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Liquefied Natural Gas (LNG) in U.S. Energy Policy: Infrastructure and Market Issues

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Summary

Liquefied natural gas (LNG) imports to the United States are increasing to supplement domestic gas production. Government officials such as the Federal Reserve Chairman and the Secretary of Energy have spoken in favor of LNG imports to mitigate high energy prices. Through regulatory and administrative actions, federal agencies are trying to attract private capital for LNG infrastructure, streamline the LNG terminal approval process, and promote LNG trade. Were these policies to continue and gas demand to grow, LNG might account for as much as 21% of U.S. gas supply by 2025, up from 3% in 2004. Congress is examining the infrastructure and market implications of greater U.S. LNG demand.

There are concerns about how LNG capacity additions would be integrated into the nation's gas infrastructure. Meeting projected U.S. LNG demand would require six to ten new import terminals in addition to expansion of four existing terminals. Five new terminals in the Gulf of Mexico are approved, but public opposition has blocked near-to-market terminals which might save billions of dollars in gas transportation costs. New LNG terminals can also require more regional pipeline capacity to transport their supply, although this capacity may not be available in key markets. Securing LNG infrastructure against accidents and terrorist attacks may also be a challenge to public agencies. Since import terminals process large volumes of LNG, a breakdown at any facility has the potential to bottleneck supply.

LNG's effectiveness in moderating U.S. gas prices will be determined by global LNG supply, the development of a "spot" market, potential market concentration, and evolving trading relationships. There appears to be sufficient interest among LNG exporters to meet global demand projections, although it remains to be seen which new export projects will be built. An LNG spot market, which may help U.S. companies import LNG cost-effectively, also appears to be growing. Although some industry analysts believe the future LNG market may be influenced by a natural gas cartel, the potential effectiveness of a such a cartel is unclear. Whether exporters cooperate or not, an integrated global LNG market may change trading and political relationships. In a global market, individual country energy polices may affect LNG price and availability worldwide. Trade with LNG exporters perceived as politically unstable or inhospitable to U.S. interests may raise concerns about supply reliability.

Recent measures before Congress (H.R. 4413 in the 109th Congress, S. 2095 in the 108th Congress, and P.L. 108-199) would affect LNG imports by encouraging domestic gas production and new LNG terminal construction, although Congress has not been explicit about the desirability of imported LNG overall. As Congress debates U.S. natural gas policy, three questions emerge: (1) Is expanding LNG imports the best option for meeting natural gas demand in the United States? (2) What role, if any, should the federal government play in facilitating the development of LNG infrastructure domestically and abroad? (3) How might Congress mitigate the risks of the global LNG trade within the context of national energy policy?

This report will be updated as events warrant.

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Introduction

The United States is considering fundamental changes in its natural gas supply policy. Faced with rising natural gas demand and perceived limitations in North American gas production, many in government and industry are encouraging greater U.S. imports of liquefied natural gas (LNG). Recent activities by the Federal Energy Regulatory Commission, the Department of Energy, and other federal agencies to promote greater LNG supplies have included changing regulations, clarifying regulatory authorities, and streamlining the approval process for new LNG import terminals. While forecasts vary, many analysts expect LNG to account for 12% to 21% of total U.S. gas supply by 2025, up from approximately 3% in 2004. If these forecasts are correct, U.S. natural gas consumers will become increasingly dependent upon LNG imports to supplement North American pipeline gas supplies.

Recent measures before Congress have sought to encourage both new LNG terminal construction and domestic gas production. The Liquefied Natural Gas Import Terminal Development Act (H.R. 359) was introduced on January 25, 2005. Among other provisions, H.R. 359 would clarify that the federal government has the primary authority to approve LNG terminal siting (Sec. 2d); would clarify that the Federal Energy Regulatory Commission (FERC) is the lead agency for onshore LNG terminal environmental review and permitting (Sec. 2g); would codify FERC's prior rulings exempting LNG terminals from certain rate regulations and open access requirements (Sec. 2d); and would streamline the onshore terminal siting review process, requiring FERC to issue siting decisions within one year of receiving an application (Sec. 2e).

In the 108th Congress, the Energy Policy Act of 2003 (S. 2095) included various incentives for domestic natural gas producers (Subtitle B), provided loan guarantees and other incentives for an Alaska gas pipeline (Subtitle D), and clarified federal approval authority for LNG terminal expansions (Sec. 320).[1] The Consolidated Appropriations Act of 2004 (P.L. 108-199) sought to amend the Energy Policy Act, should it have been enacted, to create a financial incentive for constructing an LNG terminal in Alaska for shipments to the lower 48 states (Sec. 146).

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[1] The House version of the Energy Policy Act of 2003 (H.R. 6, 108th Cong. (2003); as reported (H.Rept. 108-375 (2003)). That version also includes domestic gas production incentives (Title IIIB), and Alaska gas pipeline incentives (Title IIID).

While an increase in LNG imports is already underway, federal officials and Members of Congress have been debating the merits and risks of U.S. LNG dependency. In 2003 congressional testimony, for example, Federal Reserve Chairman Alan Greenspan called for "a major expansion of LNG terminal import capacity" as essential to alleviate the harmful economic effects of high energy prices.[2] In April, 2004, Department of Energy Secretary Spencer Abraham testified before Congress that "increasing U.S. access to [LNG] imports...will help produce the fuels we need in the 21st Century."[3] In a July, 2004 election campaign interview, President Bush reportedly stated "I strongly support developing new LNG capacity in the United States."[4] Some in Congress question the implications of such a policy, however, drawing analogies to the consequences of U.S. dependency on foreign oil.[5] Other observers express concern about LNG safety and vulnerability to terrorism.[6]

Specific questions are emerging about the implications of greater LNG imports to the United States. LNG has substantial physical infrastructure requirements and there are uncertainties about how this infrastructure would be integrated into North America's existing gas network. The potential effects of larger LNG imports on U.S. natural gas prices will be driven by the global LNG market structure, although that market structure is still evolving. Political relationships among countries in the LNG trade may also change as LNG becomes increasingly important to their economies.

This report will review the status of U.S. LNG imports, including projections of future U.S. LNG demand within the growing international LNG market. The report will summarize recent policy activities related to LNG among U.S. federal agencies, as well as private sector plans for LNG infrastructure development. The report also will introduce key policy considerations in LNG infrastructure and market structure, highlighting current market information and key uncertainties. Finally, the report will identify key questions in LNG import policy development.

Background

Natural gas is widely used in the United States for heating, electricity generation, industrial processes, and other applications. In 2003, U.S. natural gas consumption was 22 trillion cubic feet (Tcf), accounting for 2% of total U.S. energy

[2] Greenspan, A., Chairman, U.S. Federal Reserve Board. "Natural Gas Supply and Demand Issues." Testimony before the House Energy and Commerce Committee. June 10, 2003.

[3] Abraham, Spencer, U.S. Energy Secretary. Testimony to the House Committee on Energy and Commerce Hearing on Department of Energy FY 2005 Budget Priorities. Apr. 1, 2004.

[4] American Gas Association (AGA). "President George W. Bush on Supply, Demand and His Energy Plan." *American Gas*. Washington, DC. July, 2004. p3.

[5] Hon. Peter Domenici. "U.S. Must Build LNG Ports to Avoid Spiraling Natural Gas Prices, Sen. Domenici Says." Press release. Feb. 15, 2005.

[6] Hebert, H.J. "Potential of Catastrophic Fire from Terrorist Attack Worries LNG Opponents." Associated Press. Jan. 22, 2005.

consumption.[7] Until recently, nearly all U.S. natural gas was supplied from North American wells and transported through the continent's vast pipeline network to regional markets. In 2003, however, due to constraints in North American natural gas production, the United States sharply increased imports of natural gas from overseas in the form of liquefied natural gas (LNG). While absolute levels remain limited today, growth in LNG imports to the United States is expected by many analysts to accelerate over the next 20 years, reflecting growing domestic demand and expectations for a global expansion in LNG trade.

What Is LNG?

When natural gas is cooled to temperatures below minus 260°F it condenses into liquefied natural gas, or "LNG." As a liquid, natural gas occupies only 1/600th the volume of its gaseous state, so it is stored more effectively in a limited space and is more readily transported by tanker ship. A typical tanker, for example, can carry 138,000 cubic meters of LNG — enough to supply the daily energy needs of over 10 million homes.[8] When LNG is warmed, it "regasifies" and can be used for the same purposes as conventional natural gas.

The physical infrastructure of LNG includes several interconnected elements as illustrated in **Figure 1**. In producing countries, natural gas is extracted from gas fields and transported by pipeline to central liquefaction plants where it is converted to LNG and stored. Liquefaction plants are built at marine terminals so the LNG can be loaded onto special tanker ships for transport overseas. Tankers deliver their LNG cargo to import terminals in other countries where the LNG can again be stored or regasified and injected into pipeline systems for delivery to end users.

