BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To Senator Lloyd M. Bentsen

European Alternatives To Importing Soviet Natural Gas

For the Europeans, there is no simple alternative to natural gas from the Soviet pipeline. Problems, such as those associated with security of supply, technical feasibility, and cost, eliminated alternatives as either not readily available or not in line with basic European energy strategies. This is not to suggest that, in the longer term, alternatives will not be available to offset, at least in part, the need for future European imports of Soviet gas.

Following repeated U.S. expressions of concern about European vulnerability to possible Soviet supply interruptions, the Europeans have begun to identify ways to improve contingency planning and reduce the impact of any disruptions. Also, a number of European leaders have agreed to forego any further contracts for Soviet gas pending completion of a multinational study.

GAO/ID-83-31
MAY 16, 1983

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

INTERNATIONAL DIVISION

B-211349

The Honorable Lloyd M. Bentsen
United States Senate

Subject: European Alternatives to Importing Soviet Natural Gas (GAO/ID-83-31)

Dear Senator Bentsen:

In response to your August 30, 1982, request, we reviewed the potential alternatives which Western Europe could tap in lieu of purchasing natural gas from the Soviet Union. Assuming moderate growth in consumption, it appears that there was no simple alternative which could have easily eliminated the European need for the natural gas from the Soviet pipeline. The Soviets are expected to begin gas deliveries in 1984 in accordance with new supply contracts.

Problems associated with security of supply, technical feasibility, and cost eliminated the alternatives as either not readily available or not in line with basic European energy strategies. They were considered less desirable by the Europeans than accepting the risks associated with the Soviet pipeline. This is not to suggest that in the longer term alternatives will not be available to offset, at least in part, the need for future European imports of Soviet gas.

Two key issues considered when evaluating alternative sources of gas are the price and the vulnerability to potential supply interruptions. The stated price of Soviet gas seems to be very competitive with that of available alternatives, but numerous other factors affect the real price of gas. Nevertheless, it is expected that over the long term, with new sources of gas coming online and the substitute fuels being developed, the Soviets will strive to keep their gas price competitive.

The Europeans feel that the Soviet record as a gas supplier in the past has been satisfactory and the Soviets will continue to be a reliable supplier. Furthermore, according to the State Department, the Europeans believe it is desirable to import Soviet gas now and for the foreseeable future while husbanding indigenous gas reserves for the more distant future.

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However, following repeated expressions of concern by the U.S. Government about European vulnerability to possible Soviet supply interruptions, the Europeans have begun identifying ways to improve their contingency planning and reduce the impact of any disruptions. In addition, a number of European leaders have agreed to forego any further contracts for Soviet gas pending completion of a multinational study.

WHAT POTENTIAL ALTERNATIVES EXIST

Worldwide natural gas reserves are plentiful, but location, distance, and associated cost constraints quickly reduce the number of potential sources from consideration by the Europeans. Gas supplies from the Netherlands, Norway, Algeria, Libya, Nigeria, Cameroon, Canada, and several other countries have been put forth as possible alternatives warranting further consideration. Substituting coal and nuclear power have also been suggested. However, each has some drawback.

--The Netherlands offers the best short-term alternative; however, as part of an effort to conserve their natural gas as a strategic reserve, the Dutch have not been signing new gas export contracts.

--Norway offers the best long-term alternative, but all the gas it could technically produce before 1990 has already been sold to European buyers.

--Algeria, in previous dealings with the Europeans, demanded what was considered an unreasonable price for its gas. Moreover, prior Algerian gas supplies were curtailed over pricing disputes.

--There is some question whether Libya and Iran can be regarded as secure sources of supply.

--Other alternative gas sources, many still in the initial phases of development, may bring the opportunity of more diversification but not in the short term.

--Electricity generated from coal and nuclear power might be a substitute for Soviet gas in the 1990s, but because a great deal of gas is consumed in the residential markets, a wholesale switch from gas to electricity would necessitate having a large number of individual households replace their gas furnaces and ovens. This would entail considerable cost to private citizens and probably substantial domestic political implications. Moreover, in some European countries

natural gas is a fuel greatly preferred to either coal or nuclear power.

According to the State Department, the Europeans view the alternatives as valuable complements to but not substitutes for the Soviet gas they have contracted to buy through existing pipelines and the Urengoy pipeline which is under construction. The Europeans have said that they consider the Urengoy pipeline to be a project they have carefully considered and to which they are committed.

PRICING CONSIDERATIONS

On the surface, it appears that the Soviets have priced their natural gas lower than that of their principal competitors. For example, there are indications that the stated price of Soviet gas is below that of North Sea gas (e.g., Norway) and considerably lower than that sought by Algeria. Although full details of private supply contracts were not available, we learned that each gas contract is considered unique and that a general comparison of stated prices can be misleading. Other factors, such as indexation and minimum billing clauses and "most favored nation" provisions, must be considered.

Factors outside the nominal pricing structure may also affect the real price of gas. One such factor is consumer nation financing of the development of gas exporting infrastructure facilities in the producer country at less than market rates of interest. For example, the Soviet pricing policy is linked in part with the interest rate the Europeans charge for financing the pipeline project.

Another factor involves trade "packages," whereby higher gas prices are tied to commitments by the gas exporting nation to buy goods from the gas importing nation. Apparently, Algeria has such an arrangement with France, Italy, and Belgium.

U.S. defense officials point out that although the Soviet's stated gas price seems lower than those of other sources, it does not consider the extra costs the Europeans will incur in taking steps to reduce their vulnerability to possible Soviet supply interruptions. Nevertheless, the State Department has indicated that, over the long term, the Soviets can be expected to price their gas to stay competitive with gas from other sources as well as with alternative fuels.

