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Africa-Middle East Gas: A Western Alternative?



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An Intelligence Assessment

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GI 82-10184C
August 1982

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Africa-Middle East Gas: A Western Alternative?



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An Intelligence Assessment

This assessment was prepared by 
Strategic Resources Division, Office of Global Issues.
Comments and queries are welcome and may be
directed to the Chief, Energy Issues Branch, OGI, on


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Africa-Middle East Gas:
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Key Judgments

*Information available
as of 16 August 1982
has been used in this report.*

Several African and Middle Eastern countries have the potential to sharply increase gas exports. Although little growth in exports is likely during the 1980s, sales could surge during the 1990s. Under the most favorable circumstances, new projects could yield gas exports of 2.5 million barrels per day oil equivalent (b/doe) by the mid-1990s. 25X1

We think the best that can be expected, however, is an increase in exports of 750,000 to 1 million b/doe. For even these levels to materialize, Western purchasers must be willing to pay prices at least 10 to 15 percent higher than the price of Soviet gas under recently negotiated contracts.

Despite the optimism for substantial supplies 25X1

we believe several factors will inhibit, and may preclude, development of more than half of the potential gas supplies from these regions: 25X1

- Gas supplies from Africa and the Middle East would be costly to develop and would face stiff competition in the European market from Soviet and Norwegian gas. 25X1
- Even if gas supplies could be procured at a favorable price, many importers would be wary of dependence on many of these producers because of the security risks. 25X1
- Rapidly rising domestic demand for gas—particularly as a feedstock for petrochemicals, fertilizers, and electric generation—would lessen supplies available for export.
- Technical problems such as laying pipeline through hazardous terrain or deep water and poor field or facility development would limit the scope of some projects.
- A desire to maximize oil and natural gas liquid production—mainly through gas reinjection and cycling—would reduce gas availability from some countries such as Algeria and Iran. 25X1


Because of a combination of high investment costs and long transport distances for many of these projects, consumers must be willing to pay slightly higher prices for gas supplies from North Africa and the Middle East as well as from the North Sea. Based on our analysis 25X1
 of the cost of these projects, we believe the delivered price from new gas suppliers will be 10 to 15 percent higher than the price 25X1




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of Soviet gas under recently signed contracts. Even if the Europeans are willing to pay some premium for security, Moscow's need for hard currency and willingness to accept low prices will force new suppliers from Africa, the Middle East, and the North Sea to compete aggressively on price to capture a larger share of the market. 

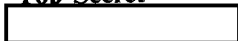
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Development of the Africa-Middle East export capability, which we believe could reasonably be expected to occur, would provide the additional supplies needed to eliminate the need for additional Soviet gas supplies in the 1990s. In that case, Soviet exports to Western Europe by the end of the decade could be limited to the 900,000 b/doe already under contract. 

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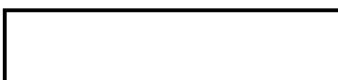
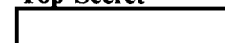
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Africa-Middle East Gas:
A Western Alternative? [Redacted]

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Markets for Gas

1978-90. We expect the falloff in West European gas consumption—an unprecedented 8 percent over the past two years—to end this year as economic recovery begins. We estimate that demand for gas in continental Western Europe will increase from 2.8 million b/doe in 1980 to about 3.4 million b/doe in 1990 and 3.7 to 4.0 million b/doe by the year 2000. Most West European gas utilities plan to meet projected demand through 1990 from domestic production and imports they have already lined up [Redacted]

Based on contracts in train, West European gas buyers expect sizable new supplies from Algeria and the Soviet Union. Should sanctions or unforeseen political events preclude expected increases in Soviet or Algerian gas deliveries, the West Europeans could still balance supply and demand through the decade by a more rapid depletion of domestic reserves. However, the economic and political decisions necessary to bring this about would require a major reversal of existing policies and a sharp acceleration of North Sea development. Deliveries of North Sea gas are projected to expand only slightly under current plans. [Redacted]

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1990-2000. West European gas import requirements will continue to rise beyond 1990. Based on our analysis of recent industry projections, import needs could increase to 2.3 to 2.8 million b/doe by 2000. Japan's import demand will probably grow rapidly also in the 1990s. Although Japan has contracted for amounts from Alaska, Brunei, UAE, and Indonesia and has several pending contracts with Southeast Asian, Canadian, and Soviet producers, Tokyo will still need additional gas during the late 1990s. [Redacted]