This LNG infrastructure requires large capital investments. In addition to gas field development costs, a new liquefaction plant costs approximately $2-$3 billion, and an import terminal costs $500 million to $1 billion. Each LNG tanker costs $150-$200 million.[9]

Due to the high capital costs of LNG infrastructure, LNG trade has traditionally relied upon long-term fuel purchase agreements in order to secure project financing for the entire supply chain. Of over 160 major LNG supply contracts in force around the world as of March, 2004, well over 90% had a contract term of 15 years or longer.[10] While these contracts have increasingly incorporated some flexibility by accommodating extra LNG deliveries, for example, or allowing shipments to be

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[7] Energy Information Administration (EIA). *Annual Energy Outlook 2005*. DOE/EIA-0383(2005). Feb. 2005. Table A13. p159.

[8] Energy Information Administration (EIA). *The Global Liquefied Natural Gas Market: Status & Outlook.* DOE/EIA-0637. Dec. 2003. p30.

[9] Clark, Judy. "CERA: Natural Gas Poised to Overtake Oil Use by 2025." *Oil & Gas Journal*. Mar. 1, 2004. p22.

[10] "LNG Contracts." *LNG OneWorld* website. [http://www.lngoneworld.com] Drewry Shipping Consultants. London, England. Mar. 9, 2004.

diverted, they have only allowed for a limited supply-demand response compared to other global commodities markets.

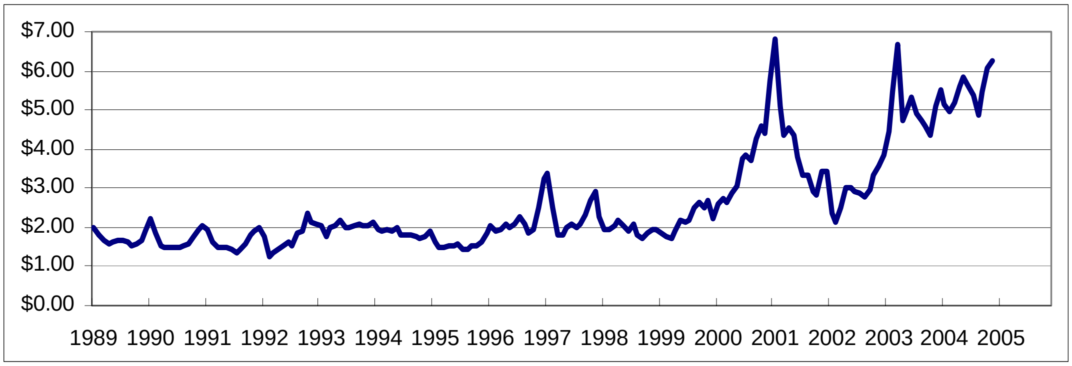
Figure 1: LNG Supply Chain

Source: *Oil & Gas Journal.* Nov. 10, 2003. p64.

U.S. LNG Import Experience and Projections

The United States has used LNG commercially since the1940s. Initially, LNG facilities stored domestically produced natural gas to supplement pipeline supplies during times of high gas demand. In the 1970's LNG imports began to supplement domestic gas production. Between 1971 and 1981, developers built four U.S. import terminals: in Massachusetts, Maryland, Georgia, and Louisiana.[11] Due primarily to a drop in domestic gas prices, however, two of these terminals quickly closed. Imports to the other two terminals remained small for the next 30 years. In 2002, U.S. LNG imports were only 0.17 Tcf, less than 1% of U.S. natural gas supply.[12]

Figure 2: U.S. Natural Gas Wellhead Price ($/Mcf)



Source: Energy Information Administration. *Natural Gas Weekly Update*. Feb. 3, 2005.

United States demand for LNG has been increasing dramatically since 2002. This growth in LNG demand has been occurring in part because North American natural gas production appears to have plateaued, so it has not been able to keep pace with growth in demand. As a result, U.S. natural gas prices have become higher and more volatile. As **Figure 2** shows, gas prices at the wellhead have risen from between $1.50 and $2.50/Mcf through most of the 1990s to an average above

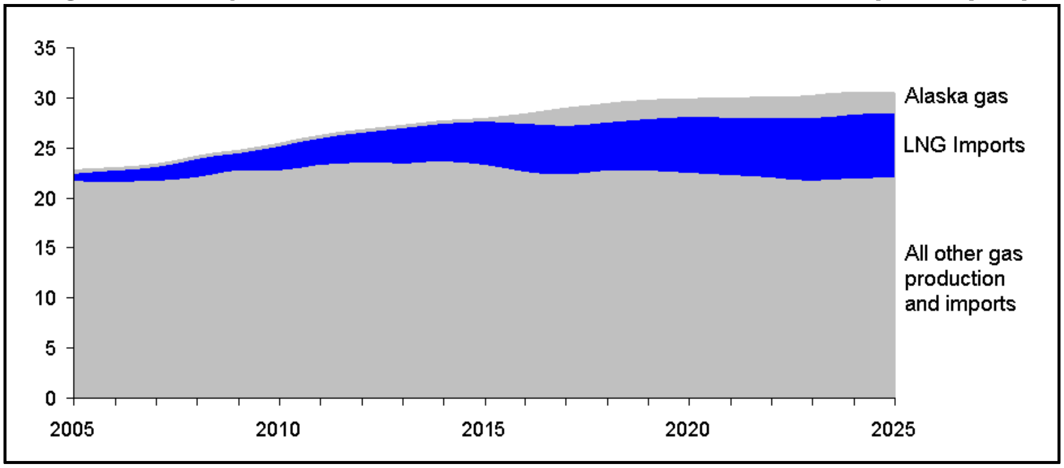
[11] An LNG terminal was also built at Kenai, Alaska in 1969 for exports to Japan.

[12] EIA. DOE/EIA-0383(2005). Feb. 2005. Table A13. p159. Tcf = trillion cubic feet.

$5.00/Mcf and a peak above $6.00/Mcf in 2004.[13] At the same time, international prices for LNG have fallen because of increased supplies and lower production and transportation costs, making LNG more competitive with domestic natural gas.[14] While cost estimation is speculative, some industry analysts believe that LNG can be economically delivered to U.S. pipelines for approximately $2.50 to $3.50/Mcf.[15]

Forecasts by the Energy Information Administration (EIA), National Petroleum Council, and other groups project expansion in U.S. LNG imports over the next 20 years. Specific LNG forecasts vary based on methodology and market assumptions, but most expect LNG to account for 12% to 21% of U.S. natural gas supplies by 2025.[16] EIA's reference forecast projects U.S. LNG imports to reach 6.4 Tcf in 2025, which equates to approximately 21% of total U.S. gas supply for that year, up substantially from the 2004 market share of about 3%.[17] **Figure 3** details projected U.S. LNG imports relative to other natural gas production and pipeline imports in EIA's forecast.

Figure 3: Projected U.S. Natural Gas Production and Imports (Tcf)



Source: Energy Information Administration. *Annual Energy Outlook 2005.* Feb. 2005. pp159-160.

Global LNG Market Development

Projections of accelerated growth in U.S. LNG demand reflect a general expansion in the global natural gas market. According to the EIA's most recent international forecast "natural gas is expected to be the fastest growing component

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[13] Mcf = thousand cubic feet

[14] Sen. Colleen Taylor. "LNG Poised to Consolidate its Place in Global Trade." *Oil & Gas Journal*. Jun. 23, 2003. p73.

[15] Hughes, Peter. "Outlook for Global Gas Natural Markets." BP, Gas Power & Renewables Division. Presentation to the World Bank Energy Week 2004 Conference. Mar. 8, 2004.

[16] For a comparison of major forecasts see EIA. *Annual Energy Outlook 2005.* DOE/EIA-0383(2005). Feb. 2005. Table 36. p118.

[17] EIA. DOE/EIA-0383(2005). Feb. 2005. Table A13. p159.

of world primary energy consumption."[18] EIA projects global natural gas demand to rise by an average 2.2 percent annually for the next 20 years, with "the most robust growth... among the nations of the developing world," much of it to fuel electricity generation.[19] A significant part of this global gas demand growth is expected to be met by new supplies of LNG. Long-term projections of global LNG growth vary, but most major energy companies and industry analysts expect global LNG demand to roughly triple by 2020, from 6 Tcf in 2003, to 18 Tcf or more in 2020.[20] According to EIA projections, 18 Tcf would account for approximately 12% of global natural gas consumption in 2020.[21]

LNG Safety and Security

Natural gas is combustible, so an uncontrolled release of LNG poses a hazard of fire or, in confined spaces, explosion. LNG also poses hazards because it is so cold. Because LNG tankers and terminals are highly visible and easily identified, they may also be vulnerable to terrorist attack. Assessing the potential risk from LNG releases is controversial. A 1944 accident at one of the nation's first LNG facilities, for example, killed 128 people and initiated public fears about LNG hazards which persist today.[22] But technology improvements and standards since the 1940's appear to have made LNG facilities safer. Between 1944 and 2004, LNG terminals experienced approximately 13 serious accidents, with two fatalities, directly caused by LNG.[23] Since international LNG shipping began in 1959, tankers have carried 40,000 LNG cargoes without a serious accident at sea or in port.[24] In January 2004, however, a fire at an LNG processing facility in Algeria killed an estimated 27 workers and injured 74 others.[25] The Algeria accident raised new questions about LNG facility safety and security.

