's future is technology – in particular, the efficiencies, cost savings and other benefits it continues to generate.

ExxonMobil's engineers, working closely with joint-venture partners, have helped build some of the world's largest LNG plants, including two in Qatar, which will ship nearly 10 million tons of LNG per year.



Contributing to these efficiency gains is new gas technology designed to improve the efficiency of liquefaction, transportation and regasification.

The focus of these efforts has been on scale, resulting in liquefaction trains that have moved from slightly more than 2 million tons per annum (MTA) to trains currently in front-end engineering design exceeding 7.5 MTA.

Together with dramatic increases in LNG ship size and recent advances in terminal tank design, these and other innovations have produced cost savings of more than 30 percent since the late 1990s. These efficiencies will enable even wider distribution of gas produced from large, remote accumulations.

The need for a strong contractual linkage between end-users and producers means that the successful development of energy projects depends on cooperation along the whole value chain.

Earlier this year, Qatar Petroleum and ExxonMobil signed a Heads of Agreement for a \$12 billion project to supply LNG from Qatar to the United States for an expected 25-year period. The agreement covers the development of two large LNG trains with combined capacity of 15.6 MTA.

The feed gas for these trains will be sourced from Qatar's giant North Field, which has proven natural gas reserves estimated at 900 trillion cubic feet. Downstream of the plants, Qatar Petroleum and ExxonMobil will be working to acquire the necessary shipping capacity and developing regasification facilities in the United States.

The successful, multiyear joint effort between Qatar Petroleum and ExxonMobil is one notable example of the change manifested in today's global LNG markets. Another is ExxonMobil's longstanding activities in Indonesia, where our Arun and satellite fields produce more than 1.2 billion cubic feet per day of gas and supply LNG to Asia Pacific markets.

International Relationships and Energy Development

Beyond the technical benefits that such projects provide for all participants, broader lessons touching international relationships have also proven beneficial and instructive.

Consuming countries need to recognize that they have an important role to play in facilitating timely energy development. They can do this by creating reasonable regulatory regimes that will allow facilities to be designed and built without undue delay or unnecessary cost, and by relying on free competition and market solutions to meet future demand.

Host-country governments can also facilitate development by fostering an environment that encourages the very large, long-term investments needed by our industry to build the necessary upstream infrastructure for bringing LNG to the United States and other major consuming countries.

Such an environment requires a stable legal framework and predictable tax structure, sanctity of contracts, an impartial court system, respect for intellectual property, elimination of duties, transparency in procurement and workforce security.

Where governments do not adopt or enforce a stable framework of laws and regulations, investments become difficult to justify. Working together, however, governments and national oil companies can play a constructive part by encouraging and facilitating the growth in capacity that will be crucial to satisfying the world's demand for energy over the coming decades. Governments that take the lead in encouraging investment will reap the substantial benefits that accrue from it. Success will require a collaborative effort and a cooperative relationship between exporting and importing countries.

Because these are often very expensive projects that are 30 or 40 years in duration, establishing solid, long-term relationships is essential. Exporting countries must have confidence of secure rules on imports, while importing countries must have confidence in stability of supply and predictability of terms from exporting countries.

We need a predictable and efficient process for permitting facilities. Such a process requires a cooperative relationship between project developers and local, state and federal government entities in importing countries, particularly in the United States.

Government agencies at all levels must meet the challenge and facilitate terminal development. This means making the regulatory process as efficient as possible and adding the necessary resources to get the job done right. Delays have a negative effect on the competitiveness of gas, as when supply shocks cause price spikes that destroy demand or when customers use coal instead.

Adverse pressures on industrial demand would directly affect the U.S. economy and could lead to reduced economic activity, job reductions and other undesirable consequences. Nonetheless, we also must be cognizant that our industry has filed a large number of proposals for new or reconfigured terminals. We recognize and appreciate the effort and dedication of all those whose job it is to review and pass judgment on the particulars of each filing.

Over the last several months, my company and others in our industry have begun the process of working with government to obtain the needed approvals to build new LNG infrastructure in the United States. We know from long experience in the U.S. that the development of new, "greenfield" facilities is often a significant challenge, especially given the need to have them ready to receive gas by 2008 or 2009.

The energy industry and all levels of government need to contemplate the consequences of failing to meet those needs for consumers and customers. We must have consistent and complete policies that both encourage the use of natural gas and address the need for additional gas supplies, including LNG. We must work for a future in which the immediate development of new resources and flexibility in fuel choices provide more balance to the North American natural gas supply/demand equation.

With so much at stake, failure is not an option. ■

Lee R. Raymond is the chairman and CEO of Exxon Mobil Corporation. Before the merger of Exxon and Mobil on November 30, 1999, Mr. Raymond was chairman and chief executive officer of Exxon Corporation.

A native of Watertown, South Dakota, Mr. Raymond graduated in 1960 from the University of Wisconsin with a bachelor's degree in chemical engineering. In 1963, he received a Ph.D. in the same discipline from the University of Minnesota. He joined Exxon that year as a production research engineer in Tulsa, Oklahoma. Over the next 16 years, he held positions of increasing responsibility with Exxon Company U.S.A., Creole Petroleum Corporation, the former Exxon International Company and Lago Oil & Transport Company, Limited, the Exxon affiliate in Aruba. He became president of Exxon Nuclear Company, Inc. in 1979 and moved to New York in 1981, when he was named executive vice president of Exxon Enterprises. In 1983, Mr. Raymond was named president and director of Esso Inter-America Inc., with responsibilities for Exxon's operations in the Caribbean and Central and South America. Mr. Raymond was named a senior vice president and was elected to the board of directors of the corporation in 1984. He became president of the corporation in 1987.

Mr. Raymond is a director of J. P. Morgan Chase & Co. and the United Negro College Fund. He is chairman of the board, a director and member of the Executive Committee and Policy Committee of the American Petroleum Institute, and a member of the President's Export Council.