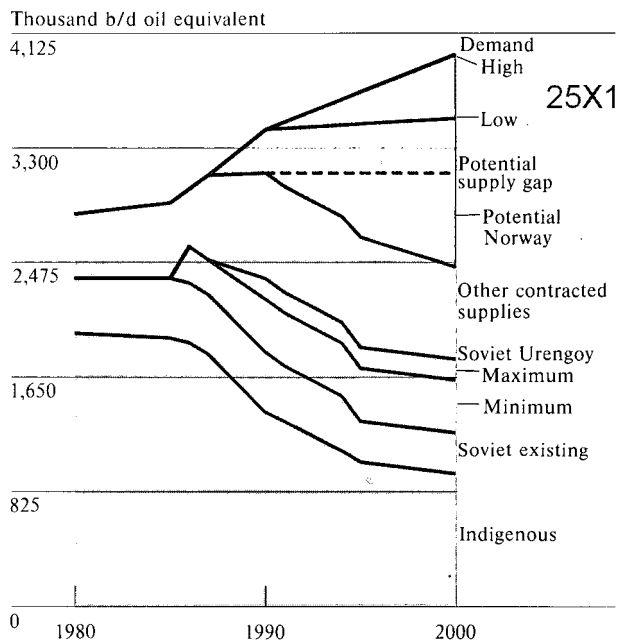
Several major suppliers have the potential to fill incremental gas needs in Western Europe and Japan. Among these sources are the North Sea, the Soviet Union, Africa, and the Middle East:

[Redacted] North Sea reserves could support a major increase in production and [Redacted]

[Redacted]

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Figure 1
Continental Europe: Natural Gas Supply and Demand^a



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^a Western Europe excluding the United Kingdom. UK gas supply and demand account for about an additional 700,000 to 1 million b/doe.

[Redacted]

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provide Western Europe with a secure source of supply but at premium prices.

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- The Soviet Union, with huge gas reserves and a need for hard currency earnings, will vie for as large a share of the gas market as possible.
- North African and Middle Eastern producers are viewed by West European and Japanese governments and utilities as potential suppliers because of their large reserve base and, in some cases, proximity to markets. [Redacted]

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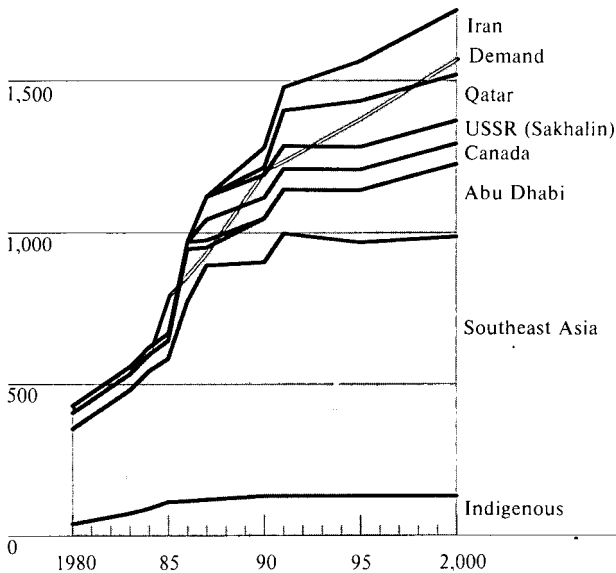
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Figure 2
Japan: Natural Gas and Demand Forecast

Thousand b/d oil equivalent
2,000



^aForecast based on economic growth projections of 5.2 percent until 1990 and 4 percent from 1990 through 2000.

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Incentives To Export

Declining oil production and the need to find alternative sources of revenues will be perhaps the greatest incentive for some African and Middle Eastern countries to proceed with gas export projects:

- Our analysis [redacted] indicates that Algeria, Cameroon, Egypt, and Nigeria will see the most rapid decrease in oil export capacity—largely a result of limited reserves and rapidly rising consumption.
- Based on our analysis of existing oil reserves, Qatar, Iran, UAE, and Libya all have sufficient surplus oil productive capacity to maintain current rates of oil production through at least 1995. We believe that investment in developing new oilfields or upgrading

existing oil facilities would probably provide greater rates of return in these countries than the development of gas reserves at this time. By the early-to-mid-1990s these countries nevertheless will probably have to consider gas exports as a supplement or alternative to declining oil exports. [redacted]

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In addition, we believe that encouragement to proceed with gas export projects also will come from several of the politically and economically allied importing countries who will seek to develop the projects to meet their gas import needs. Italy, in particular, has actively sought close ties with North African producers, such as Algeria, Libya, and Egypt. The Italian firm AGIP has already developed strong commercial interests in Libya and Egypt. Traditional French/Algerian political ties have resulted in accommodation on gas pricing issues, and the French can be expected to take an active role in the development of any gas export project in Cameroon. [redacted]

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Based on increasing levels of trade, we believe that Japanese commercial interests in the UAE and Qatar would favor development of new export projects in these countries provided the gas were competitively priced. In addition, with the recent Japanese agreement to renew construction of Iran's largest petrochemical facility, other commercial and industrial projects, including a liquid natural gas (LNG) project, could also go forward again. The West German firm Wintershall has a large commercial stake in the North Dome field in Qatar that could encourage West Germany to consider LNG or pipeline imports from the region if favorable pricing arrangements were available. However, recent price demands by Qatar have at least postponed consideration of the LNG project. [redacted]