SECURITY OF SUPPLY

The Reagan administration has expressed strong concern that the new pipeline arrangement crosses a prudent threshold of Western European dependence on the Soviet Union. U.S. officials have urged their European counterparts to review the potential

supply vulnerabilities and the risks involved and to improve their contingency planning.

Encouraged by the United States, the Europeans have begun identifying ways to ensure the security of supply and reduce their vulnerability to a supply disruption. In the short term, these efforts may include (1) development of flexibility in domestic gas production and surge capacity, (2) systems of interruptible contracts for certain large users to quickly reduce consumption and extend available supplies for other consumers, (3) enlarged storage capacity, and (4) further improvement in the integrated European gas transportation grid network to allow better reallocation of gas. For the long term, the Europeans think they can help to ensure the continuity of gas supplies by encouraging indigenous production, exploration, and development; diversifying sources of energy imports; and developing substitute gas from coal, peat, oil, or other hydrocarbons.

It should be pointed out that some efforts listed as possible future initiatives already exist to some degree. According to the State Department, (1) all European gas utilities currently supply some of their industrial customers under interruptible contracts, (2) strategic storage facilities are being developed in some countries, and (3) existing pipeline grid flexibility provides some capacity to offset disruptions.

Moreover, President Reagan announced in November 1982 that a number of European leaders had affirmed that no new contracts for the purchase of Soviet natural gas will be signed or approved pending the results of a multinational study of energy requirements and the question of dependence on energy imports from insecure sources.

AGENCY COMMENTS AND OUR EVALUATION

We obtained comments from the Departments of State and Energy on the draft of this report.

The State Department commented that the Europeans could have found alternatives to additional imports of Soviet gas if they had undertaken a comprehensive review of various alternatives at the same time that discussion began on new imports from the Soviet Union. However, State's comments offered no specific information about such alternatives.

The Department of Energy commented that our report provides a good general description of each alternative but that more analyses should be presented on the sizes of gas reserves, the economics of development, the technology required and the sensitivity of each alternative to changes in such factors as economic growth, world oil prices, and demand for natural gas. The Energy Department added that the report ignores the possibility

of adopting a mix of alternatives which could include to some degree all the gas sources which are examined. Without such a thorough analysis of the alternatives, the Department of Energy believes it is difficult to determine whether the alternatives represent complements to or substitutes for Soviet gas. However, it did not indicate what mix of alternatives it believed could be adopted.

The issue of selecting a mix of alternatives is complex. We agree that the factors identified by the Energy Department, as well as many other issues such as foreign policy implications and employment in home markets, should be considered in any decision about adopting alternatives. Moreover, we believe each individual alternative must be viable in its own right before it is considered as part of a mix of alternatives. It must also be recognized that the economic implications of building a number of costly infrastructures to get smaller amounts of gas from various sources detract from adopting such an approach.

The Department of Energy also questioned whether sufficient information was available to assess the increased vulnerability of Europe as a whole as a result of increasing imports of Soviet gas. The Department of Energy indicated that the ongoing International Energy Agency study is apparently the first attempt to conduct an in-depth analysis of natural gas supply security on a regional basis. Until this analysis is completed, Department of Energy officials do not believe it possible to fully understand the supply security implication of increased Soviet gas for Europe.

SCOPE AND METHODOLOGY OF OUR REVIEW

Our audit work was conducted in accordance with generally accepted Government auditing standards. We obtained information from officials at the Departments of Energy, State, and Defense; Central Intelligence Agency; and National Security Council. We contacted the Washington embassies of several European countries to obtain the perspectives of foreign governments. At our request, the Commission of the European Communities provided a number of its documents on natural gas and security of supply.

We also reviewed reports from other sources, including the

Office of Technology Assessment
Congressional Research Service
International Energy Agency
American Gas Association
International Gas Union

Appendix I provides a more detailed discussion of the various proposed alternatives, pricing considerations, and security of supply. Appendixes II through V provide statistical information on European imports of natural gas. Comments from the Department of Energy and State on the draft of this report are included in Appendixes VI and VII, respectively. Appendix VIII is a copy of your August 30, 1982, request.

As arranged with your office, no further distribution of this report will be made for 30 days from the date of issue, unless you publicly announce its contents earlier.

Sincerely yours,

Frank C. Conahan
Director

ALTERNATIVES TO SOVIET GAS

At the request of Senator Lloyd Bentsen, we reviewed the natural gas alternatives which Western Europe had to the purchase of natural gas from the Soviet Union and addressed the issues related to security of supply and price. Our review showed that:

--The alternatives, especially in the short-term, are limited and have considerable drawbacks. The Europeans view the gas from other sources as long-term complements to rather than substitutes for Soviet gas.

--On the surface, the stated price of Soviet gas appears to be cheaper than that of other sources, but numerous other factors influence the real cost of gas.

--After repeated U.S. warnings that the Soviet gas pipeline arrangement crosses the prudent threshold of European dependence on the Soviet Union, the Europeans are now identifying a number of ways to improve contingency planning and reduce vulnerability to any supply interruption.

BACKGROUND

The Soviet's Siberian gas export pipeline will be 2,800 miles long, running from the giant Urengoy gas field in Siberia to the town of Uzhgorod on the Czech-Soviet border. The pipeline will be capable of delivering 2.8 billion cubic feet per day of natural gas to Western Europe via Czechoslovakian and Hungarian transit pipelines. The Soviets are expected to begin gas deliveries in late 1984 in accordance with new supply contracts.

According to the State Department, planning for a large-scale Soviet natural gas pipeline to transport Western Siberian gas to Western European markets began in the mid-1970s as part of a triangular project in which Iranian gas would have been exported to the Soviet Union while Soviet gas would have been exported to Western Europe. The Iranians dropped out in 1978, but the Soviets and the Europeans decided to go ahead.