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[18] Energy Information Administration (EIA). *International Energy Outlook 2004.* DOE/EIA-0484(2004). Apr. 2004. p47.

[19] DOE/EIA-0484(2004). Apr. 2004. p47.

[20] See, for example, Nauman, S.A. ExxonMobil. "The Outlook For Energy: A 2030 View." Irving, TX. Slide presentation. Jan. 25, 2005.; Deutshce Bank Securities, Inc. "Global LNG: Exploding the Myths." July 22, 2004. p.2.; Brinded, M., Royal Dutch/Shell. "Shared Trust - The Key to Secure LNG Supplies." Speech to the U.S. LNG Summit. Washington, DC, Dec. 17, 2003.

[21] DOE/EIA-0484(2004). Apr. 2004. p47.

[22] Bureau of Mines (BOM). *Report on the Investigation of the Fire at the Liquefaction, Storage, and Regasification Plant of the East Ohio Gas Co., Cleveland, Ohio, October 20, 1944.* February, 1946.

[23] CH-IV International. *Safety History of International LNG Operations, Revision 2*. TD-02109. Millersville, MD. November, 2002. p6-12.

[24] Verberg, G. "The Role of IGU in the Promotion of LNG." Presentation to the *Groupe International des Importateurs de Gaz Natural Liquefie*. Korea. Oct. 17, 2004.

[25] Junnola, Jill *et al.* "Fatal Explosion Rocks Algeria's Skikda LNG Complex." *Oil Daily*. Jan. 21, 2004. p6.

A number of technical studies since the terror attacks of September 11, 2001, have been commissioned to reevaluate the safety hazards of LNG terminals and associated shipping. These studies have caused controversy because, due to differences in analytic assumptions, some have reached inconsistent conclusions about the potential public hazard of LNG terminal accidents or terror attacks. In an effort to resolve these inconsistencies, the Department of Energy commissioned a comprehensive LNG hazard study from Sandia National Laboratories. The Sandia report, released in December 2004, determined that a worst-case, "credible" LNG tanker fire could emit harmful thermal radiation up 2,118 meters (1.3 miles) away.[26] Although, the report concluded that "risks from accidental LNG spills ... are small and manageable," it also concluded that "the consequences from an intentional [tanker] breach can be more severe than those from accidental breaches."[27] Both proponents and opponents of new LNG terminals have cited the Sandia findings to support their positions. The controversy continues.

LNG Policy Activities of U.S. Federal Agencies

The Federal Energy Regulatory Commission and the Department of Energy have been actively promoting increased LNG imports. Through regulatory and administrative actions, these agencies have tried to foster LNG capital investment, streamline the LNG terminal approval process, and promote global LNG trade.

FERC Regulations. The Federal Energy Regulatory Commission (FERC) grants federal approval for the siting of new onshore LNG facilities and interstate gas pipelines, and also regulates prices for interstate gas transmission.[28] In December, 2002, the FERC exempted LNG import terminals from rate regulation and open access requirements. This regulatory action allowed import terminal owners to set market-based rates for terminal services, and allowed terminal developers to secure proprietary terminal access for corporate affiliates with investments in LNG supply.[29] These regulatory changes greatly reduced investment uncertainty for potential LNG developers, and assured access to their own terminals.[30] In February 2004, FERC streamlined the LNG siting approval process through an agreement with the Coast Guard (USCG) and the Department of Transportation (DOT) to coordinate review of LNG terminal safety and security. The agreement "stipulates that the agencies

[26] Sandia National Laboratories (SNL). *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water*. SAND2004-6258. Albuquerque, NM. Dec. 2004. p51.

[27] SNL. Dec. 2004. p14.

[28] Natural Gas Act of 1938 (NGA), June 21, 1938, ch. 556, 52 Stat. 812, (codified as amended at 15 U.S.C. §§ 717 *et seq*).

[29] Under open access, terminal owners were required to offer terminal services on a first come, first served basis, and could not discriminate against service requests to protect their own market activities.

[30] Vallee, James E. "FERC Hackberry Decision Will Spur More U.S. LNG Terminal Development." *Oil & Gas Journal*. Nov. 10, 2003. p64.

identify issues early and quickly resolve them."[31] FERC also announced a new branch devoted to LNG within its Office of Energy Projects.[32]

Between 1999 and 2005, FERC approved the reactivation of the two idled U.S. LNG terminals, and subsequently approved the expansion of the four existing import terminals in the continental United States. In September, 2003, FERC approved the Cameron LNG project in Hackberry, LA, the first new LNG import terminal to be sited in the continental United States in over 25 years.[33] In 2004, FERC also approved LNG terminals in Freeport, TX and Sabine Pass, LA.[34] These approvals could increase total U.S. LNG import capacity to approximately 3.8 Tcf per year. In 2004, FERC also approved the construction of two new gas pipelines connecting Florida to proposed LNG import terminals in the Bahamas.[35]

Offshore Terminal Regulations. In November, 2002, Congress passed the Maritime Transportation Security Act of 2002 (P.L. 107-295), which transferred jurisdiction for offshore LNG terminal siting approval from the FERC to the Maritime Administration (MARAD) and the U.S. Coast Guard (USCG). According to the Department of Energy (DOE), the act

> ... streamlined the permitting process and relaxed regulatory requirements. Owners of offshore LNG terminals are allowed proprietary access to their own terminal capacity, removing what had once been a major stumbling block for potential developers of new LNG facilities.... The streamlined application process ... promises a decision within 365 days....[36]

The proprietary access provisions for offshore terminals are similar to those set by FERC for onshore terminals to ensure equal treatment for both kinds of facilities. In November, 2003, the MARAD and USCG approved the Port Pelican project, the first offshore LNG terminal ever to be sited in U.S. waters. The agencies have subsequently approved Energy Bridge (January, 2004) and Gulf Landing (February, 2005), two additional offshore LNG projects. All three terminals would be located in the Gulf of Mexico. Their combined annual capacity would be approximately 1.2 Tcf. As of February, 2005, the agencies were reviewing six additional offshore terminal applications, two off the California coast, four in the Gulf of Mexico, and one off the coast of Massachusetts..

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[31] Federal Energy Regulatory Commission (FERC). Press release. R-04-3. Feb.11, 2004.

[32] Lorenzetti, M. "LNG Rules." *Oil & Gas Journal*. Apr.5, 2004. p32.

[33] Eckert, Toby. "Sempra Gets Final OK for Louisiana Gas Import Facility." Copley News Service. Sep. 10, 2003.

[34] Federal Energy Regulatory Commission (FERC). "Existing, Proposed and Potential North American LNG Terminals" Office of Energy Projects. Washington, DC. Jan. 6, 2005. [http://www.ferc.gov/industries/gas/gen-info/horizon-lng.pdf].

[35] "Cheyenne Plains, Tractebel's Calypso Pipelines Get Green Light." *Natural Gas Intelligence*. Mar. 24, 2004.

[36] EIA. DOE/EIA-0383(2004). Jan. 2004. p15.

DOE LNG Summit. In December 2003, the Department of Energy (DOE) hosted an LNG Summit attended by energy ministers from 24 countries as well as senior executives from multinational energy and infrastructure companies. According to the welcome address by Secretary Spencer Abraham, the conference was intended as a call "to get new [LNG] terminals up and running, to develop new [gas] fields around the globe, and to come together in partnership on mutually beneficial, long-term agreements."[37] The Secretary also asked federal agencies to "speed up the siting and permitting process for regasification and related facilities."[38]

Key Issues in U.S. LNG Import Policy

Federal actions have been facilitating greater U.S. LNG imports, and the private sector is responding with plans for new LNG facilities. Nonetheless, concerns are emerging about the infrastructure needs of LNG, the future structure of global LNG trade, and the relationship between the United States and other LNG market participants.

Physical Infrastructure Requirements

To meet U.S. LNG imports of 6.4 Tcf in 2025 as projected by the EIA would require significant additions to North American import terminal capacity. Along with planned expansions at the four existing terminals, six to ten new import terminals would be needed. LNG developers have proposed over 70 new terminals with a combined annual import capacity exceeding 12 Tcf — far more capacity than would likely be needed the meet the projections (**Appendix**).[39] These developers include major multi-national corporations with both the financial resources and the project experience to develop such facilities. At issue is where these terminals would be constructed, how they would be integrated into the nation's existing gas infrastructure, and how they might be secured against accident or terrorist attack.