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The Gas Supply Potential

[redacted] Middle East (OPEC) and African (Northwest and Sub-Saharan) gas reserves total about 885 trillion cubic feet (tcf) equal to 150 billion barrels oil equivalent (boe). Iran, Algeria, Qatar, Saudi Arabia, and Nigeria account for about 85 percent of the reserves. Roughly half of the total reserves are in fields not associated with oil production—the largest of which are Hassi R'Mel

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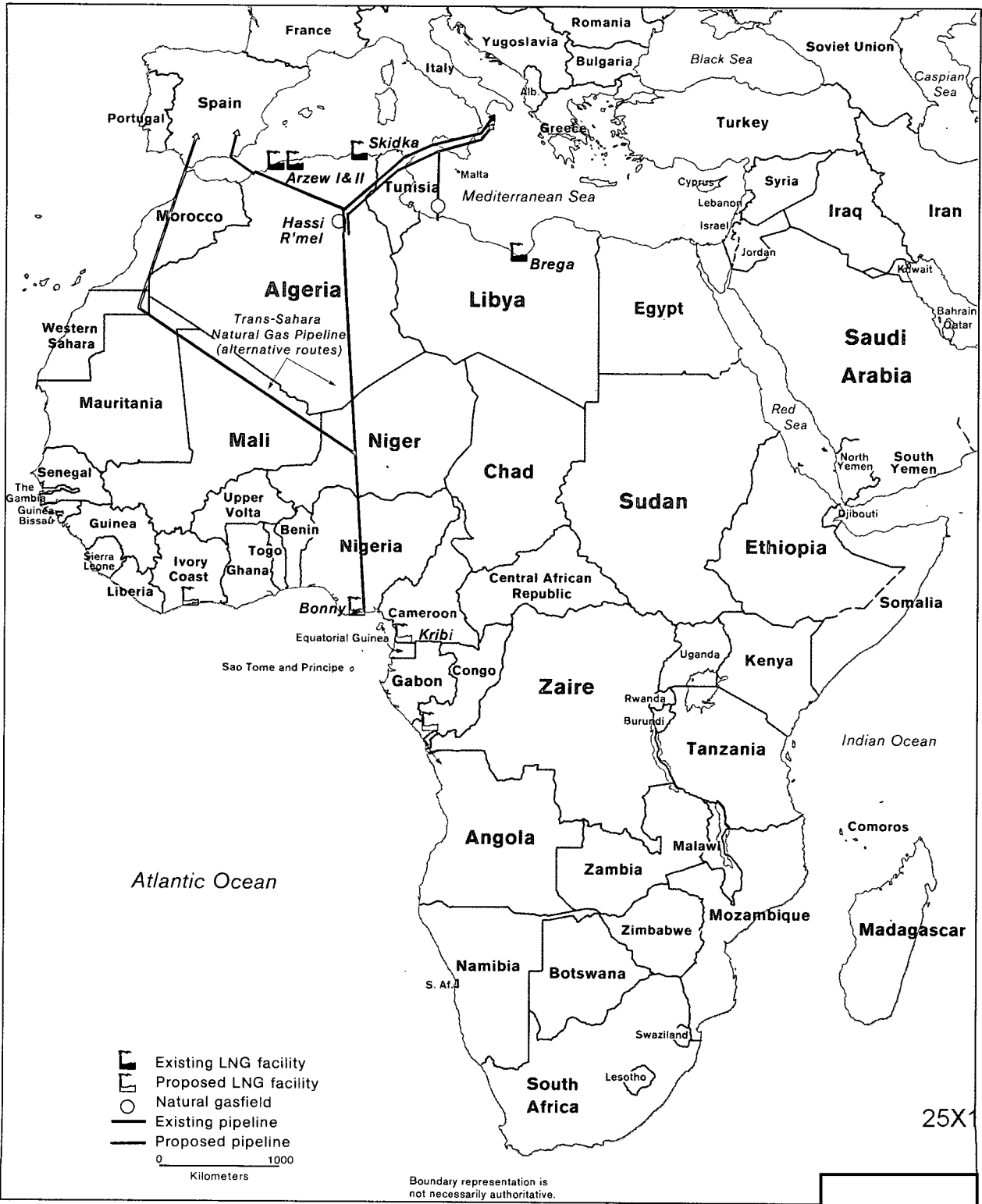
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Figure 3
Africa: Proposed Natural Gas Export Projects