In late 1981 and early 1982, long-term gas supply contracts based on the new pipeline were signed between the Soviet Union and gas distribution companies in West Germany, France, Austria, and Switzerland. A preliminary agreement also was signed with the Italian state gas distribution company, but it has not received Italian Government approval. The new contracts were expected to increase West European dependence on the Soviet

Union for natural gas, in some cases pushing it to about 30 percent of gas consumption. U.S. officials believe that such a level of dependence on Soviet gas could be troublesome because gas is particularly hard to replace on short notice with the way it is transported and stored and because it is used increasingly in the politically sensitive residential and commercial sectors of Europe.

The potential dependence on Soviet energy supplies has given rise to consideration of potential alternatives which might be more attractive from a security and economic point of view.

WHAT POTENTIAL NATURAL GAS ALTERNATIVES EXIST

According to the American Gas Association, world resources of natural gas are very large and largely untapped. Moreover, substantial quantities of natural gas (about 10 percent of world production) are lost each year in flaring. However, this does not mean that numerous alternatives were readily available to the Europeans. Cost constraints, generally associated with the location of gas and the distance involved in transporting it to Europe quickly remove some potential sources from serious consideration.

Supplies from the Netherlands, Norway, Algeria, Iran, Libya, Cameroon, and several other countries have been put forth as possible alternatives warranting further consideration. Use of large submarines to transport liquid natural gas from Prudhoe Bay, Alaska, to Western Europe has also been proposed. However, each has some drawback. Moreover, the economic implications of building a number of expensive infrastructures to get smaller amounts of gas from various sources detract from adopting such an approach.

The Europeans view the proposed alternatives as valuable complements to but not substitutes for the Soviet gas that they are contracting to buy. According to the State Department, the Europeans have said they carefully considered the new Soviet pipeline project and are committed to it.

A closer look at these alternatives reveals the following.

The Netherlands

The Netherlands, currently Europe's largest gas supplier, offers the best short-term alternative (1985-90) according to U.S. officials. However, faced with the limited prospects of finding new reserves, the Dutch Government adopted a policy to conserve its gas as a strategic reserve. As part of this conservation effort, the Dutch have not been signing new contracts

for gas exports. If the Netherlands significantly increases gas exports now to offset the European need for Soviet gas, then Europe loses this gas as a future source of indigenous supply in an emergency (spare production capacity).

Norway

Increased Norwegian gas has been cited by U.S. officials as the best long-term alternative. Norway has much more gas reserves than previously thought, particularly offshore in the North Sea. However, according to the Norwegian Government, all Norwegian gas that could technically be produced before 1990 has already been sold to European buyers. The two large new gas fields, which are expected to provide substantial future gas, have not yet been declared commercially viable. Companies licensed to develop one of these fields indicated that if satisfactory terms were obtained in the market the first gas could be onstream around 1990-91 but that under no circumstances would production from this field be technically feasible before 1990.

The other new Norwegian gas fields, especially the huge Troll field, present numerous obstacles to development in the short term. There is a substantial amount of oil below the gas in the Troll field and, due to the reservoir conditions, it will be necessary to delay full-scale gas production if the oil is going to be produced. This gas field also presents new technological challenges because it is under more than 1,000 feet of sea water and no one has yet built a production platform for such depths. Moreover, the gas field is a shallow reservoir that extends over the large area, which limits the coverage of each production unit and necessitates the use of several production units. Thus, new production in this field is not expected, even optimistically, until well into the 1990s, with "plateau" production (i.e., a stable level of volume production) commencing 10 years later.

Iran

Iranian gas reserves are second only to Soviet gas reserves. However, because of the ongoing Iran-Iraq war, continuing political instability, and Iranian attitudes toward the West, there is some question as to whether Iran can be considered a secure source of supply. As things currently stand, the International Energy Agency believes the uncertainties surrounding future Iranian gas policy make it highly questionable whether any export project will come to fruition during the foreseeable future despite a substantial exportable surplus.

Given the large gas reserves, there is a possibility that Iran could become a major gas exporter in the 1990s, but the State Department pointed out that in considering possible Iranian gas exports one should note the problems--financial, political and technical--in constructing either a pipeline to Europe

or a pipeline to Turkey combined with a liquefied natural gas (LNG) plant for exports to Europe.

Algeria

U.S. officials have pointed out the possibility of additional European consumption of Algerian natural gas. However, Europeans and Americans alike have had difficulties negotiating with the Algerians on price and other contractual provisions. The Algerians have taken what European and U.S. officials believe to be an unreasonable position in their price demands.

Algeria has the world's fourth largest gas reserves. However, its export commitments have been substantially reduced, with two LNG contracts with Europe cancelled and an LNG contract with a U.S. customer interrupted. The current LNG program has been troubled by technical difficulties and high capital and operating costs, despite preferential loans from importing countries.

The 1,070 kilometer Trans-Mediterranean gas pipeline which links Algerian gas fields to Italy via Tunisia and Sicily was completed in the summer of 1981. According to the State Department, deliveries to Italy were originally scheduled to begin in the second half of 1981 but start-up has been delayed over Algeria's demand for a higher base price and a dispute over contract provisions. Publicly, however, Algeria has blamed the delay in initiation of deliveries on technical problems.

Recently the Algerian and Italian Governments reached some agreement on the price of gas, which in essence will have the Italian Government underwriting for 3 years a portion of the gas purchased by its state-controlled gas company. However, according to U.S. officials, no deliveries have as yet been made through the pipeline. This pipeline can provide Algerian gas to new customers in Italy and possibly to other customers elsewhere in Europe. A second pipeline under consideration (the so-called Segamo project) could carry gas to Spain and other European countries if it proves to be technically and economically feasible.

