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96th Congress
2d Session

JOINT COMMITTEE PRINT

A STRATEGY OF OIL PROLIFERATION

A STUDY

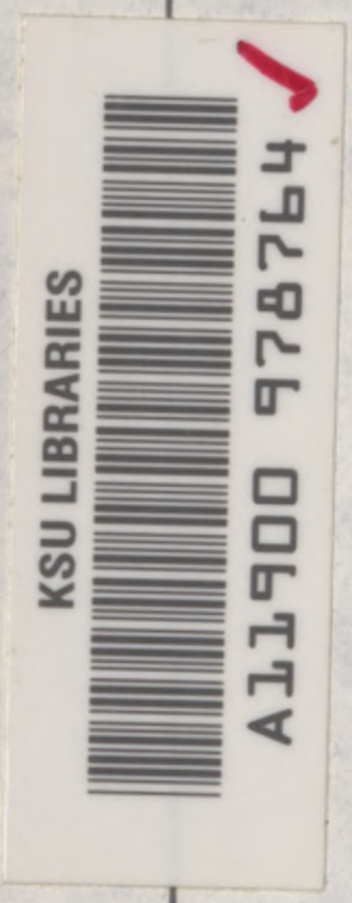
PREPARED FOR THE USE OF THE

SUBCOMMITTEE ON ENERGY

OF THE

JOINT ECONOMIC COMMITTEE

CONGRESS OF THE UNITED STATES



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Printed for the use of the Joint Economic Committee

U.S. GOVERNMENT PRINTING OFFICE

63-326 O WASHINGTON : 1980

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LETTER OF TRANSMITTAL

JUNE 20, 1980.

Hon. LLOYD BENTSEN,
Chairman, Joint Economic Committee,
Congress of the United States,
Washington, D.C.

DEAR MR. CHAIRMAN: I am pleased to transmit herewith a study prepared for the Subcommittee on Energy entitled "A Strategy of Oil Proliferation." The study was prepared by Dr. Arnold E. Safer, partner, Resources Planning Associates, Washington, D.C.

Our over-reliance upon OPEC oil can be effectively countered through various strategies, many of which have been acted upon by the Congress in recent times. However, I feel it is equally important to develop a program to encourage drilling in independent oil companies in non-OPEC developing countries. This study shows that a program of oil proliferation is one of the quickest, least expensive methods of increasing our energy security. A Federal role in the financing and sorting out of diplomatic hurdles would do much to stimulate the actions required to make the diversification promise a reality.

The findings of this study, of course, are those of the author and do not necessarily coincide with the views of the members of the Subcommittee on Energy.

Sincerely,

EDWARD M. KENNEDY,
Chairman, Subcommittee on Energy.

FOREWORD

By Senator Edward M. Kennedy

Oil imports have been a major issue in the energy debate in the United States for three decades. For many years, the debate concentrated on the oil import quota. Since 1973, the debate has increasingly concentrated on national programs and policies designed to stop the growth or significantly reduce levels of imports.

While most of the political debate has concentrated on the level of oil imports, an important group of energy analysts have pursued the theme that it is not the absolute level of imports—but instead, the source of the imports—that is the fundamentally important consideration. It is obvious that not all imports are equal in economic and strategic terms. Some exporters have been extremely reliable oil suppliers. Other suppliers have used their oil export capability in a manner detrimental to U.S. interests.

There is also a growing awareness that total self-sufficiency—even if it were achievable—would not solve our energy security problems. The energy security problem will remain because it is virtually impossible to envision a scenario in which most of our key Western European and Asian allies could become energy self-sufficient. Presently about two-thirds of Western Europe's oil comes from the Persian Gulf.

If the import sources for our nation and our allies can be significantly diversified, overall energy security will be greatly increased even though oil imports continue to be a major energy source. Considerations such as these have led the Energy Subcommittee of the Joint Economic Committee to hold hearings on whether it is possible to increase energy security internationally through the diversification of the sources of oil supplies.

In spite of the obvious benefits of oil diversification, some policy makers have doubted its importance because they believed that the likelihood of finding additional supplies of oil outside of the major production areas is very small.

The dramatic expansion of the Mexican oil reserves is an obvious illustration that major improvements in the world oil supply picture are possible. Is Mexico the exception that proves the rule, or is it the first in a series of successful efforts to diversify oil supplies?

In this work, Dr. Safer looks broadly at the potential for diversifying oil production throughout the world. Using information on drilling and finding rates in the non-OPEC lesser developed countries, Dr. Safer makes a strong case that an oil diversification strategy is not only desirable, but feasible as well.

Safer identifies two important barriers to increased non-OPEC oil exploration: Insufficient financial incentives and political risks. He believes that the United States should develop a program to break through these barriers and to reduce the risks of petroleum exploration abroad. As developed by Safer, this program would utilize the expertise and the risk-taking proclivity of independent nonintegrated oil drillers. The program should be coordinated by a specialized office of our Government which would fund exploration projects, either directly or through multilateral lending agencies like the World Bank, and negotiate with foreign host governments to assure reliable, commercially favorable exploration and development terms that can be relied upon over time.