Terminal Siting. Choosing acceptable sites for new LNG terminals has proven controversial. As noted earlier in this report, federal agencies have approved the siting of five new terminals in the Gulf of Mexico as well as two new Florida pipelines for proposed terminals in the Bahamas. But many developers have sought to build terminals nearer to major consuming markets in California and the Northeast (**Figure 4)**. Near-to-market terminal proposals have struggled for approval due to community concerns about LNG safety, effects on local commerce, and other potential negative impacts. LNG terminal opposition is not unlike that experienced by some other types of industrial and utility facilities. Due to local community opposition, LNG developers have already withdrawn terminal projects recently proposed in California, Maine, North Carolina, Florida, and Mexico. Other terminal

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[37] Abraham, Spencer. U.S. Secretary of Energy. Welcoming remarks at the LNG Ministerial Summit. Mayflower Hotel. Washington, DC. Dec. 17, 2003.

[38] Abraham, Spencer. U.S. Secretary of Energy. Keynote address at the LNG Ministerial Summit. Mayflower Hotel. Washington, DC. Dec. 18, 2003.

[39] This figure Includes several proposed terminals in Canada, Mexico and the Bahamas.

proposals in Rhode Island, New York, New Jersey and Canada are facing stiff community opposition. In Alabama, a state assumed by many to be friendly to LNG development, community groups have effectively blocked two onshore terminal proposals and have called for LNG import terminals to be built only offshore.[40]

In some cases state and local agencies are at odds with federal agencies over LNG terminal siting approval. For example, the California Public Utilities Commission (CPUC) has rejected FERC's assertion of sole jurisdiction over the siting of an LNG terminal in Long Beach. The CPUC has opened an investigation into the terminal proposal, has ordered the developer to apply for a separate siting approval from the state, and is challenging FERC's assertion that it can preempt state jurisdiction over the proposal.[41] In June, 2004, FERC reasserted its earlier jurisdictional ruling, prompting a federal court appeal by California regulators. In December, 2004 Congress included language in H.Rept. 108-792 accompanying P.L. 108-477 affirming FERC's authority to pre-empt states on LNG terminal siting and permitting (page 963).[42] Eighteen members of Congress have since filed an *amicus* brief with the federal court hearing the CPUC case in support of the CPUC's position.[43] Litigation continues.

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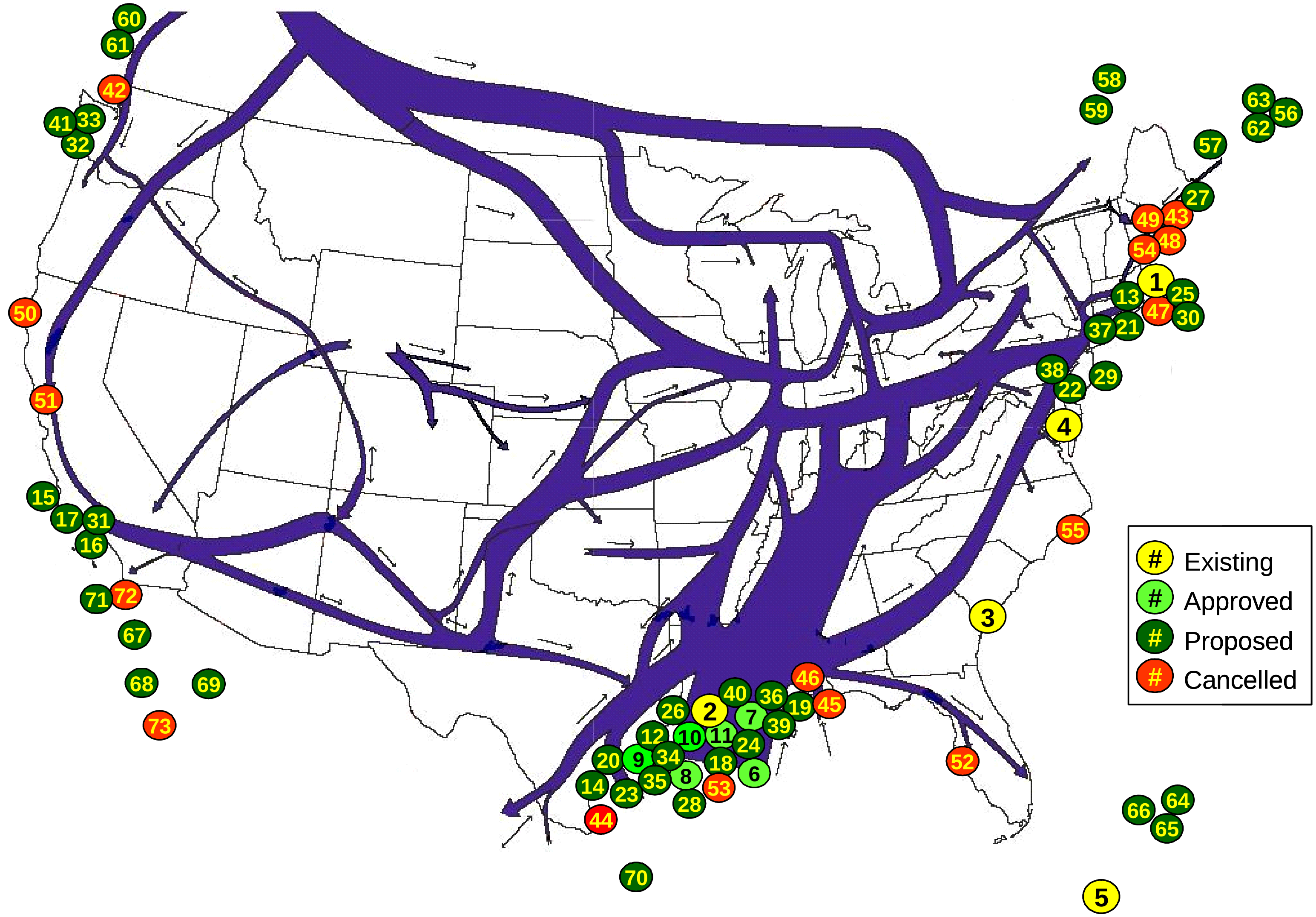
[40] Editorial. "Move ExxonMobil's LNG Plant Offshore." *Mobile Register*. Nov. 30, 2003.

[41] Schmollinger, C. "Aggressive FERC Tangles With States on Jurisdiction Issues." *Natural Gas Week.* May 7, 2004.

[42] This language can be found in the joint explanatory statement accompanying the Consolidated Appropriations Act, 2005. *See* 150 Cong. Rec. H10,560 (daily ed.Nov. 19, 2004) (Joint Explanatory Statement on H.Rept. 108-792, 108th Cong. 2nd Sess. (2004)).

[43] Hon. Barney Frank. "Lawmakers File Brief Opposing LNG Preemption Language." Press release. Jan. 1, 2005.

Figure 4: U.S. Natural Gas Pipeline Flows and Proposed LNG Terminals



Note: Terminal numbers refer to tables in the Appendix.
Sources: Energy Information Administration, FERC, Trade Press

In a similar dispute, Delaware's environmental secretary has blocked the development of an LNG terminal on the Delaware-New Jersey border ruling that part of the planned terminal would violate Delaware's Coastal Zone Act.[44] The ruling is under appeal. In 2004, a Rhode Island state representative (unsuccessfully) introduced legislation that would have banned LNG tankers from passing through the Sakonnet River, preventing them from serving proposed LNG terminals at Fall River and Somerset, MA.[45] Also in 2004, the Governor of Alabama helped to block the development of an onshore LNG terminal in Mobile Bay by calling for "an adequate independent, individualized, site specific safety study" apart from safety studies required by FERC under federal siting regulation.[46]

Developers have proposed terminals near consuming markets to avoid pipeline bottlenecks and to minimize transportation costs. In 2003, soon after LNG deliveries to the Cove Point resumed, natural gas for the local Maryland market was priced well below conventional gas supplies transported by pipeline from the Gulf of Mexico.[47] If new terminals are built far from key consumer markets, delivered gas might cost more than if LNG terminals were built locally.

Local opposition for LNG terminals has been strong in the Northeast, which has a constrained gas transmission infrastructure. Northeast gas prices are higher than in other parts of the country. In Maine, for example, the monthly average wholesale price of gas delivered between October, 2003 and October, 2004 was $8.85/Mcf, compared to $6.09/Mcf in Louisiana.[48] Were the same price differential to hold in the future, Maine consumers would have to pay $2.76/Mcf, or 45 percent, more for LNG delivered to Louisiana rather than the Maine coast. Many factors like weather and pipeline tariffs could significantly change relative prices. Nonetheless, if recent regional pricing patterns persist, displacing a handful of proposed LNG terminals from consumer markets to the Gulf of Mexico could cost regional gas consumers billions of dollars in extra pipeline transportation charges. On the other hand, siting new terminals in more receptive locations could help bring them into service more quickly, and could still exert downward pressure on gas prices while alleviating community safety concerns.

Pipeline Infrastructure. LNG supplies to the United States have been such a small share of the total market that they have had little discernible influence on the development of North America's gas pipeline network. If projections of U.S. LNG growth prove correct, however, LNG terminals may have more impact on pipeline infrastructure in the future. As additional LNG import capacity is approved, how

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[44] Fifield, A. "Del. Hands BP a Setback on Pier." *Philadelphia Enquirer*. Feb. 4, 2005.