The key determinant of future levels of Algeria's gas exports will be the price it seeks. Algeria has a history of aggressive price behavior, and its delivered price is much higher than that of existing and planned supplies of Soviet gas. Moreover, the State Department noted in a December 1982 letter to the Federal Energy Regulatory Commission that Algeria's record as a gas supplier has been mixed and has included interruptions in delivery to both American and European customers. Although Algerian deliveries have now resumed, both the United States and France experienced supply interruptions after opposing Algerian price demands for price parity with crude oil. As part of an energy diversification strategy, we believe the

Europeans may be using the Soviet gas arrangement to some extent to influence the Algerians to price their gas competitively.

Libya

Libya has some natural gas reserves and currently exports small LNG volumes to Europe. However, because of technical problems it has experienced with existing LNG operations and its reputation as an insecure source of supply, Libya is generally not considered to be a viable alternative supplier of gas to Europe, according to the State Department.

Nigeria

According to the International Energy Agency, Nigeria has been anxious to develop markets for its gas and to reduce the level of flaring. Consultants to the Nigerian Government are now studying the feasibility of an LNG project aimed at the European gas market. According to the State Department, an earlier LNG project was officially abandoned in February 1982 because (1) the company providing the technical leadership withdrew from the project, (2) projected costs were high, and (3) the Nigerian Government failed to provide necessary support and financing. The International Energy Agency believes the most optimistic outcome is likely to be a project about half the size of the one that was abandoned, which might start operation in the late 1980s or early 1990s to serve European customers. A Nigerian pipeline was also previously considered, but the idea was dropped in favor of the LNG project, according to the State Department.

Cameroon

It has been suggested that Cameroon might offer a viable alternative source of gas for the Europeans. However, Cameroon's proven reserves of gas are generally not considered substantial relative to other sources and the viability of developing a gas export project in Cameroon must be considered in that light.

The State Department indicated there is virtually no possibility of building an overland pipeline from Cameroon to Europe. However, a small project to get Cameroon LNG by ship to Europe in the 1990s is being tentatively considered, according to the International Energy Agency.

Canada

Canada, with its significant gas reserves and promising potential for further discoveries, has been suggested as a possible gas supplier to Europe. Formidable technical problems presented by the very hostile environment would have to be overcome to recover the "Arctic" gas resources.

Four companies are sponsoring a 2-year feasibility study to review environmental, engineering, supply and demand, and financial aspects of a project to sell Canadian LNG to West Germany. Under this project, icebreaking tankers would be used to transport the LNG about 4,100 miles to a regasification plant in West Germany. If the study shows the project to be feasible, the involved companies will then seek Canadian and West German Government approvals. Construction of LNG tankers, a liquefaction plant, and a gas gathering system would follow government clearances.

With the lengthy development time involved, the Commission of the European Communities has concluded it is unlikely that the Europeans could expect significant quantities of Canadian gas to be a near-term alternative.

According to the State Department, the European gas market has not been of particular interest to Canada. The Department commented that, aside from the U.S. market, the only foreign market in which Canada is currently interested is Japan. The Department added that Arctic gas would be almost prohibitively expensive to develop; thus, it is unlikely that Arctic LNG could effectively compete with Soviet supplies in Europe.

OTHER GAS ALTERNATIVES

More diversification of European gas supplies is expected after 1990 as new sources are developed and deliveries begin. Possible new sources of supply to Europe include some Middle East countries, such as Qatar and the United Arab Emirates.

According to the Commission of the European Communities, however, because of the need to fully consider the technical, economic, and environmental aspects of such large projects and the considerable lead times for their development, none of these sources could supply gas to Europe before the end of the decade at the earliest.

The supply potentials for a number of projects being considered are "ambitious" according to a June 1982 International Gas Union report, which indicated that translating reserves into production calls for major financial, technological, and political efforts.

Several Middle East countries have substantial gas reserves. Currently, Qatar has shown interest in developing an LNG project and some countries (e.g., Saudi Arabia) are interested in exporting gas after converting it into methanol. However, the International Gas Union report points out that the natural gas industry in this region has developed more slowly than in other parts of the world and, despite some reductions in flaring, even now more gas is flared in the region than is produced for domestic use or export.

The International Energy Agency points out that developing gas reserves for the export market has been deferred in a number of Middle East countries, in part because investment alternatives in such areas as oil and industrial development are more attractive.

The advantages of exporting gas that is currently being flared are increasingly being recognized and it is reasonable to expect that gas exports will occur sometime in the future. The size of such exports will depend upon the ability of local economies to use the gas, the costs associated with reaching the export markets, and foreign customer acceptance of such sources as being reliable. However, a report by the Organization of Arab Petroleum Exporting Countries concludes that the financial return for LNG exporting projects is low and the Arab countries should discourage the development of LNG contracts with industrialized nations and seek alternative uses for the gas.

Because Europe's energy strategy has been to become less dependent on Middle East oil, there is some question as to whether it would want to become heavily dependent on the same Middle East countries for gas.

There have been proposals for transporting LNG from Prudhoe Bay, Alaska, under the polar ice caps to Western Europe using large submarines. In general terms, the submarine tankers to be used under a such proposal would be many times larger than any submarines previously built. Building them and the necessary liquefaction facilities would require major industrial commitment and investment decisions. Department of Energy officials have concluded that using submarines poses technological, economical, logistical, and financial uncertainties and the potential for substantial cost overruns. In addition, Energy has indicated there may also be legal barriers to the export of Prudhoe Bay gas to Europe.

COAL OR NUCLEAR SUBSTITUTES

Most people who have studied the issue have concluded that neither coal nor nuclear power offers the Europeans an attractive, readily available substitute for Soviet gas imports in the short term.

