Chapter 6

Gas Imports—An Overview

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Natural gas imports in 1983 totaled 918 billion cubic feet (BCF)[1] and composed 5.5 percent of the total U.S. dry gas consumption. The current import status and future import projections are summarized in table 29.

In evaluating potential import supplies of natural gas to the Lower 48 States, the most obvious sources are the border countries, Canada and Mexico. Canada has been and probably will remain our most important source of supplemental natural gas. In January 1983, the National Energy Board recommended an additional 9.25 trillion cubic feet (TCF) of reserves for export. Although this decision nearly doubles the exportable quantity available to the United States, actual imports will depend on U.S. demand and competitive pricing. An important uncertainty in this regard is the effect of recent Canadian initiatives to price their gas more competitively in the current U.S. market. In the long run, the increase in allowable exports will probably help encourage frontier development.

Exports from Mexico will probably remain at or below 300 million cubic feet per day (MMCF/day) in the near term, consistent with what they have been since the present contract was *negotiated* in 1979. In fact, Mexico temporarily ceased gas exports to the United States in the fall of 1984 because of the pressure for *lower* gas prices in the current weak U.S. market. Although Mexican natural gas supplies are bountiful, the Mexican Government's current export philosophy seems to preclude significant increases in exports to the United States. Mexican consumption is expected to increase as the distribution infrastructure develops.

Alaska represents another large potential supply; the Prudhoe Bay Field alone constitutes over 10 percent of the total U.S. proved reserves. At

[1] U.S. Department of Energy, Energy Information Administration, "U.S. Imports and Exports of Natural Gas, 1981," June 1982.

Table 29.—Natural Gas Imports Summary Table

Source	Natural gas supplied to Lower 48 States in 1983	Allowable imports under recent licenses/contracts	Proved reserve estimates (Dec. 31, 1982)	Range of future export estimates 1990	2000
Mexico	0.07 TCF (AGA/GER)	0.11 TCF (AGA/GER)	76 TCF (OGJ)	0.1-1.0 TCF (AGA, LA-Mexico)	0-1.5 TCF
Canada	0.7 TCF (AGA/GER)	1.75 TCF (AGA/GER)	97 TCF (OGJ)	1.0-2,5 TCF (AGA, LA-Canada)	1.0-3.0 TCF
Alaska	0	—	35 TCF (EIA)	ANGTS[b] 0.7-1.2 TCF Pacific-Alaskan LNG 0.1-0.2 TCF (AGA)	
LNG	0.13 TCF (AGA/GER)	0.9 TCF[c]	235 TCF (OGJ)[d]	Variable—depends on future U.S. policy and pricing.	
Total	0.9 TCF (EIA)				

aThis range represents the highest and lowest estimates of the references cited.
bAlaskan Natural Gas Transportation System.
cThis value represents the total contract volumes for completed terminals.
dReserve of SIX countries (other than U S.) *currently* exporting LNG

REFERENCES

AGA—American Gas Association, The *Gas Energy Supply Outlook:* 198.3-2000, October 1983.
AGA/GER—American Gas Association, Gas *Energy Review,* various dates
EIA– Energy Information Administration, *U.S. Crude Oil, Natural* Gas, *and Natural Gas Liquids, 1982* Annual Report
LA–Canada– Lewin & Associates–Canadian *Natural Gas: A Future North American Energy Source?* January 1980
LA– Mexico– Lewin & Associates–Future *Mexican Oil and Gas Production,* July 1979.
OGJ —*Oil and Gas Journal,* December 1982 and other issues.

SOURCE' Office of Technology Assessment.

present, there is no natural gas production reaching the Lower 48 States, owing to the lack of a means of transportation. Financing for a transportation project is difficult to obtain because of current surplus supply and market prices below levels necessary for financial success. Despite a waiver package to eliminate roadblocks to private financing, the Alaska Natural Gas Transportation System project still has not achieved adequate financing arrangements. A rival TransAlaska Gas System would enable North Slope gas to be marketed outside of the domestic market. A methanol conversion alternative would allow the gas to be marketed either domestically or internationally. Neither of these alternatives appear to have good prospects for the immediate future,

Throughout the early to mid-1970s, liquefied natural gas (LNG) contracts were viewed as a favorable means of achieving long-term natural gas supplies. Since that time, the supply scenario has changed significantly, and LNG purchasers are now confronted with high-priced gas during a time of gas surplus. In the near term, there is little incentive to increase LNG imports; however, the availability of the long-term contracts and the opportunity to diversify U.S. supply may prove to be attractive in the future.

MEXICO

Mexico had reported 75.4 TCF of proved reserves as of December 1981. Within the last 4 years, large reserve additions have caused Mexico's reserve-to-production ratio to double from 30 to 60.