[45] O'Driscoll, M. "LNG: Safety Debate Intensifies, R.I. Law Could Block Mass. Shipments." *Greenwire.* Mar. 29, 2004.

[46] Raines, B. "Gov. Riley Demands Studies Before LNG." *Mobile Register*. Jan. 15, 2004.

[47] Jowdy, M. and Haywood, T. "LNG Imports Undermine Premiums Near US Terminals." *World Gas Intelligence*. Nov. 25, 2003.

[48] Energy Information Administration (EIA). "Natural Gas City Gate Price." website data series. [http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm]. Feb. 8, 2005.

new terminals will be physically integrated into the existing pipeline network becomes a consideration.

LNG terminals may affect pipeline infrastructure in two ways. First, new terminals and terminal expansions must be connected to the interstate pipeline network through sufficient "takeaway" pipeline capacity to handle the large volumes of imported natural gas. Depending upon the size, location and proximity of a new terminal to existing pipelines, ensuring adequate takeaway capacity may require new pipeline construction. For example, the owner of the Lake Charles, LA terminal intends to build a 23-mile pipeline to transport additional gas volume from the terminal's planned expansion.[49] The owner of the Everett, MA terminal has predicted that, without significant new pipeline investments, the terminal's production capacity could exceed takeaway capacity by 10 times or more in the next decade due to pipeline demand growth in New England.[50] The availability of pipeline capacity directly affects pipeline transportation costs, so it is an important consideration in evaluating the economics of LNG versus traditional pipeline supplies in specific markets.

Second, if gas imported as LNG cannot move freely through interstate pipeline systems, consumers may not realize the lower prices that result from additional gas availability. One industry observer remarked, "without more infrastructure, gas may face the kind of glut plaguing the electric utility industry, with too much generating capacity and too few connections."[51] For this reason, some LNG developers advocate building LNG terminals in traditional gas producing regions, where pipeline nodes are located. According to one industry executive, "it doesn't make a lot of sense to build a terminal and then have to build a huge pipeline."[52] Others argue that the most costly constraints in the gas pipeline network are at the ends of the pipelines, not the beginnings. Gas is expensive in Boston, for example, because there are few pipelines supplying the region — a transportation constraint that would not be alleviated by pumping more gas into pipelines in the Gulf of Mexico. As one senior FERC official recently remarked, "we can site all the LNG we want in the Gulf but it won't help people in New England."[53] It is not clear, therefore, whether adding LNG supplies to traditional producing regions would be less costly for consumers than building in-market terminals and adding to regional pipeline capacity.

In addition to requiring sufficient takeaway capacity, LNG terminals likely will influence pipeline network flows. As **Figure 4** shows, major U.S. pipeline systems

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[49] "FERC gives OK to Second Expansion of Trunkline LNG's Louisiana Terminal." *Inside F.E.R.C.'s Gas Market Report*. Sept. 24, 2004. p3.

[50] "LNG Expansion Requires Adequate Takeaway Capacity and Market Integration." *Foster Natural Gas Report*. Feb. 5, 2004. p15.

[51] *Foster Natural Gas Report*. Feb. 5, 2004. p15

[52] "For Sponsors, Stake in Supply is Key to Getting LNG Terminals Built, says ExxonMobil Head." *Inside F.E.R.C.* Feb. 16, 2004. p20.

[53] Robinson, M. Federal Energy Regulatory Commission (FERC), Office of Energy Projects. Remarks at the Senate Energy Committee Natural Gas Conference. Washington, DC. Jan. 24, 2004.

were designed primarily to move gas from traditional producing regions (e.g., Gulf Coast, Appalachia, Western Canada) to consuming regions (e.g, Northeast, Midwest). If most new LNG capacity is built in the Gulf of Mexico, then traditional gas flows would be maintained. If a number of new terminals are built in consuming regions, however, they may change historical gas transportation patterns, potentially displacing traditional production and changing infrastructure constraints. Among other potential impacts, some analysts have suggested that new LNG terminals will result in "less market leverage and probably lower cash flows" for some existing pipelines because new LNG supplies may be able to reach consumer markets by alternate routes.[54] Predicting the overall effects of long term changes in gas flows is a complex problem, although such changes may have important implications for current pipeline utilization and for future pipeline investments.

Interchangeability. LNG consists primarily of methane, but it may also contain significant quantities of other hydrocarbon fuels, such as ethane, propane and butane. The quantity of these other fuels in LNG affects the overall heat content in the LNG and varies depending upon its source. In markets outside the United States, LNG contains more non-methane fuels and, therefore, has a higher heat content than traditional U.S. natural gas supplies. LNG with a high heat content can cause problems when imported into the United States because it may damage pipelines and natural gas-fired equipment (e.g., electric power turbines) which are designed for a lower heat content. There are a number of potential technical solutions to LNG interchangeability problems, such as stripping out the non-methane fuels, blending the LNG with domestic natural gas, and "diluting" the LNG with nitrogen.[55] These solutions may involve significant added expense to LNG processing, however, which could be reflected in higher natural gas prices. The FERC has been working with natural gas trade associations to establish appropriate national policies for natural gas interchangeability and quality, possibly including national standards for LNG composition.[56]

Safety and Physical Security. To protect the public from an LNG accident or terrorist attack, the federal government imposes numerous safety and security requirements on LNG infrastructure. The nature and level of risk associated with LNG is the subject of ongoing debate among industry, government agencies, researchers and local communities.[57] Whatever the specific risk levels are determined to be, they could multiply as the number of LNG terminals and associated tanker shipments grows. Likewise, the costs associated with mitigating these risks are also likely to increase. To the extent these costs are not borne by the LNG

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[54] "Consultant: LNG Will Cut Transportation Values, Put Downward Pressure on Prices." *Natural Gas Intelligence*. Dec. 29, 2003.

[55] Rogers, D. "Gas 'Interchangeability' and Its Effects On U.S. Import Plans." *Pipeline & Gas Journal*. Aug. 2003. pp21-24.

[56] Jura, M. "Industry Still Struggling with Gas Interchangeability Issues." *Natural Gas Week*. Sept. 20, 2004.

[57] For further discussion see CRS Report RL32205: *Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety, and Regulation* by Paul W. Parfomak and Aaron Flynn. Jan. 28, 2005.

industry, they may represent an ongoing burden to public agencies such as the Coast Guard, law enforcement, and emergency response agencies.

Securing tanker shipments against terrorist attacks may be the most significant public expense associated with LNG. CRS has estimated the public cost of security for an LNG delivery to the Everett terminal to be on the order of $80,000, excluding costs incurred by the terminal owner.[58] Marine security costs at other LNG terminals could be lower than for Everett because they are farther from dense populations and may face fewer vulnerabilities, but could still be on the order of $20,000 to $40,000 per shipment. If LNG imports increase as projected, the number of vessels calling at LNG terminals serving the United States would increase from 99 (0.17 Tcf) in 2002 to over 3700 (6.40 Tcf) in 2025.[59] At current levels of protection, marine security costs would then be in the range of $74 million to $148 million annually.[60] Few, if any, interested parties have suggested that current levels of maritime LNG security ought to be reduced, at least in the short term. Furthermore, the public costs of LNG security may decline as federally mandated security systems and plans are implemented. Nonetheless, the potential increase in security costs from growing U.S. LNG imports, and the corresponding diversion of Coast Guard and safety agency resources from other activities have been a concern to policy makers.[61] Whether the costs of security should be assumed by industry may become an issue.

Supply Bottlenecks. Because U.S. LNG terminals process large volumes of LNG, the potential for one facility to bottleneck supply might not be recognized. A disruption at a U.S. import terminal (or at an associated supplier's export terminal) could effect regional gas availability.

In March, 2004, striking workers at an export terminal in Trinidad stopped all LNG operations — interrupting shipments from the largest U.S. supplier and the sole supplier to the Everett terminal. Although the strike ended quickly and U.S. gas demand at the time was moderate, one gas trader stated that if the strike had occurred during the heart of winter it might have exacerbated already high Northeast gas prices.[62] Similarly, when LNG shipments to the Everett LNG terminal were suspended after the terror attacks of September 11, 2001, markets analysts feared

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[58] CRS Report RL32073. *Liquefied Natural Gas (LNG) Infrastructure Security: Background and Issues for Congress* by Paul W. Parfomak. Feb. 2, 2004. p18.

[59] Increasing tanker size may reduce the actual number of future shipments, but are assumed not to reduce associated security costs since the hazard associated with each ship and time in port would increase proportionately.

[60] Note that security costs associated with LNG terminals in Canada, Mexico and the Bahamas (built primarily to serve U.S. markets) would not be a direct U.S. responsibility, although such costs might still priced into LNG supplied from those terminals.