The general growth of nuclear power production has been impeded by a decrease in the rate of growth for power demand, long construction times, high capital costs, waste disposal problems, and growing anti-nuclear sentiment. The International Energy Agency points out that there has been a continuing stagnation in most national nuclear programs. Given the long lead times involved, the range of nuclear capacity likely to be installed by 1990 is already largely determined. The factors constraining the development of nuclear power, such as public acceptance, financial requirements, regulatory procedures, and

waste management, are widespread, but their importance and impact vary from country to country.

For example, the State Department pointed out that political and environmental factors currently limit construction of additional nuclear facilities in West Germany. The construction and operation of nuclear facilities is currently barred by court-imposed requirements that the West German nuclear industry develop firm waste disposal plans before commissioning new facilities. To date a politically viable disposal plan that would comply with this requirement has not been developed.

According to the State Department, the Europeans believe that coal is not a substitute for Soviet gas, principally because coal and gas have very different characteristics and would be used to fill needs that are quite different. Typically, coal is used to produce electricity. However, the International Gas Union's June 1982 report indicates that the trend in gas consumption has been away from electrical power generation markets. According to the report, the policy of European countries is to concentrate natural gas use in "premium" market applications which require a highly efficient, controllable, and low-pollutant fuel.

U.S. officials believe that electricity generated from coal and/or nuclear power could be a substitute for natural gas in the 1990s. Since a great deal of natural gas is consumed in the residential markets, U.S. officials believe electricity produced from both nuclear and coal could be used economically for home heating (heat pumps) and for cooking (electric stoves). However, it should be pointed out that a wholesale switch from gas to electricity would necessitate having a considerable number of individual households replace their gas furnaces and ovens. This would entail considerable cost to private citizens and probably substantial domestic political implications.

The production of substitute natural gas from coal (coal gasification) is a long-term possibility which, according to the Commission of the European Communities, could contribute to future gas supplies if the technology can be developed to an economically viable stage. Research projects continue on coal gasification, but it is not considered as a short-term alternative to Soviet gas.

PRICING CONSIDERATIONS

On the surface, it appears that the Soviets have priced their natural gas lower than their principal competitors. For example, there are indications that the price of Soviet gas is below that of North Sea gas (e.g., Norway) and considerably lower than that sought by Algeria. However, general comparisons of base prices can be misleading.

Although the Soviets have reached price agreements with gas-importing companies in France, Germany, and Italy, the full details of these contracts have not been made public. The International Energy Agency stresses that Europe is not a single gas market and that conditions will vary from country to country and indeed from company to company. Each contract is unique, with its own specific characteristics concerning quantity, transportation distance and route, infrastructure required, and other provisions as may be established.

Besides the stated price, there are a number of other pricing considerations. The indexation clauses in gas contracts may vary widely but customarily are tied in some way to changes in the price of one or more oil products. "Most favored nation" clauses are sometimes used to guarantee the producer the highest price paid to any producer; in other cases, the price paid by the importer may be linked to the lowest price given by the producer. A minimum billing, commonly called a "take or pay" clause, is intended to ensure investors in the gas production and transportation infrastructure that minimum sufficient revenues will be generated to cover investments.

Elements outside of the nominal pricing structure also can affect the price of gas. One such element is consuming-country financing of the infrastructure (gas gathering and processing systems, liquefaction plants, pipes, and compressors) in producing countries at less than market rates of interest. For example, according to Department of Energy officials the Soviet pricing policy is linked in part to the interest rate the Europeans charge for financing the pipeline project.

Another element of international gas trade deals which can increase the actual price of gas is trade "packages," in which higher gas prices are tied to commitments by the producer to buy goods from the consuming country. For example, Algeria apparently has such an arrangement with France, Italy, and Belgium.

The Congressional Research Service reports that a floor price and escalation formula devised by the Soviet gas agency and the German utility makes Soviet gas pricing flexible and competitive with other fuel sources in West Germany. The Soviet-West German contract apparently sets a minimum floor price of $4.70 per million BTUs and contains an escalator formula related to heating oil and selected oil prices in Germany. Gas importers in France and Italy will receive similar prices, plus transportation costs. As the French gas will flow through the trans-German pipeline built for an aborted Iranian gas supply deal, no additional capital outlay will be required.

In general, U.S. officials, particularly at the Department of Defense, are concerned that although the Soviets may continue to offer very competitive prices during the implementation of

the pipeline, once they cement their role as the world's largest gas exporter and Europe is more dependent on Soviet gas, they could then demand higher prices.

Defense officials also contend that even though the Soviets may charge less for their gas, there are additional costs in getting the Soviet gas (e.g., the cost of contingency planning, expanding storage for emergencies, and enhancing the gas supply grid). However, it can be argued that such efforts as increasing gas storage and improving the transportation supply grid also help lessen European energy dependence on other limited sources of supply.

According to the International Energy Agency and the State Department, imported gas must, over the long term, compete with alternative energy sources. From the consumers' perspective, this means that the parameters for pricing gas are formed by the price of certain oil products.

SUPPLY VULNERABILITY

Natural gas is difficult to replace in the event of a supply interruption. Pipelines or LNG facilities require large start-up financial investments and time. Certain regions within Europe will depend heavily on Soviet gas once the pipeline is completed. Unless there were available capacity in other parts of the European natural gas grid, it would be difficult to replace substantial levels of gas should a supply interruption occur.

Unlike oil or coal, for which spot markets exist that may respond to short-term requirements, U.S. officials point out that there is no ready alternative to fixed and long-term supply arrangements for natural gas delivered through dedicated pipelines. Virtually all the homes and many industries in some regions will lack reliable substitutes for Soviet natural gas, according to U.S. officials.