I am hopeful that this study will stimulate the proper policy framework so that an oil diversification strategy becomes an integral part of our energy policy. A program to encourage greater diversification of our imports can do much to increase our energy security and, at the same time, provide us with a lessening of uncertainties in terms of our future world oil supplies.

I commend this study by Dr. Safer and I trust that my colleagues in the Congress and the general public will give it their fullest consideration.

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A STRATEGY OF OIL PROLIFERATION

By Arnold E. Safer [1]

Introduction

The upward spiral of oil prices in 1979 demonstrates once again the overriding need for oil consuming nations to challenge the supremacy of OPEC over the world's energy markets. As the largest single oil importing nation, and as the technological and military leader of the Free World, the United States should take the lead in this effort. While a more efficient use of energy is clearly to be encouraged, no one really knows how much of the proposed reduction in oil consumption will result from conservation or from economic recession. While ever rising oil prices might bring about reduced fuel consumption, they will also cause more inflation and eventual economic downturn. Thus, government policy cannot focus on conservation alone, but must also emphasize new fuel supplies.

The most rapid and least expensive new supplies could come from pursuing a determined policy of oil proliferation—namely, increasing worldwide supplies of oil, especially in non-OPEC developing countries, through direct U.S. Government financing of overseas exploration. Geologists have identified numerous areas of potential oil production in non-OPEC developing countries. The time required to explore and possibly develop these frontier areas is in the range of 3–5 years, but these leadtimes are not particularly long relative to making synthetic or solar energy sources both available and economic. In terms of timing, development of conventional oil and gas reserves in promising geologic areas around the world is the most rapid answer to OPEC's tightening of world oil markets. While oil discovered in these non-OPEC developing countries would not be under U.S. control, the greater diversity of supply sources would add importantly to U.S. buying leverage in world oil markets, and thus reduce the upward pressure on oil prices.

If new oil reserves were discovered in these areas, the benefits to the world economy could be substantial, in terms of reducing the balance of payments pressure on these nations, of increasing competition among oil suppliers, and of restraining further price rises by OPEC. To accomplish this goal, if it can be done at all, enormous sums of capital are required. Since the international oil companies and the OPEC countries are reluctant to invest heavily in potential new sources of supply, it will be up to the governments of the industrial, oil consuming nations to finance such a program.

It is an obvious, and sometimes overlooked fact, that prior to the development of known oil structures, massive sums for exploration must be spent. In frontier area wildcatting, 9 out of 10 holes are usually dry. But unless these nine dry holes are drilled, with the result-

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[1] Partner, Resources Planning Associates, Washington, D.C.

ing funds literally "poured down a hole", the tenth producing well will not be found. The game of wildcat exploration is not normally played very well by bureaucrats, in governments or in giant corporations. Because to drill that tenth successful well, the driller must have optimism, nerve, freedom of action, and a shrewd gambling instinct, traits not commonly associated with most government or corporate executives.

It will take financial incentives to encourage the oil wildcatter into the non-OPEC developing countries. Not only are the geological risks high, but the political risks can be even higher. If oil (or natural gas) is in fact discovered, what is to prevent the host government from changing the terms of its initial prediscovery agreement with the wildcatter? These, and related problems, can best be handled by the governments of the United States and other industrial, oil consuming nations, because of the leverage which they can exercise on the host government should it choose to renege on its initial commitments.

What could such a financing program achieve? How big should it be? What role should the financing agency play in the negotiations between the oil operator and the host government? The answers to these and other related questions are critical to the success of any government oil related venture-capital investment fund and will be addressed in detail in this study.

The Fallacy of Demand Curtailment Alone

The single most important economic challenge to OPEC would be the emergence of new supply sources, in sufficient quantity and diversity so that oil consumers could take advantage of both the capacity and willingness of new oil producers to supply their oil. The ineffectual consumer response of demand curtailment by itself has been totally discounted, if not ignored, by both the OPEC governments and by the major international oil companies. By centering the consumer response on demand curtailment alone, the Western nations have become increasingly vulnerable to continued inflation and sluggish economic growth. Even then such a policy of demand reduction alone will not succeed in reducing the OPEC price squeeze.

There are a number of reasons why demand curtailment alone is insufficient as a response to the cartel. First, the financial gains already made by Saudi Arabia and the other sparsely populated countries of the Persian Gulf have been so enormous that they can withstand the pressure of exporting less oil (or no oil at all) longer than the consuming countries can do without oil imports. In fact, because these countries have by how reached the limit of their capacity to absorb new resources internally for domestic economic development, their interest in expanding oil production is very limited. Second, the decision by the new Iranian regime to reduce production to levels significantly lower than under the Shah's policy, has given the larger population OPEC members substantial leeway to raise oil production and increase oil prices at the same time, thereby substantially improving their trade balances, and removing their incentives to restrain prices. Finally, since OPEC is comprised of sovereign governments, they can further their cohesive structure through such noneconomic means as political and military alliances and common religions and cultural values.