Most of Mexico's gas production is from wells associated with oil; nonassociated wells are typically not put into production. This practice reflects Mexico's policy of exporting oil and using natural gas primarily to meet domestic energy demands. Mexico exports only the surplus gas remaining after domestic demand is met, which could in the future become a limiting factor to export levels. Mexico's current export maximum of 110 BCF/yr was established in 1979 by a contract with Border Gas, a U.S. pipeline company.[2] This quantity is recognized as a compromise between Mexican policy makers, who believe energy exports are necessary to bolster Mexico's ailing economy, and those who believe the resource should be saved for future domestic use. Because of the low gas demand and low market price in the United States, actual import levels had been reduced to the 60 percent minimum take-or-pay level, causing 1983 imports to be about 72 BCF.[3] Mexican exports to the United States have now been temporarily suspended because of the unfavorable market conditions.

Mexico has been successful in encouraging conversions to natural gas, and, as a result, domestic gas demand has been growing at a rate of 13 percent per year.[4] Because Mexico's financial condition has precluded investment in distribution equipment, the primary constraint to increased domestic consumption is a lack of transmission and distribution capability. As the distribution system develops and the process of converting end users to gas progresses, domestic consumption will increase, which could further constrain the exportable surplus.

Early in 1982, the Mexicans talked of increasing exports to 500 MMCF/day and later to 1,000 MMCF/day; however, these plans were not carried out, owing to problems with gas-gathering systems and budget cutbacks. s The factors that will determine the actual value of future imports include the progress of Mexico's economic growth and attempted reliance on gas for domestic

[2]Border Gas is owned and controlled by six interstate pipeline companies: Tennessee Gas Transmission Co., Texas Eastern Transmission Corp., El Paso Natural Gas Co., Transcontinental Gas Pipeline Corp., Southern Natural Gas Co., and Florida Gas Transmission Co.

[3]J. L. Wingenroth and A. A. Bohn, "Mexican Gas Supplies to the United States, " *Gas Energy Review,* American Gas Association, August, 1984.

[4]*Petroleum Intelligence Week/y, Special Supplement,* "Mexico's Expanding Role in World Oil Markets, " June 28, 1982.

[5]I bid.

needs, the levels of demand for Mexican oil,[6] any changes in Mexico's view of gas as a natural patrimary, and future U.S./Mexican export/import agreements. Also, development of its substantial resources of non associated gas could greatly affect future exports.

There is a considerable range of estimates for the future quantity of Mexican gas available for export to the United States. In their "high success" case, Lewin & Associates estimate that annual exports will rise to 766 BCF in 1990 and then decrease to 255 BCF by 1995 and O by 2000.[7] The American Gas Association (AGA) is considerably more optimistic in its long-run projections and estimates that between 100 and 1,000 BCF/yr will be available in the 1990s and between 100 and 1,500 BCF/yr will be available by 2000.[8] The upper end of the range reflects a potential Mexican response to inadequate oil revenues using increased gas exports to stabilize its national income.

[6]Oil demand is a factor not only because oil production drives associated gas production, but also because oil revenues are necessary for the Mexican economy, and low oil exports would exert pressure on Mexico to increase gas exports.

[7]Lewin & Associates, *Future Mexican Oil and Gas Production,* July 1979.

[8]American Gas Association, *The Gas Energy Supply Outlook: 1983-2000,* October 1983,

CANADA

Canada also has large natural gas reserves, estimated at **97** TCF.[9] Its ultimately recoverable resource base estimate of **420** TCF[10] could be increased considerably by developing unconventional gas in Western Canada. At present, the technology to produce most of these low permeability reservoirs has not been demonstrated.

Marketability problems have created a large surplus export capability, and, until recently, Canadian exporters had succeeded in marketing only about 40 percent of their allotment of exportable gas. **In January 1983, in an attempt to alleviate the situation, the National Energy Board nearly doubled the exportable quantity of gas available to the United States. Also, in April 1983, the price was reduced from $4.94 per thousand cubic feet** (MCF) to **$4.40** per MCF to compete more readily in the U.S. market. In July 1983, an incentive sales program was added that made additional gas available at $3.40 per MCF to purchasers buying specified quantities of regularly-priced Canadian gas. In July 1984, the Canadian Government announced a policy, effective November **7, 1984,** that gave gas exporters the option of negotiating prices with their customers, with a price floor at the wholesale price of natural gas at the Toronto City gate. [11] Despite these efforts, decreased U.S. demand and improved short-term domestic supply prospects may still keep U.S. imports of Canadian gas low in the near term. There is, however, considerable disagreement about the effect of the new Canadian pricing policies, and some Canadian producers have been newly successful in selling to the U.S. market. The price considered acceptable by the Canadians will be a dominant factor affecting the level of exports to the United States. In the longer term, if the U.S. surplus disappears, Canadian exporters should be well-positioned to substantially expand their gas sales to the United States.