After the Urengoy pipeline project is operating, the European capacity to withstand a major Soviet supply interruption during the winter is, in the view of Department of Energy officials, highly uncertain. If a Soviet gas interruption is coordinated with a curtailment of Middle East oil supplies, these officials believe the European energy security problem becomes critical.

The Reagan administration expressed strong concern because, in its view, the pipeline arrangement crosses a prudent threshold of Western European dependence on the Soviet Union. U.S. officials urged their European counterparts to review the potential supply vulnerabilities and the risks involved and to improve their contingency planning. They argue that the Soviet pipeline, which would significantly increase the current import

level, would make West European participants overly dependent on Soviet gas and thus vulnerable to Soviet threats to cut off the gas in a political crisis.

Assuming full contractual quantities, gas imports from the Soviet Union would represent about 19 percent of total European Community gas and less than 4 percent of total energy supplies. Percentages for individual nations vary quite widely, but in no case would the share of natural gas from the Soviet Union exceed one-third of the total gas consumption in the importing country, according to the Commission of the European Communities.

U.S. officials have emphasized that the volume of energy imports from the Soviet Union is not in itself a sufficient indicator of the potential economic and political vulnerability that could arise from expanded energy ties. They believe the Europeans must look beyond the aggregate numbers to more fundamental energy security considerations, specifically the potential for replacing Soviet gas in the event of a supply disruption.

According to the Office of Technology Assessment, there are no clear indicators to quantify the degree of risk involved in different levels of dependence. Risk assessments based on perceptions of vulnerability and considerations about alternatives cannot be precisely measured. None of the European countries were unmindful of the risks associated with increasing imports of Soviet energy. A sudden cutoff of Soviet gas would probably affect each differently, but it seems clear that none would be immune from hardship. However, the European assessment apparently led to a conclusion that the benefits from obtaining Soviet gas outweighed the potential risks.

The Europeans have defended their planned use of Soviet gas on the grounds that it reduces dependence on insecure supplies of imported oil. Further, they believe it is desirable to import Soviet gas now and for the foreseeable future while husbanding indigenous gas reserves for the more distant future. They also have contended that some provisions have been made to reduce vulnerability to any gas supply interruption.

For example, the West German Government has indicated that reducing the risks inherent in import dependency requires geographical diversification of energy sources and that pursuing an optimal diversification calls for a realistic assessment of available energy supply. The West German Government announced that after a thorough examination of all involved factors, it concluded that (1) the share of Soviet gas in energy consumption would rise to a level still acceptable and (2) the nature of the project as well as the safety measures taken simultaneously would minimize the risks. It also contends that in general getting the Soviet gas would also allow a further stretching of the Western gas reserves.

Although the Soviet Union in the past has curtailed gas supplies for technical reasons and suspended oil supplies to other countries for political reasons, Western Europeans already receive a substantial quantity of Soviet gas and generally believe the Soviet Union to be a reliable supplier. Past experience with the Soviet Union has led to the European perception, at least, that the Soviets are reliable and that their potential for continued reliability is judged to be at least as great as that of Middle East oil exporting nations.

The Office of Technology Assessment pointed out the following other factors that must be considered in evaluating the risks involved.

--Interruptions in the pipeline gas supplies would likely hurt the Soviets as well as the Europeans, although shortages of gas in Europe would be felt much more quickly than the reduction in the flow of hard currency to the Soviet Union.

--If the pipeline project is developed as envisioned, Soviet gas exports will probably largely replace Soviet oil exports by the end of the decade.

--The decision to increase the importance of natural gas in the energy supplies of some European countries has been made in part because it is a fuel greatly preferred to either coal or nuclear power.

U.S. officials, nevertheless, emphasized that potential recipients of Soviet gas would benefit from more contingency planning and that such planning would be most effective if it were undertaken jointly by all the nations involved. Encouraged by repeated U.S. warnings, the Europeans have begun identifying ways to enhance the security of supply and reduce their vulnerability to a supply disruption.

In the short term these efforts may include (1) development of flexibility in domestic gas production and surge capacity, (2) systems of interruptible contracts for certain large users, (3) enlarged storage capacity, and (4) further improvement in the integrated European gas transportation grid network to allow better reallocation of gas. For the long term, the Europeans believe that they can help ensure the continuity of gas supplies by (1) encouraging indigenous production, exploration, and development, (2) diversifying sources of energy imports, and (3) developing substitute gas from coal, peat, oil, or other hydrocarbons.

Such measures to ensure the continuity of natural gas supplies have been proposed by the Commission of the European Communities and broadly affirmed by its member nations. Ways to

further implement these measures are being studied. In addition, the International Energy Agency, spurred by U.S. efforts, has started accumulating data from member nations on their efforts to reduce the potential vulnerabilities to interruptions in natural gas supplies.

It should be pointed out that some efforts listed as possible future initiatives already exist to some degree. For example, according to the State Department, all European gas utilities currently supply some of their industrial customers under interruptible contracts. Such contracts were originally offered to facilitate load-shedding in peak demand periods, but they also can serve energy security objectives. Strategic storage facilities are being developed in some countries. In addition, existing pipeline grid flexibility does provide some capacity to offset disruptions.

In November 1982, President Reagan announced that a multinational study of Western energy alternatives, as well as the question of dependence on energy imports from insecure sources, would be undertaken. He also said that a number of European leaders had affirmed that no new contracts for the purchase of Soviet natural gas would be signed or approved during the course of this study. The study is now underway.

These actions reflect an enhanced European awareness of the risks involved in becoming dependent on Soviet gas supplies and the consideration being given to reducing potential vulnerability.