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(Algeria), Pars (Iran), and North Dome (Qatar). Each of these fields has reserves close to 100 tcf or 20 billion boe. Because nearly all of the gas currently being flared will eventually be used domestically (either through reinjection or as a fuel or feedstock), most of the proposed gas export projects will use reserves in nonassociated fields. [redacted]

[redacted] potential African suppliers—Algeria, Cameroon, Egypt, Libya, Nigeria, and Ivory Coast—could deliver as much as 1.6 million b/doe annually of additional gas supplies to Western Europe by the early 1990s. [redacted] potential Middle Eastern suppliers—UAE, Qatar, and Iran—could deliver an additional 750,000 b/doe annually, mostly to Japan. Pricing policies and financial and technical constraints, however, are likely to cause total gas supplies available from these countries to fall considerably below these levels [redacted]

[redacted] some countries, such as Egypt and the Ivory Coast, have yet to find large enough reserves to support proposed LNG projects. Moreover, the reserves found may be sufficient to meet only the growing domestic requirements. [redacted]

Pricing Policy Constraints

Pricing policies of key producing countries will limit the amount of gas that Western purchasers will be able and willing to buy. This constraint alone could take several projects, such as those in Nigeria, Qatar, and Algeria, out of serious consideration or, at a minimum, limit their scope. [redacted]

Several existing and potential gas contracts are already bogged down in pricing disputes. Algeria has adopted a militant pricing stance which calls for basing gas prices on the level of premium fuels—currently \$5 to \$5.50 per million BTU at the Algerian border. Over the past two years, the Algerians have suspended or refused to initiate gas deliveries to France, the United States, and Italy until the pricing demands were met. Only the French have acceded.

[redacted]

Several West European importers have argued with producers that gas should be priced lower than the level of premium fuels for it to compete in the industrial market with low-quality residual fuel oil, currently selling at around \$4 per million BTU (f.o.b.). Although considerable future growth in gas sales will be in premium markets, such as residential space heating, importers claim that to generate a demand for large-scale gas projects, sizable increments in gas demand must also come from the industrial sector. Failure to price gas commensurate with competing fuels in this sector will limit the amount of additional gas that can be sold. In addition, Soviet willingness to compete aggressively in gas pricing to ensure hard currency earnings will give Moscow a considerable edge in capturing the West European gas market in the 1990s, thus limiting exports from countries that maintain militant pricing policies [redacted]

Capital Costs and Financial Constraints

The pricing problem is complicated by the high capital and delivery costs of some gas projects (table 1). Except for the relatively short-distance, low-cost trans-Mediterranean gas pipelines from North African producers, [redacted] most LNG and pipeline projects will, at a minimum, cost \$10 billion for each 280,000 b/doe of capacity. Interest and finance charges can raise this cost sharply, making some projects marginally economical. For example, interest on \$10 billion borrowed at the current average interest rate of 15 percent versus earlier rates of around 12 percent, would raise total costs by about \$2.3 billion. For each percentage point decrease in interest, total investment costs would be lowered by about 8 percent. [redacted]

Delivery costs to Western Europe can also be quite high for Middle Eastern producers because of the long distance. LNG would have to be transported 11,200 km around the Cape to Western Europe at a cost of about \$4 to \$5 per million BTU. Passage of LNG tankers through the Suez Canal would shorten the route considerably but, we believe, may not be possible because of likely Egyptian concerns over environmental and safety hazards. [redacted]

[redacted] pipeline

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**Soviet Versus Middle East-African Gas:
Competing on Prices**

The ability of the Soviets to absorb costs and their willingness to do so are key factors in giving Moscow a price edge over other producers. Factors involved in enabling the Soviets to price gas at or below their competitors include:

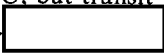
- *An ability to acquire other pipeline right-of-way through their own territory and other Bloc countries virtually cost free.*
- *Subsidized interest rates on Western loans, including a grace period until payback is required.*
- *Not having to lay out hard currency for foreign labor.*

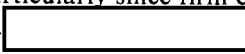
As a result, the Soviets can hold hard currency costs to a minimum. In the case of the Yamal pipeline, hard currency outlays could be as low as \$8 billion. More importantly, the Soviets are willing to accept low or even negative returns initially to ensure hard currency earnings. Because Moscow can afford these low rates of return, they are willing to price their gas at levels that guarantee market penetration.

The Middle Eastern and African suppliers, other than the North Africans, do not have as many of the advantages the Soviets have in minimizing hard currency outlays. Only North American producers can build relatively low-cost pipelines with delivery costs competitive with Soviet prices, but these countries—like other African and Middle Eastern producers—have been unwilling to accept the lower wellhead value for gas needed to compete with the Soviets. Other pipelines such as those proposed from Qatar and Nigeria must traverse long routes across several countries, incurring high right-of-way and transit costs. Since most of these countries do not have the required domestic skilled labor, the need for a large foreign labor force will add further to hard currency outlays. Although subsidized financing and other credits may be arranged for countries such as Nigeria and Cameroon, creditworthiness and political instability may prevent subsidized financing for other countries such as Iran.