[61] See, for example: Government Accountability Office (GAO). *COAST GUARD: Station Readiness Improving, but Resource Challenges and Management Concerns Remain*. GAO-05-161. Jan. 2005; Representative Edward Markey at the House Select Committee on Homeland Security hearing on the FY2005 Department of Homeland Security budget request. Feb. 12, 2004.

[62] Reuters News Service. "U.S. Gas Traders Shrug Off Trinidad LNG Strike." Mar. 9, 2004.

shortages of gas for heating and curtailments of gas deliveries to regional power plants in New England.[63]

Some industry analysts view the Trinidad and September 11, 2001 events as new supply risks the United States could face as LNG becomes a larger share of gas supply. Others view these kinds of events as ordinary supply uncertainties readily managed in other fuel markets. As one consultant stated,

> they are not problems that should make the industry shy away from developing LNG trade ... they are just problems that should make you consider how you are going to structure long-term LNG contracts and estimate what kind of premiums you are going to pay over indigenous pipeline supply.[64]

The future sensitivity of U.S. natural gas markets to LNG terminal disruptions is difficult to forecast and will be driven by factors such as supply diversity and pipeline development. Nonetheless, the concentration of incremental gas supplies among perhaps a dozen major import facilities may raise new concerns about the security of U.S. natural gas supply.

Global LNG Market Structure

In his 2003 congressional testimony, Federal Reserve Chairman Alan Greenspan asserted that increasing LNG import capacity would create "a price-pressure safety valve" for North American natural gas markets which would be "likely to notably damp the levels and volatility of American natural gas prices."[65] Basic market economics suggest that increasing marginal gas supplies from any source would tend to lower gas prices. But the long-term effectiveness of LNG in moderating gas prices will be significantly influenced by global LNG supply, the development of an LNG spot market, and potential market concentration.

Global LNG Supply. The belief that LNG can serve as a "price-pressure safety valve" by setting a price ceiling on natural gas assumes that sufficient LNG would be available at that price to satisfy all incremental gas demand. Otherwise, gas prices would be capped by potentially more costly North American production alternatives. The question, then, is whether there will be sufficient LNG production abroad to supply incremental U.S. demand and sufficient global infrastructure to distribute it. **Table 1** summarizes basic characteristics of existing or potential LNG exporters. As the table shows, 2004 global LNG production capacity currently operating totaled approximately 6.7 Tcf per year. **Table 1** also shows an additional 16.4 Tcf of global capacity proposed for service by 2015, with more proposals likely in the future. If all these proposed facilities were constructed, total global production capacity could exceed 23 Tcf annually, exceeding EIA's projected global LNG demand of 18 Tcf in 2020.

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[63] "LNG Ban Could Spell Higher Power Prices." *Gas Daily*. Oct. 5, 2001. p5.

[64] "Trinidad Strike Settled in Two Days, But Raises Red Flags." *Natural Gas Intelligence*. Mar. 15, 2004. p1.

[65] Greenspan, A., Chairman, U.S. Federal Reserve Board. "Natural Gas Supply and Demand Issues." Testimony before the House Energy and Commerce Committee. Jun. 10, 2003.

Global tanker capacity also appears to be keeping up with LNG demand growth. Current tanker orders will add 111 ships to the current operating fleet of 158, increasing overall LNG shipping capacity 70% by 2007.[66] Based on these figures, there appears to be sufficient interest among existing and potential exporters to meet both short-term and long-term global LNG demand projections. It remains to be seen which of these export projects will be constructed and how they will be integrated into the global LNG trade.

Table 1: Global Natural Gas Reserves and LNG Production Capacity

Country	2004 Gas Reserves (Tcf)	Share of World Gas Reserves (%)	LNG Production Capacity (Bcf/yr)		OPEC Member?
			Estimated 2004	Projected 2015	
Russia	1,660	26.7	0	3,145	No
Iran	942	15.2	0	1,753	Yes
Qatar	910	14.7	920	2,843	Yes
Saudi Arabia	236	3.8	0	0	Yes
U.A.E.	214	3.4	263	268	Yes
United States	185	3.0	63	409	No
Nigeria	176	2.8	672	3,209	Yes
Algeria	160	2.6	949	1,383	Yes
Venezuela	147	2.4	0	390	Yes
Iraq	110	1.8	0	0	Yes
Indonesia	90	1.5	1,212	2,147	Yes
Australia	90	1.5	443	1767	No
Norway	87	1.4	0	204	No
Malaysia	85	1.4	969	1,105	No
Egypt	62	1.0	0	1,052	No
Libya	46	0.7	29	24	Yes
Oman	33	0.5	356	487	No
Bolivia	29	0.5	0	390	No
Trinidad	26	0.4	487	935	No
Yemen	17	0.3	0	316	No
Brunei	12	0.2	341	321	No
Peru	9	0.1	0	195	No
Angola	2	<0.1	0	390	No
Eq. Guinea	1	<0.1	0	195	No
Others	875	12.9	0	0	No
OPEC Total	**3,031**	**48.9**	**4,045**	**12,017**	
World Total	**6,205**	**100.0**	**6,704**	**23,074**	

Sources: Deutsche Bank, July 22, 2004; Energy Information Administration; BP; Trade press.

[66] "LNG Fleet." *LNG OneWorld* website. [http://www.lngoneworld.com] Drewry Shipping Consultants. London, England. Feb. 9, 2005.

Spot Market Growth. Some gas market analysts believe that a robust short-term or "spot" market for LNG is essential for U.S. importers to manage price and supply risk, and to do business cost-effectively. An LNG spot market could allow for short-term balancing of physical supply and demand. It could also offer greater LNG price discovery and transparency, benefitting companies negotiating long-term LNG contracts and potentially serving as a more relevant index for LNG contract price escalators than traditional petroleum indexes.[67] A spot market might also support financial trading and derivatives, important tools for managing price risk, especially during periods of volatile prices.[68]

In recent years, the global LNG market has seen limited, but increasing short-term trade. Short-term contracts accounted for between 8% and 9% of global LNG transactions in 2004, up from less than 2% in 1998, and have already enabled some physical market balancing. In 2003-2004, for example, South Korea purchased 36 spot cargoes of LNG to meet extra residential heating demand during winter.[69] In December, 2003, Indonesia sought four LNG cargoes from rival producers to meet delivery contracts following production problems at its Bontang plant.[70]

Unlike petroleum markets where all prices are essentially short-term, analysts believe LNG trade will stabilize with some mix of long and short-term contracts since infrastructure costs are so high. No new LNG liquefaction project yet has been launched without a long term contract. The likely size of an LNG spot market is difficult to predict, however at least one major exporter expects 30% of global LNG capacity will ultimately trade on the spot market.[71] Coupled with projections of overall LNG demand growth, a 30% spot market share implies a ten-fold increase in spot market volumes by 2020. It is an open question, however, whether this volume of spot trade in LNG will materialize and if it will offer the full range of benefits realized in comparable commodity markets.

A concern related to LNG spot market development is the potential role of market intermediaries. In the late 1990's, independent marketers like Enron and Dynegy emerged to participate in trading of natural gas, electricity, and other energy commodities. These market participants increased market liquidity, selling risk management services to both producers and consumers. Many marketers fell into bankruptcy, however, following the California electricity crisis in 2001 and subsequent scandals. It is unclear which entities might step into LNG markets to help provide the capabilities needed for a fully functioning market.

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67 For an alternative view see J.T. Jensen, "The LNG Revolution," *The Energy Journal*, vol. 24, no. 2 (2003), p. 14.

68 J. Roeber, "The Development of the UK Natural Gas Spot Market," *The Energy Journal*, vol. 17, no. 2 (996), p. 2.

69 "Asia Lures Natural Gas Cargoes From Trinidad, Nigeria, Boosts Prices," *Africa News*, Oct. 19, 2004.

70 Mike Hurle, "Indonesia Seeks LNG Cargoes to Cover Bontang Shortfall," *World Markets Analysis*, Dec. 23, 2003.

71 Hand, Marcus. "Petronas Head Says 30% of LNG Trade Will be Spot Deals." *Lloyd's List* Feb. 5, 2004. p2.

Market Concentration. Some industry analysts believe the future LNG market may be susceptible to concentration-related inefficiencies. They note that only a limited number of buyers and sellers can effectively participate in LNG trade because the capital requirements are so great.[72] Many analysts also believe that a relatively small number of exporting countries are likely to account for the majority of LNG trade in the foreseeable future.