The 1980 National Energy Plan (NEP) has had important effects on the Canadian petroleum industry. The NEP established guidelines aimed at enabling Canada to achieve energy self-sufficiency by 1990. Several NEP objectives include:

- encourage substitution of gas for oil by favorable pricing;
- increase Canadian ownership of the domestic petroleum industry to **50** percent by 1990;

[9]Robert J. Enright, "World Oil Flow, Refining Capacity Down Sharply; Reserves Increase," *Oil and Gas Journal,* December 1982.

[10]R.M. Procter, P. J. Lee, and D. N. Skibo, "Canada's Conventional Oil and Gas Resources," Geological Survey of Canada, Open File 767, March 1981, p. 27.

[11]*Oil and Gas Journal,* "Canada Allows Gas Exporters to Negotiate Prices," July 23, 1984.

- stimulate frontier exploration off the East Coast and in the Arctic;
- allow a 25 percent back-in interest for the Canadian Government on federal leases; and
- increase the Canadian Government's share of petroleum revenues relative to those received by industry and the producing provinces.

The increased regulation of the NEP has had a noticeable negative impact on risk investment. Canadian operators and support companies have left Canada for more lucrative prospects in the United States. Many petroleum companies have cut expenditures and long-term projects and suffered severe losses. These effects, if not reversed, could lessen the quantity of gas produced in the remainder of the century, thereby limiting the availability of surplus for export to the United States.

Another factor affecting gas export is the level of Canadian gas consumption. In an attempt to reduce the need for expensive foreign oil imports, the Canadian Government is encouraging increased use of natural gas and has provided several incentives for doing so, such as favorable gas prices, grants, and loans. The NEB forecasts natural gas demand to increase at 4 percent per year during the 1980s and 3 percent per year throughout the 1990s.[12] Although the conversion process is progressing slowly, the quantity of gas available to the United States could be" constrained if Canadian consumption increases substantially in the future.

Under current Canadian export agreements, natural gas exports will increase to about 1.6 TCF/yr by 1990 and then decline to about 0.15 TCF/yr by 2000.[13] AGA **estimates that between 0.8 and 1.8 TCF/yr** will be exported by 1990 and 1.0 to 2.4 TCF/yr by 2000.[14] Lewin & Associates believe that technological advances in the frontier areas and the development of unconventional gas could allow exports of **2.5** and **3.0** TCF/yr in 1990 **and 2000, respectively.**[15]

[12] National Energy Board, "Omnibus '82 Backgrounder," Jan. 27, 1983.
[13] Ibid.
[14] American Gas Association, *The Gas Energy Supply Outlook: 1983 -2000,* October 1983,
[15] Lewin & Associates, *Canadian Natural Gas: A Future North American Energy Source,* January 1980,

ALASKA

The massive hydrocarbon potential of Alaska was realized with the discovery of the Prudhoe Bay Field in 1968, which added 26 TCF to estimated U.S. proved gas reserves. Reserve estimates for Alaska average 35 TCF, and resource base estimates are as high as 169 TCF.[16]

Despite the substantial quantity of reserves in Alaska, lack of a transportation system has precluded marketing of Alaskan gas to the Lower **48 States.** The Alaskan Natural Gas Transportation Act of 1976 directs the President, subject to congressional approval, to establish a means to transport Alaskan natural gas to the Lower 48 States. To ensure domestic use of the resources, the Export Administration Act of 1979 forbids the export of North Slope hydrocarbons to non-U.S. customers. Several transportation methods have been proposed; not all of these have designated the Lower 48 States as the final market.

In September 1977, the Alaskan Natural Gas Transportation System (ANGTS) was chosen over several alternatives. The 4,800-mile pipeline was to be routed from Prudhoe Bay across Alaska and Canada to Alberta, and split into a western leg to California and an eastern leg to Illinois. Despite a waiver submitted by President Reagan and approved by Congress in mid-December 1981, to remove any legislative deterrents to private financing, the pipeline has not yet been financed. Investment capital has been difficult to attract because the marketability of the gas is questionable. ANGTS is estimated to cost between $38.7 billion and $47.6 billion[17] and deliver gas at prices

[16] Potential Gas Committee, *Potential Supply of Natural Gas in the U. S.,* June 1983.