ESTIMATED EUROPEAN COMMUNITY NATURAL GAS SUPPLIES IN 1990

	Total natural gas consumption	Indigenous production	Intra community trade (Exp.- Imp.+)	Estimated imports from third countries					Natural gas imports from third countries as percent of:	
				Total	Algeria	Libya	Norway	USSR	Total energy consumption	Natural gas consumption
	billions of cubic meters									
Fed. Rep. of Germany	68.0	17.5	22.5	28.0	-	-	8.0	20.0	7	41
France	42.9	3.1	6.5	33.3	9.2	-	2.9	12.0	11	78
Italy	45.5	7.8	6.5	31.2	13.0	2.6	-	7.0 [b](8.0)	14	69
Netherlands	38.0	75.8	[a]-39.8	2.0	-	-	2.0	-	2	5
Belgium	12.7	-	4.3	8.4	5.0	-	2.9	[c](0.5)	11	66
Luxembourg	0.7	-	0.7	-	-	-	-	-	-	-
United Kingdom	61.5	45.0	-	16.5	-	-	16.5	-	5	27
Ireland	2.1	2.1	-	-	-	-	-	-	-	-
Denmark	1.9	2.6	-0.7	-	-	-	-	-	-	-
Greece	0.1	0.1	-	-	-	-	-	-	-	-
Total	273.4	154.0	0	119.4	27.2	2.6	32.3	39.0	8	44

[a] Based on forecasts for importers.
[b] Contract not yet Government approved.
[c] Under negotiation; quantity given would be the estimated take in 1990.

Notes: Sum of the imports given by source country is not necessarily equal to imports, as source of some supplies is not yet settled.
Forecasts based on expert group work; not necessarily official member state forecasts.

Source: Commission of the European Communities.

NATURAL GAS RESERVES, PRODUCTION, AND EXPORT POTENTIAL OF CERTAIN COUNTRIES WITHIN TRADING DISTANCE OF EUROPE (note a)

Country	Estimated proven reserves 1-1-81	1980 gross production	1980 flared or reinjected gas	Net export potential 1980 (note b)	1990	2000
	Billions of cubic meters					
Soviet Union	26,050	435.0	13.0	25	65	170-230
Iran	13,730	20.1	11.8	-	0-5	5-60
Algeria	3,720	36.2	25.4	6	45-49	49-80
Saudi Arabia	2,830	54.3	39.4	-	-	0-28
Nigeria	1,160	26.8	25.7	-	8	16-28
Abu Dhabi	570	12.6	6.8	3	6	9

[a]Information on reserves, production and amounts flared or reinjected based on data from Commission of the European Communities; data on export potential based on information from International Energy Agency.

[b]Actual exports.

WESTERN EUROPEAN LNG IMPORT PROJECTS

Export Scheme	Status	1985	1990	1995
		(billions of cubic meters)		
Algeria-United Kingdom	[a]No longer in operation	1.1	1.1	1.1
Algeria-France (Le Havre)	Operational	0.6	0.6	-
Algeria-France (Fos sur Mer)	Operational	3.6	3.6	3.6
Libya-Italy	Suspended	2.5	2.5	-
Libya-Spain	Operational	1.1	-	-
Algeria-France (Montoir)	Operational	5.4	5.4	5.4
Algeria-Spain	Operational	4.5	4.5	4.5
Algeria-Belgium	Operational	5.0	5.0	5.0
Nigeria-Europe	[b]Possible	-	8.0	8.0
Cameroon-Europe	Tentative	-	5.0	5.0
Total into Europe		23.8	35.7	32.6

Note: "Possible" indicates signed contracts or letters of intent. "Tentative" indicates that one or both sides have reported such a project, but no firm decision exists to commence the project.

[a]Contract has expired but could be renewed.

[b]Volumes may be doubled if a Nigeria-U.S. contract is not approved.

Source: Prepared by International Energy Agency from various published sources and updated by the Department of Energy.

POTENTIAL W. EUROPEAN PIPELINE GAS TRADE

Pipeline connection	Status	Throughput 1985	1990	1995
		(billions of cubic meters)		
Netherlands-Europe	Operational	40.0	31.0	13.0
Norway-Europe[a]	Operational	26.0	26.0	26.0
USSR-Europe	Operational	25.0	25.0	25.0
Algeria-Italy (Transmed)	Operational	12.5	18.0	18.0
Subtotal		103.5	100.0	82.0
USSR-Europe	Possible	-	40.0	40.0
Norway-Europe[b]	Under construction	-	7.0	7.0
Algeria-Europe (Transmed II)	Tentative	-	12.5	18.0
Algeria-Europe (Segamo)	Tentative	-	10.0	15.0
Subtotal		-	69.5	80.0
Total into Europe		103.5	169.5	162.0

[a]Includes pipelines to both the United Kingdom and Continental Europe. Estimates of production from fields now being produced indicate a decline to 22 bcm in 1990 and 12 bcm in 1995. The Secretariat has assumed that increases in Norwegian production will keep the pipeline flowing at capacity.

[b]Does not account for possible pipeline for production north of the 62nd parallel.

Source: International Energy Agency

Department of Energy
Washington, D.C. 20585

MAR [illegible] 1983

Mr. J. Dexter Peach
Director, Resources, Community
and Economic Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

The Department of Energy (DOE) appreciates the opportunity to review and comment on the GAO draft report entitled "European Alternatives to Importing Soviet Natural Gas" (Code 488111). DOE believes that the issues of energy security and diversification require careful and thorough analysis.

The draft report addresses a broad range of alternatives to importing Soviet gas. While the report provides a good general description of each alternative, there is not sufficient analysis to provide a basis for comprehensively comparing the alternatives with Soviet gas. More analysis should be presented on the size of the gas resources, the economics of development, the technology required, and the sensitivity of each alternative to changes in factors such as economic growth, world oil prices, and demand for natural gas. In addition, by examining each alternative separately, the draft report ignores the possibility of adopting a mix of alternatives which could include to some degree all of the gas sources which are examined. Without such a thorough analysis of the alternatives, it is difficult to determine whether the alternatives represent complements to or substitutes for Soviet gas as mentioned on page 3 of the draft report.