Based on LNG's similarity to the world oil trade, some observers are concerned about the possible emergence of a natural gas export cartel analogous to the Organization of Petroleum Exporting Countries (OPEC). One analyst remarked:

> Might a few countries come to dominate the supply of LNG and adopt policies harking back to the confrontational OPEC of the 1970's? An association of some kind among LNG exporters is likely. Many of them are also oil exporters, and the desire to compare fiscal terms will be irresistible.[73]

In March, 2004, at the Fourth Annual Gas Exporting Countries Forum, 15 major natural gas exporters established an "executive bureau" to develop common policies and joint initiatives regarding natural gas exports. According to press accounts, some forum members viewed the bureau as "a major step toward creating an OPEC-like organization to regulate gas production."[74] Some analysts have also pointed to apparent efforts by Russian gas company, Gazprom, "to sketch out the basic terms for broad cooperation in the gas sector between Russia and Iran" the two countries controlling the largest natural gas reserves in the world.[75]

The ability of a cartel to play a similar role in gas as OPEC does in oil is debatable. OPEC member countries currently control over 75% of the world's proven oil reserves and approximately 40% of global oil supply.[76] By comparison, OPEC members control approximately 50% of proven world gas reserves and approximately 52% of global LNG production capacity projected for 2015 **(Table 1)**. When non-LNG sources are accounted for, however, OPEC countries' share of global gas supply would be approximately 5% in 2015. Based on these figures alone, it is difficult to draw conclusions about the potential market power of an association of LNG exporters. It is possible, however, that the diversity of LNG suppliers, and the competitive relationship between LNG and traditional pipeline gas could make the world LNG market somewhat different than that of oil.

Global Trade and Politics. Continued growth of United States demand in an integrated global LNG market may affect trading and political relationships with

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[72] J.T. Jensen, 2003, p. 25. For example, the natural unit of trade, an LNG tanker cargo, is several hundred times the size of a commodity contract for pipeline natural gas.

[73] Daniel Yergin and Stoppard Michael, "The Next Prize," *Foreign Affairs*, Nov./Dec. 2003.

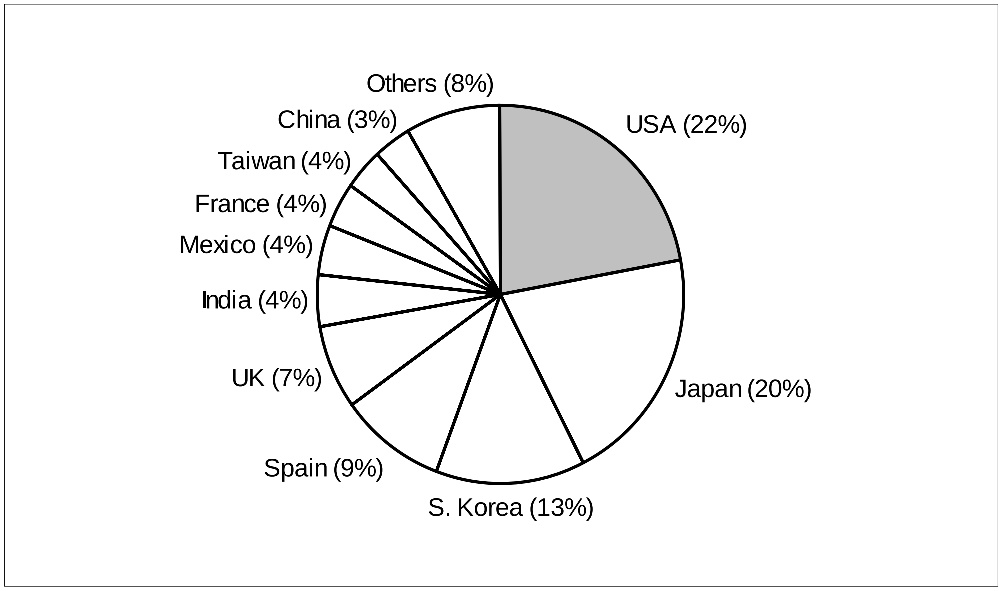
[74] M. Schmidt, "Former DOE Policy Chief: U.S. Focusing on Importing LNG from Nearest Locales," *Inside Energy*, Apr. 5, 2004, p. 10.

[75] "Gazprom's Iran Strategy," *World Gas Intelligence*, Feb. 2, 2005.

[76] Organization of Petroleum Exporting Countries (OPEC), "About OPEC," at [http://www.opec.org], visited Feb. 10, 2005.

key market participants. According to one estimate, by 2015 the United States may be the world's largest LNG importer, accounting for 22% of global volumes (**Figure 5**). South Korea, Spain, and the UK will also be importing large quantities of LNG, and may be joined by developing nations including India and China, seeking greater imports for rapidly growing economies.

Figure 5: Global LNG Import Market Shares Projected for 2015



Source: Deutsche Bank Securities, Inc. "Global LNG: Exploding the Myths." July 22. 2004. p2.

In an integrated global LNG market, individual country energy polices may significantly affect LNG price and availability worldwide. In 2001 and 2002, for example, after the Japanese government forced Tokyo Electric Power to shut down over a dozen nuclear plants for safety reasons, Japanese utilities relied more heavily on fossil fuels for electricity generation. According to the EIA:

> the result was a significant increase in Japan's demand for LNG, so that the majority of world spot cargoes were delivered to the Japanese market. Japan's increased reliance on LNG probably contributed to the reduction in short-term deliveries of LNG to the United States... [77]

Japan's nuclear energy policies also affected South Korea, which depends on flexible spot LNG supplies to meet winter heating demand. With LNG supplies in Asia suddenly scarce, South Korea had to pay a substantial premium to attract spot cargoes originally destined for Spain.[78] In 2004-2005, Spain attracted several LNG spot

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[77] Energy Information Administration (EIA), *International Energy Outlook 2004*, DOE/EIA-0484(2004), Apr. 2004, p. 53.

[78] "LNG Supply Shock Would Hit Asia Hard," *Petroleum Intelligence Weekly*, Mar.12, 2003.

cargoes "at the expense of the US" in response to record cold weather and inadequate hydroelectric power supplies.[79]

Trade with LNG exporters such as Indonesia, Iran and Nigeria may also raise geopolitical concerns. According to one analyst, "question remains on the merits of increasing reliance on imported energy ... if supply sources are from a region perceived as politically unstable or inhospitable to U.S. interests."[80] In part to mitigate such risks, the DOE has been encouraging the development of LNG supplies in South America and West Africa rather than the Middle East. According to the former DOE Assistant Secretary for Policy and International Affairs, "DOE is trying to make countries like Equatorial Guinea as attractive as possible to investors while aiming to limit the countries' potential political instability through contract and regulatory reform."[81]

LNG trade may also be linked to broader trading and political relationships among key LNG partners. For example, in the fall of 2004, China's interest in securing LNG supplies from Iran "put it in direct conflict with U.S. efforts to force Iran to renounce its ambitions to become a nuclear weapons state."[82] In an April, 2004 meeting with U.S. Energy Secretary Spencer Abraham, the Prime Minister of Trinidad reportedly used his country's status as the largest U.S. LNG supplier to seek most favored nation status for Trinidad's energy exports, duty free U.S. access for all Trinidadian-packaged products, and U.S. aid to offset gas exploration costs.[83]

It is difficult to predict the nature of trading and political relationships either among LNG importers, or between specific LNG importing and exporting countries over a 20-year time frame. Nonetheless, experience suggests that global LNG trade may introduce new risks and opportunities among trading countries that warrant consideration in LNG policy debate.

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[79] M. Jura, "Spiking Spanish Demand Diverts LNG Cargoes Away from US," *The Oil Daily*, Feb. 3, 2005.

[80] Frank A. Verrastro, *LNG the Growing Alternative*, Center for Strategic and International Studies, Qatar Embassy Policy Series, Washington, DC, Mar. 16, 2004.

[81] M. Schmidt, "Former DOE Policy Chief: U.S. Focusing on Importing LNG from Nearest Locales," *Inside Energy*, Apr. 5, 2004, p. 10.

[82] I. Bremmer, "Are the U.S. and China on a Collision Course?," *Fortune*, Jan. 25, 2005, p. 50.

[83] Lucy Hornby, "Trinidad to Expand Role as Top Supplier of US LNG." *Oil Daily*, Apr. 21, 2004, p. 4.

Conclusions

As long as domestic demand outpaces North American natural gas production, the option of developing LNG import capacity appears economically attractive. Currently, LNG supplies 3% of U.S. natural gas, but both industry and government project this figure to rise to as much as 21% by 2025. Such an increase would pose a number of practical, immediate challenges, such as ensuring adequate production and import capacity, integrating LNG efficiently into the existing natural gas supply network, and securing LNG infrastructure against accident or terrorist attack. Public opposition to LNG-related facilities and new trading relationships in an increasingly integrated global gas market will also bear upon the expansion of the industry.

As the practical challenges to LNG import expansion are addressed, the policy discussion turns to the long-term implications of increased LNG imports in the nation's energy supply. Intentionally or not, the United States may be starting down a path of dependency on LNG imports similar to its current dependency on foreign oil. Such a dependency would represent a major shift in the nation's energy policy, and may have far-reaching economic impact. Because U.S. natural gas markets are regional, major consuming areas such as California and the Northeast might be particularly affected.

Some energy analysts believe that U.S. dependency on imported LNG is inevitable; the only uncertainty is how quickly it will occur. Others disagree, promoting instead familiar alternatives such as greater domestic gas production, switching to oil or other energy sources, and conservation. Recent measures before Congress affect LNG imports by providing incentives for domestic gas production and for new LNG terminal construction. If Congress considers the relative merits of LNG and other energy supply alternatives, three overarching policy questions may emerge.