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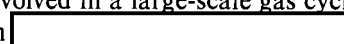
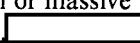


transport from the Middle East to Europe appears more economical at \$3 per million BTU, but transit fees could easily add another \$1 to \$2. 


The multibillion-dollar cost of these gas projects are forcing Governments in Nigeria, Cameroon, and Qatar to move cautiously in committing resources to projects that will not pay off for a number of years. Spending such large sums on gas export projects—particularly in capital poor countries like Nigeria and Cameroon—rather than on agricultural and other industrial development projects, risks internal political criticism. The uncertain market outlook for gas also imposes risks, particularly since firm contracts have not been signed. 

Technical Constraints

Technical problems may also delay or limit the scope of some projects. For example, a desire to optimize oil

and natural gas liquids (NGL) production (mainly through gas reinjection and cycling operations) could delay production of gas from gascaps and gasfields with high NGL content.¹ Presently, Algeria is the only country involved in a large-scale gas cycling effort, although  Iran is considering plans to renew the reinjection of massive volumes of gas into several of its oilfields. 



¹ The cycling program removes NGL from produced gas and reinjects the dry gas into the reservoirs to maximize ultimate NGL recovery. Without gas reinjection, pressure of the reservoir drops, condensing and confining some of the NGL within the reservoir 

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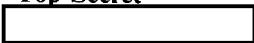
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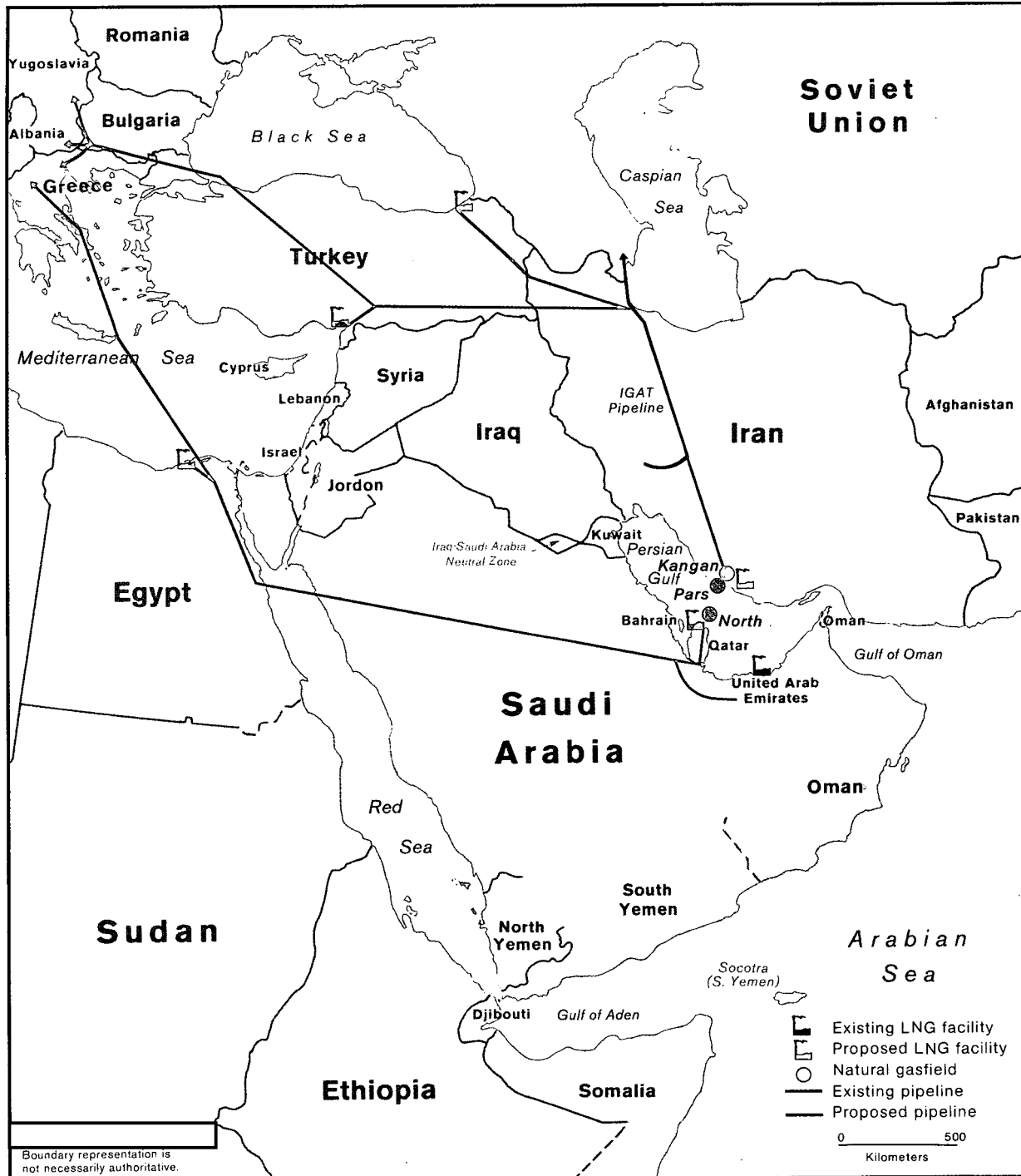