On page 19, the draft report discusses the possibility of LNG from Prudhoe Bay, Alaska, serving as an alternative to European imports, but, while the report mentions various difficulties with this concept, it does not mention potential legal barriers to the export of Prudhoe Bay gas to Europe. The most serious potential barrier is set forth in President Carter's Decision and Report to Congress on the Alaskan Natural Gas Transportation System (September 1977), which Congress enacted into law in late 1977, (Public Law No. 95-158, 91 Stat. 1268). This law could be read as prohibiting any export of Prudhoe Bay gas absent further Congressional action. Section 12 of the Alaska Natural Gas Transportation Act of 1976, specifies that any exports of natural gas from Alaska are subject to the licensing requirements of Section 3 of the Natural Gas Act, possible prohibitions under section 103 of the Energy Policy and

GAO note: Page numbers in this appendix may not correspond to numbers in final report.

Conservation Act, and a requirement that any such export "will not diminish the total quantity or quality nor increase the total price of energy available to the United States."

The question of security of supply is a critical factor in the analysis of Soviet gas and alternatives. The draft report reaches the conclusion on page 27 that "the European assessment apparently led to a conclusion that the benefits from obtaining Soviet gas outweighed the potential risks." This conclusion appears to be based on the assumption that "none of the European countries were unmindful of the risks associated with increasing imports of Soviet energy" (page 27) and on announced West German policy to limit the share of Soviet gas and the "modalities" of the project and simultaneous safety measures. We question whether sufficient data was available to assess the increased vulnerability of Europe as a whole rather than for specific countries. The International Energy Agency is currently conducting an analysis of natural gas supply security of the IEA regions. This is apparently the first attempt to conduct an in-depth analysis of this issue on a regional basis. Until this analysis is completed, it will not be possible to fully understand the supply security implications of increased Soviet gas imports for Europe.

On pages 5 and 29 of the draft report, there is a description of the efforts being taken by Europe "to ensure the security of supply and reduce their vulnerability to a supply disruption." The efforts described are a general list of arrangements which can be taken to prepare for possible disruption of gas supply. As evidence of the steps being taken, the draft report references the recommendations of the Commission of the European Communities and European participation in the multinational study of Western energy alternatives. Such a critical element as the measures being undertaken to enhance security and reduce vulnerabilty needs to be examined in more detail than is apparent in the current draft of the report. Without this type of analysis the impression given by the report that the European countries are actively instituting a broad range of security measures may be misleading.

Comments of an editorial nature are being provided directly to members of the GAO audit staff. DOE appreciates the opportunity to comment on this draft report and trusts that GAO will consider the comments in preparing the final report.

Sincerely,

Martha O. Hesse
Assistant Secretary for
Management and Administration

GAO note:
Report was modified to reflect Energy's concern over possible legal barriers to exports of Alaskan gas and to clarify the extent to which Europeans have begun to identify ways to reduce their vulnerability to a disruption. Editorial comments provided separately were incorporated in report as appropriate.

DEPARTMENT OF STATE
Comptroller
Washington, D.C. 20520

31 MAR 1983

Dear Frank:

I am replying to your letter of March 2, 1983, which forwarded copies of the draft report: "European Alternatives to Importing Soviet Natural Gas."

The enclosed comments on this report were prepared by the Deputy Assistant Secretary in the Bureau of Economic and Business Affairs.

We appreciate having had the opportunity to review and comment on the draft report. If I may be of further assistance, I trust you will let me know.

Sincerely,

Roger

Roger B. Feldman

Enclosure:
As stated.

Mr. Frank C. Conahan,
Director,
International Division,
U.S. General Accounting Office,
Washington, D.C.

EB/IEP has three general points on the GAO draft report:

1) the GAO paper needs to draw a distinction between existing European imports of Soviet gas and new imports planned through the pipeline under construction that will tap gas from the Urengoy field in Western Siberia;

2) the report should note that Europeans could have found more alternatives to additional imports of Soviet gas if they had undertaken a comprehensive review of various alternatives at the same time that discussion began on new imports from the USSR;

3) the paper needs to draw an additional distinction between the role of Soviet gas imports or their alternatives in the 1990's as opposed to the immediate future.

E. Allan Wendt
Deputy Assistant Secretary
Bureau of Economic and Business Affairs

GAO note: Although not reprinted here, State provided a number of specific technical comments and editorial changes. These have been incorporated in the report where appropriate and helped to ensure the clarity and accuracy of the report and draw the distinctions called for in the first and third general comments.

Congress of the United States

JOINT ECONOMIC COMMITTEE
(CREATED PURSUANT TO SEC. 5(a) OF PUBLIC LAW 304, 79TH CONGRESS)
WASHINGTON, D.C. 20510

August 30, 1982

The Honorable Charles A. Bowsher
Comptroller General
General Accounting Office
441 C Street, N.W.
Room 7000
Washington, D.C. 20548

Dear Mr. Bowsher:

I would like for your staff to evaluate the natural gas alternatives which Western Europe has to the purchase of natural gas from the Soviet Union. As you know well, the issue of such purchases and provision of the equipment for its delivery have become more of a political than an economic issue. That focus has distracted attention from the fundamental issue which is what other potential sources of natural gas could Western European countries tap in lieu of Soviet gas? Could your staff answer that question in some detail, including issues related to security of supply and price?

Sincerely,

Lloyd M. Bentsen
U.S.S.

LMB:lgt

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