- Is expanding LNG imports the best option for meeting long-term natural gas demand in the United States?

- What role, if any, should the federal government play in facilitating the ongoing development of LNG infrastructure in the United States and abroad?

- How might Congress mitigate the risks of the global LNG trade within the context of national energy policy?

The answers to these questions may flow from enhanced understanding of the infrastructure and market structure issues discussed in this report. With incomplete information and limited policy analysis, LNG imports may look unrealistically attractive to some, but unreasonably risky to others. The reality probably lies somewhere in between. It may not be possible to predict the LNG future 20 years from now, but choices made now can substantially affect that future.

Appendix: Existing and Proposed LNG Import Terminals in North America

Map No.	Location	Name	Developer(s)	Type	Capacity (Bcfd)[a]	Permit Status
1	Everett, MA	Distrigas	Tractebel	Onshore	0.70	Operating
2	Lake Charles, LA	Lake Charles	CMS Energy	Onshore	1.80	Operating
3	Elba Island, GA	Savannah	El Paso	Onshore	0.80	Operating
4	Cove Point, MD	Cove Point	Dominion	Onshore	1.80	Operating
5	Peñuelas, PR[b]	Peñuelas	EcoElectrica	Onshore	0.19	Operating
6	Gulf of Mexico, LA	Energy Bridge	Excelerate Energy	Offshore	0.50	Under Construction
7	Hackberry, LA	Cameron LNG	Sempra	Onshore	1.50	Approved 9/03
8	Gulf of Mexico, LA	Port Pelican	ChevronTexaco	Offshore	1.60	Approved 11/03
9	Freeport, TX	Freeport	Cheniere Energy	Onshore	1.50	Approved 6/04
10	Sabine Pass, LA	Sabine Pass	Cheniere Energy	Onshore	2.00	Approved 11/04
11	Gulf of Mexico, LA	Gulf Landing	Shell	Offshore	1.00	Approved 2/05
12	Sabine Pass, TX	Golden Pass	Exxon Mobil	Onshore	1.00	Applied 11/03
13	Fall River, MA	Weaver's Cove	Poten & Partners	Onshore	0.40	Applied 12/03
14	Corpus Christi, TX	Corpus Christi	Cheniere Energy	Onshore	2.00	Applied 12/03
15	Oxnard, CA	Clearwater Port	Crystal / Woodside	Offshore	0.80	Applied 1/04
16	Long Beach, CA	Long Beach	Mitsubishi / Conoco	Onshore	0.70	Applied 1/04
17	Oxnard, CA	Cabrillo Port	BHP Billiton	Offshore	0.80	Applied 1/04
18	Gulf of Mexico, LA	Main Pass	McMoran	Offshore	1.00	Applied 2/04
19	Mobile, AL	Compass Port	ConocoPhillips	Offshore	1.00	Applied 3/04
20	Ingleside, TX	Vista Del Sol	Exxon Mobil	Onshore	1.00	Applied 9/04
21	Providence, RI	Fields Point	KeySpan	Onshore	0.40	Applied 5/04
22	Logan Twp., NJ	Crown Landing	BP	Onshore	1.20	Applied 9/04
23	Ingleside, TX	Corpus Christi	Occidental Petrol.	Onshore	1.00	Applied 11/04
24	Gulf of Mexico, LA	Beacon Port	ConocoPhillips	Offshore	1.50	Applied 2/05
25	Gloucester, MA	Neptune	Distrigas	Offshore	0.4	Applied 2/05

Map No.	Location	Name	Developer(s)	Type	Capacity (Bcfd)[a]	Permit Status
26	Port Arthur, TX	Port Arthur	Sempra	Onshore	1.50	Feasibility study
27	Point Pleasant, ME	Quoddy Bay	Quoddy Bay, LLC	Onshore	TBD	Feasibility study
28	Gulf of Mexico, LA	Vermillion 179	HNG Stor./ CGI	Offshore	1.00	Feasibility study
29	Belmar, NJ	Energy Bridge	Excelerate Energy	Offshore	0.50	Feasibility study
30	Gloucester, MA	TBD	Excelerate Energy	Offshore	0.50	Feasibility study
31	Camp Pendleton, CA	TBD	ChevronTexaco	Onshore	TBD	Feasibility study
32	Coos Bay, OR	Jordan Cove	Energy Projects	Onshore	0.15	Feasibility study
33	St. Helens, OR	Port Westward	Port West. LNG	Onshore	0.70	Feasibility study
34	Galveston, TX	Pelican Island	BP	Onshore	1.50	Feasibility study
35	Port Lavaca, TX	Calhoun LNG	Gulf Coast LNG	Onshore	1.00	Feasibility study
36	Pascagoula, MS	Bayou Casotte	Gulf LNG Energy	Onshore	1.30	Feasibility study
37	Long Is. Sound, NY	Broadwater	TransCanada / Shell	Offshore	1.00	Feasibility study
38	Philadelphia, PA	Port Richmond	Philadelphia Gas	Onshore	0.60	Feasibility study
39	Pascagoula, MS	TBD	ChevronTexaco	Onshore	1.30	Feasibility study
40	Cameron Parish, LA	Creole Trail	Cheniere Energy	Onshore	2.60	Feasibility study
41	Astoria, OR	Skipanon LNG	Calpine	Onshore	1.00	Feasibility study
42	Cherry Point, WA	Cherry Point	Cherry Pt. Energy	Onshore	0.45	Suspended
43	Sears Island, ME	Sears Island	Not disclosed	Onshore	TBD	Suspended
44	Brownsville, TX	Brownsville	Cheniere Energy	Onshore	TBD	Suspended
45	Mobile, AL	Mobile Bay	Exxon Mobil	Onshore	1.00	Suspended
46	Mobile, AL	Pinto Island	Cheniere Energy	Onshore	1.00	Suspended
47	Somerset, MA	Somerset	Somerset LNG	Onshore	0.43	Suspended
48	Gouldsboro, ME	TBD	Cianbro	Onshore	TBD	Cancelled
49	Sears Island, ME	Sears Island	Not disclosed	Onshore	TBD	Cancelled
50	Eureka, CA	Humboldt Bay	Calpine	Onshore	1.00	Cancelled
51	Vallejo, CA	Mare Island	Bechtel / Shell	Onshore	1.30	Cancelled
52	Tampa, FL	Tampa Bay	BP	Onshore	0.55	Cancelled

Map No.	Location	Name	Developer(s)	Type	Capacity (Bcfd)[a]	Permit Status
53	Gulf of Mex., LA	Liberty	HNG Stor./ CGI	Offshore	1.50	Cancelled
54	Harpswell, ME	Fairwinds	Conoco / TCPL	Onshore	0.50	Cancelled
55	Radio Island, NC	Radio Island	El Paso	Onshore	0.25	Cancelled
56	Canada (NS)	Bear Head	Anadarko	Onshore	0.75	Under construction
57	Canada (NB)	Canaport	Irving Oil / Repsol	Onshore	0.55	Approved 8/04
58	Canada (PQ)	Rabaska	Gaz Metro	Onshore	0.65	Feasibility study
59	Canada (PQ)	Gros Cacouna	TransCanada / P-C	Onshore	0.50	Feasibility study
60	Canada (BC)	Kitimat	Galveston LNG	Onshore	0.34	Feasibility study
61	Canada (BC)	TBD	WestPac	Onshore	0.30	Feasibility study
62	Canada (NS)	TBD	Keltic Petrochem.	Onshore	1.00	Feasibility study
63	Canada (NS)	TBD	Statia Terminals	Onshore	TBD	Feasibility study
64	Bahamas	Ocean Express	AES	Onshore	0.84	Pipeline approved
65	Bahamas	Calypso	Tractebel	Onshore	0.83	Pipeline approved
66	Bahamas	Seafarer	El Paso	Onshore	0.75	Applied 2003
67	Mexico (Baja CA)	Costa Azul	Sempra / Shell	Onshore	1.00	Approved 10/04
68	Mexico (Baja CA)	Puerto Coronado	ChevronTexaco	Offshore	0.70	Approved 1/05
69	Mexico (Sonora)	Puerto Libertad	Sonora Pacific LNG	Onshore	TBD	Feasibility Study
70	Mexico (Gulf)	TBD	Tidelands O&G	Offshore	TBD	Feasibility Study
71	Mexico (Baja CA)	Rosarito	TAMMSA / Moss	Offshore	TBD	Feasibility Study
72	Mexico (Baja CA)	Tijuana	Marathon	Onshore	0.75	Cancelled
73	Mexico (Baja, CA)	Rosarito	El Paso / Phillips	Onshore	0.68	Cancelled

Source: Trade press; Company websites

a. May indicate baseload or peak delivery capacity. Includes planned expansions.
b. Terminal supplies dedicated to a gas-fired electric power plant.