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Figure 4
Middle East: Proposed Natural Gas Export Projects



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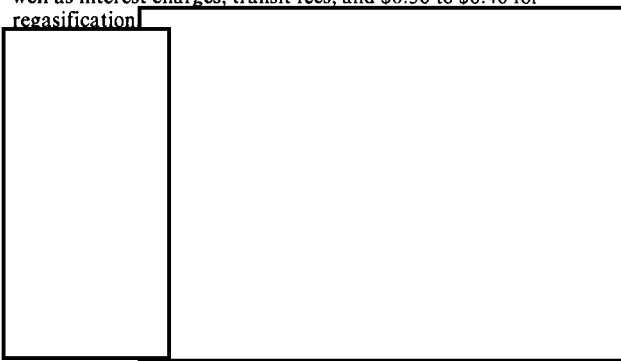
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Table 1
Africa-Middle East: Estimated Facility
and Operating Costs

Facility	Distance (kilometer)	Investment Costs ^a (billion US \$)	Operations and Transport Costs (\$ per million BTU)
Arabia-Europe pipeline	3,375-3,735	6-8.9	3
Arabian Peninsula to Egyptian coast	2,570	3.4	1
Egypt-Greece trans-Mediterranean Sea	565-925	2.1-4.5	1
Greece-Italy trans-Aegean Sea	240	0.5-1.0	1
Algeria-Italy pipeline	2,500	3.3	0.32-0.64
Algeria-Tunisia	920	1.2	
Tunisia-Italy trans-Mediterranean Sea	160	0.5	
Italy (to Minerbo)	1,420	1.6	
Nigeria-Spain pipeline			
Trans-Saharan	3,750-4,335	6-7.5	1.63
LNG facilities		8-10	
Plant cost		3-5	
Ships cost (15)		5	
Transport cost from:			
Egypt-Italy	1,500		1.50
Algeria-Northern Europe	1,500		1.50
UAE-Japan	1,200		1.05
Arabian Peninsula to Southern Europe via Suez Canal	10,300		3.00
Arabian Peninsula to Northern Europe via Cape of Good Hope	18,000		5.00

^a Excludes field development and gas gathering pipelines that range from an additional \$2 to \$4 billion per 300,000-b/dae capacity, as well as interest charges, transit fees, and \$0.30 to \$0.40 for regasification



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problems, poor maintenance, or insufficient gas feed to operate normally:

- Algeria has faced delays in construction of gas feeder pipelines into LNG plants, poorly designed or installed equipment in several LNG trains, and high gas losses resulting from low operating efficiencies of plant operations and equipment.

a number of existing LNG plants have been plagued with design flow

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- Libya's Brega LNG plant is in poor operating condition because of poor maintenance and the relatively old age of the facility.
- Abu Dhabi's Das Island plant has had recurrent problems with insufficient gas feed and design flaws in some equipment.

Experience from operating these plants has discouraged Algeria, and probably Libya, from undertaking additional LNG projects and may cause other producers to rethink their plans for similar facilities [redacted]

Domestic Consumption

Rapidly rising domestic gas consumption could also limit supplies available for export. Because net revenues are likely to remain lower for gas than for oil on an energy equivalent basis, potential suppliers will probably push development of gas for domestic use to maximize oil available for export. They may also favor gas derivative export projects (methanol and petrochemicals) if the returns are greater than for LNG or pipeline gas. [redacted]

Saudi Arabia's master gas plan is an example of prioritizing domestic use and gas derivative export projects rather than export of gas. Qatar, Iran, Algeria, Libya, Egypt, and UAE have all more than doubled their domestic gas consumption in the past few years and plan for even more rapid increases. We believe that in Algeria and Iran rising consumption will likely cut into existing export capacity during the next several years. The potential for rapidly rising consumption in Egypt and the Ivory Coast could prevent exports altogether [redacted]

Gas Supply Outlook

Development of African-Middle Eastern gas supplies will hinge on Western Europe's and Japan's desire to find alternatives to Soviet gas and willingness to pay prices probably 10 to 15 percent higher than Soviet prices. Assuming full-scale development of North Sea reserves and the willingness of the West Europeans and Japanese to forgo additional supplies of Soviet gas, we believe African and the Middle Eastern

producers could supply an additional 750,000 b/doe to 1.0 million b/doe by the mid-1990s:

- Algeria could provide the bulk of these supplies, perhaps up to an additional 600,000 b/doe above existing contracts, in the early-to-mid-1990s. Because current technical problems with its gas cycling program will probably prevent Algiers from fully meeting existing contracts totaling 613,000 b/doe until the early 1990s, West European customers may be extremely reluctant to contract for large additional volumes from Algeria.