[17] American Gas Association, *Gas Energy Review,* vol.10, No. 1, January 1982.

estimated between **$4.85 per** MCF[18] and $20 per MCF.[19] ANGTS is the only pipeline transportation scheme designed to market North Slope natural gas in the Lower 48 States. AGA currently does not project any pipeline imports from Alaska by 1990 but expects imports of 0.7 to 1.2 TCF by 2000, assuming that the pipeline is built.[20]

Converting North Slope gas to methanol could provide an alternative market for the gas. The principal advantage of the methanol option is that the existing oil pipeline system could be used to transport the methanol from the North Slope to Valdez, assuming capacity were available. The major problems with the methanol alternative are the high energy loss associated with conversion and the potential that future demand for methanol might be insufficient to absorb Alaskan production. Also, costs would be very high; estimated first year costs for conversion and transportation range between $14.24 and $17,24 per million Btu (MM Btu).[21]

Two LNG projects have been proposed to market Alaskan gas. The Alaska Governor's Economic Committee recommended the TransAlaska Gas System (TAGS). The TAGS requires an 820-mile pipeline from the North Slope to the Kenai Peninsula, where the gas would be liquefied and shipped to foreign markets, principally Japan. If this proposal is adopted and an executive order or legislation declaring gas exports to be in the national interest is obtained, the Lower 48 States may never receive supplemental gas from the North Slope. Another LNG proposal, the Pacific Alaska LNG Project, calls for the shipment of south Alaskan LNG to receiving facilities on the California coast; however, the potential supply contribution from this project is small. AGA estimates between 0.1 and 0.2 TCF could be supplied by 2000, depending on the construction schedule.[22]

[18] *International Gas Technology Highlights,* "Alaskan Pipeline Costs Could Be Lower Because of Delay Northwest Heat," Aug. 30, 1982.

[19] *Oil and Gas Journal,* "Angt~ Seen Top Option for Alaskan Gas," Aug. 9, 1982, p. 61

[20] American Gas Association, *The Gas Energy Supply Outlook 1983-2000,* October, 1983,

[21] Congressional Research Service, *Major Issues Associated With the Alaska Natural Gas Transportation Waivers* Dec. 18, 1981.

[22] American Gas Association, *The Gas Energy Supply Outlook 1983-2000,* October, 1983

LIQUEFIED NATURAL GAS

During the early to mid-1970s, when the United States was confronted with natural gas shortages, LNG imports appeared to be a favorable supplemental supply alternative. Several long-term contracts were established with Algeria. Since then, the supply situation has changed drastically, and in the midst of a natural gas surplus, LNG purchasers are confronted with very high-cost gas supplies.

Although existing agreements enable imports of up to 800 BCF/yr, the United States imported only 132 BCF of LNG in 1983 at two of four existing receiving facilities. The Distrigas facility in Everett, MA, received 36,4 BCF and the Lake Charles, LA, facility received 119.9 BCF since its first shipment in September 1983. Small amounts of LNG were also trucked from Canada to New England. Also in 1982, the United States exported 60 BCF from Cook Inlet, AK, to Japan, and in 1981 was a net exporter of LNG.[23]

For purposes of evaluating future LNG availability, the LNG resource base includes any large reserves which, owing to remote location or lack of a transportation method, are not committed to existing markets. In 1978 OTA estimated that of the 2,257 TCF of proved reserves in the world, about 812 TCF were surplus (635 TCF of the surplus are located in the U. S. S. R., Iran, and Algeria[24]). Although reserves are plentiful, high costs preclude a large percentage of natural gas reserves from being made available as LNG. The total capital required for a world-scale LNG fa-

[23] U.S. Department of Energy, Energy Information Administration, "U. S." Imports and Exports of Natural Gas, 1981 ," June 1982.

[24] Office of Technology Assessment, *Alternative Energy Futures, Part. 1, The Future of L, WC,* March 1980,

cility (1 BCF/day) including production and liquefaction, transportation, and receiving and vaporization facilities is around $3 billion to $7 billion (1982$),[25] depending on shipping distance. Although the cost of service is dependent on interest rates and shipping distance, a cost of $3/MMBtu to cover liquefaction, transportation, and reconstitution of the gas would not be unusual .[26]

The future of LNG depends principally on pricing and policy. If the producing country demands a high price at the wellhead—as an extreme example, a price approaching parity with oil on a $/Btu basis–then the delivered price of the gas generally will be much higher than the price of competing fuels. Currently, the price of LNG is higher than market-clearing levels in the United States, and could be sold only by mixing the gas with lower cost gas and charging a price in line with the average cost. In fact, because the current cost of liquefaction, transportation, and reconstitution may be almost equal to the average wellhead price of new gas,[27] future imports of LNG will probably require both a substantial increase in U.S. domestic wellhead prices and a marketing policy on the part of the exporting nations that considers the transportation costs in pricing the gas at the well head.

[25] SD. Napoli, R. N., "Economics of LNG Projects, " *Oil and Gas Journal,* Feb. 20, 1984.

[26] Becausemany of the capital costs are sunk, however, this cost will not necessarily be added to the price of the gas.

[27] according to the February 1984, *Natura/ Gas M* (Energy Information Administration, DOE/EIA-0130 (84/OZ), the average price for New Gas (NGPA sees. 102, 103, 108, and 109) was $3.59 per MCF.

Part II
Unconventional Gas Supplies