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- Cameroon will probably provide 75,000 b/doe of gas by 1990. A proposed LNG project was scaled back recently because of insufficient reserves, but construction could begin by 1984 once pricing and marketing arrangements are settled.

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- The UAE will probably expand LNG production by 30,000 b/doe from existing reserves by 1990. It could increase output another 150,000 b/doe by 1995 [redacted]

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[redacted] Most sales will probably continue to go to Japan.

- We believe a decline in the amount of oil available for export will eventually force Nigeria to undertake a gas export project in the 1990s to meet revenue needs. Any new facility would probably be considerably smaller than the original Bonny LNG proposal and could total only 130,000 b/doe.

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- Qatar has temporarily postponed plans to export gas from the North Dome gasfield. We believe Doha will proceed to develop the field to meet domestic requirements and may have to reconsider gas exports as oil production declines in the early 1990s.

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Other Possible Supplies

The search for alternatives to Soviet gas has sparked a number of proposals by industry groups. Although most are technically feasible, we believe that few are likely to come into fruition in the 1990s. Nevertheless, several of these projects in countries including Iran, Egypt, Libya, the Ivory Coast, and Qatar will continue to draw attention because of their potential for substantial supplies. [redacted]

We believe Iran could export gas to continental Western Europe or to Japan, but Tehran's low financial reserves, outstanding debts, and political instability under the current regime make financing of a major gas venture very risky in the near term.

[redacted]

On balance, however, we believe that until Tehran's political situation stabilizes, Iran's gas exports will be limited to Turkey for domestic use and eventually some renewed sales to the USSR if a pricing agreement is reached. [redacted]

Egypt, the Ivory Coast, and others will consider gas exports only if sizable new reserves are found. So far, companies are optimistic about the prospects, but we believe domestic consumption will prevent significant gas exports. Libya, on the other hand, could expand exports from its LNG facility at Brega but with negligible results because of the poor condition of the plant. Recent discoveries of sizable offshore gas reserves in Libya probably will not be developed until the 1990s, pending development of adjacently located offshore oilfields. [redacted]

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Nor are recently proposed Persian Gulf-to-Western Europe pipeline routes likely to be implemented in view of Western concerns about the political instability in the region and the potentially high cost of the gas. [redacted]

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Appendix Prospects for Gas Projects

Algerian Prospects

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Technical problems with the gas cycling program, delays in developing new fields, and rapidly growing domestic consumption will probably prevent Algeria from meeting current export commitments through the late 1980s. [Redacted]

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[Redacted] Algiers will likely maintain its militant price stance and sell its gas to the highest bidders. By the late 1980s, however, we believe declining oil and natural gas liquids production could force Algiers to soften its gas pricing stance. [Redacted]

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[Redacted]

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Once southern gasfields are developed and gas reinjection requirements diminish by the early 1990s, Algeria will have the potential to export 1.2 million b/doe annually. If Algeria maintains its militant pricing demands or fails to honor existing contract commitments, customers will be extremely reluctant to negotiate taking additional volumes of this magnitude. At best, Algeria will probably be able to export an additional 600,000 b/doe above existing contracts.

[Redacted]

LNG Projects

LNG projects in Nigeria and Cameroon are likely in the early 1990s:

- Despite Nigerian failure to proceed with a gas project because of inability to finance its share of capital costs, a decline in the amount of oil available for export will force Lagos to undertake a gas export project in the 1990s. [Redacted] both the French and Italians remain interested in assuming a lead in the project. Any new facility is likely to be considerably smaller than the original Bonny LNG proposal, and exports would total only 130,000-b/d oil equivalent. Proposals for a trans-Saharan pipeline, which have sparked

Italian interest, have consistently been dismissed by Lagos, primarily because of Algerian refusal to allow total Nigerian control. 25X1

- Cameroon has postponed the start of construction of the Kribi LNG plant until late 1983 or early 1984, pending a reevaluation of the project. [Redacted]

[Redacted]

[Redacted] The project will probably be scaled back to 75,000 b/doe. Strong commercial and political ties with the French and guaranteed construction subsidies will probably ensure the project's implementation by 1990. [Redacted] 25X1

Based on recent discoveries of abundant reserves, the UAE and Qatar have the potential to export substantial amounts of gas to Japan, and possibly Western Europe:

- The UAE is currently considering expanding the Das Island LNG plant from 57,000 b/doe to 85,000 b/doe in the mid-1980s, if additional offshore gas becomes available. Consideration is also being given to building a 150,000-b/doe LNG plant to use substantial quantities of gas recently discovered in the Khuff onshore gas zones. 25X1

- Qatar, on the other hand, has again shelved plans indefinitely to export gas from the North Dome gasfields following a recent failure to reach agreement with Japanese firms on gas volumes and prices, according to recent press reporting. West 25X1 European firms involved in a proposed 150,000-b/doe project have not yet expressed an interest in assuming a larger share of the output. Although 25X1 Doha will probably proceed with plans to develop the field to meet domestic requirements, exports will again have to be considered as oil production declines in the early 1990s. [Redacted] 25X1

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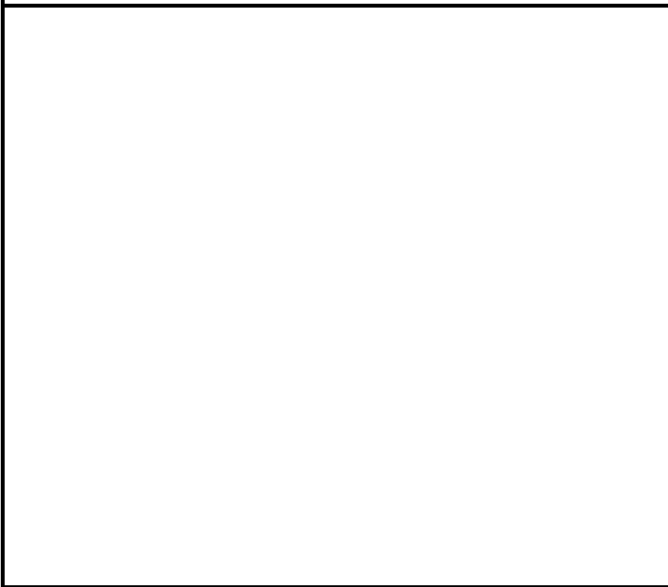
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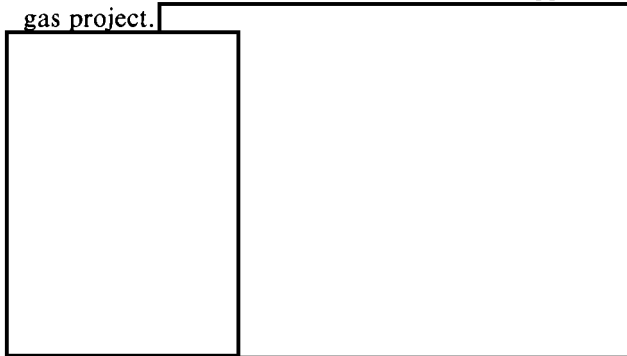
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Although the Italians are interested in a trans-Mediterranean pipeline from recently discovered offshore gasfields, development of offshore oil will have first priority for the next several years.

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- Egyptian reserves are so far insufficient to support a gas project.

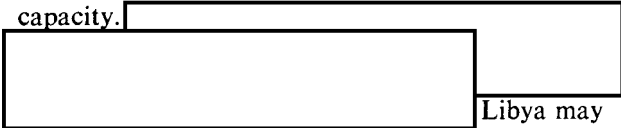


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Other Potential Suppliers

Libya, Egypt, the Ivory Coast, and Congo could have the potential to export gas if recent discoveries or additional reserves are proved up:

- Libya is considering expanding gas export sales and capacity.



Libya may also discuss expanding sales to Italy and Spain from its existing 160,000-b/doe capacity LNG plant. However, the poor condition of the plant and low oil production levels may prevent increased production.

- Recent associated and nonassociated gas finds in the Ivory Coast and Congo have sparked interest in possible small gas export projects from these countries.

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made. It is also probable that much of the gas found will be used to meet domestic energy consumption, particularly as these countries attempt to slow the rapid growth in oil demand. [Redacted]

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For such a project to move forward, the West Europeans probably would have to forego any large additional purchases of gas from Norway, the USSR, or Iran. We believe a number of factors indicate that a Persian Gulf pipeline is unlikely in the next decade:

Arabian Gulf Pipelines

Proposals for pipeline networks from the Arabian Gulf to Western Europe face a number of political and financial obstacles. [Redacted]

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[Large Redacted Area]

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- Delivered gas prices are likely to be as high or higher than alternatives from Norway, the USSR, or even Iran unless producers are willing to accept extremely low wellhead prices. Past history indicates such pricing decisions are unlikely.

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- Transit fees could be exorbitant in some of the countries crossed by the pipeline.

Political instability in the Gulf region raises serious questions about the security of supplies, and some European purchasers may question the wisdom of trading dependence on OPEC oil for dependence on OPEC gas. [Redacted]

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