In other words, as long as the Western consuming nations rely solely on the economically disruptive demand curtailment response, OPEC can continue to raise prices and cut production. And the more OPEC is able to raise revenues in this way, the more immune it is from a Western demand curtailment response.

The Supply Response

Conservation as *one* of several anti-OPEC strategies is useful, but increasing non-OPEC supplies is at least as vital. The unwillingness of Iran to return to its 6 MMB/D level means that the oil importing nations must identify two more North Seas to make up for this loss. Some will argue that there is literally nothing the West can do, since other large pools of oil simply do not exist. Thus the oil consuming nations must adjust to the economic rents granted by nature to OPEC and accept the new balance of economic power.

The problem with this kind of reasoning is that it accepts known reserves as if it were an accurate reading of actual reserves. The fact is that the only way oil will be found is to drill for it. And if drilling is not done outside of known producing areas, the chances are excellent that oil will not be found outside of known producing areas. Conversely, if drilling is concentrated in the Middle East, it is not at all surprising to discover that an increasing share of the world's known oil reserves are located in the Middle East.

As elementary as this logic is, it is precisely this logic that discredits the school of thought that has come to dominate U.S. policy with respect to Middle East oil. Simply put: the size and location of the world's proven oil reserves reflect no more and no less than how much and where exploratory drilling is concentrated.

The 1964–76 drilling record (see table 1) that for the 10 years preceding the OPEC revolution (1964–73), the number of wells drilled declined, both in the United States and elsewhere in the non-Communist world. Far from "needing oil," it seems clear from what actually occurred that there was too much around.

TABLE 1.—OIL WELL DRILLINGS COMPLETED: TOTAL, OPEC AND UNITED STATES, 1964–67 AND 1971–76

	United States	Total drilled outside United States	OPEC	OPEC/total
1964	19,905	4,492	1,164	25.9
1965	18,065	4,605	1,216	26.4
1966	16,216	3,843	873	22.7
1967	15,073	3,652	775	21.2
1971	11,567	3,429	1,314	38.3
1972	11,184	3,424	1,328	38.6
1973	9,555	3,494	1,389	37.6
1974	13,719	3,496	1,849	38.6
1975	16,626	3,459	1,120	32.4
1976	16,389	3,437	1,179	34.3

Source: Data derived from World Oil, Gulf Publishing Co., Houston, Tex., Aug. 15, 1965; Aug. 15, 1966; Aug. 15, 1967; Aug. 15, 1968; Aug. 15, 1972; Aug. 15, 1973; Aug. 15 1974; Aug. 15, 1975; Aug. 15, 1976; Aug. 15, 1977.

Table 1 also shows that an increasing share of the fewer oil wells which were drilled were located in the OPEC countries. The reason for this shift had little to do with the unavailability of oil prospects elsewhere. Rather, it reflected a policy on the part of the oil multinationals to produce where the profit margins were the largest. While

this shift may have seemed then as sound business practice, in retrospect it was shortsighted even from the industry's point of view. It was disastrous from a U.S. national security perspective. This lure to the OPEC countries for greater profits has now created a major vulnerability in the U.S. and world economic system. This dichotomy between national interest and international oil company interest is continually overlooked in the formulation of policy. Every administration, by default if not by design, has blurred this important international conflict of interest, focusing instead on the more imagined than real excess profits of the domestic oil companies. The relatively small number of wells drilled outside the United States during this period attests to the rather limited interest the oil multinationals had in pursuing oil exploration. Although the non-OPEC developing nations account for approximately 50 percent of the world's prospective area of oil reserves, less than 5 percent of the exploratory wells ever drilled have been located in these countries. The distribution of exploratory wells drilled over the past 25 years is shown in table 2.

TABLE 2.—*Exploratory wells drilled*

[Approximate figures]

Developed countries:	
U.S.S.R.	100,000
United States	482,000
Canada	20,000
Australia and New Zealand	500
Western Europe	12,500
Japan	1,000
Total (95.4 percent)	616,000
Developing countries:	
Africa and Madagascar	6,500
Latin America	14,000
South and Southeast Asia	5,000
People's Republic of China	2,000
Total (4.3 percent)	27,500
World total	643,000

To challenge the idea that poor discovery rates in the developing countries discouraged more intensive drilling there, table 3 shows the barrels of oil found per foot of total drilling for 5 year averages over the period 1949–70. Not only do the numbers show drilling outcomes more favorable in these countries, but neither does the drilling record within the United States show any trend toward diminishing returns.

TABLE 3.—BARRELS OF OIL PER FOOT OF TOTAL DRILLING, UNITED STATES, WESTERN EUROPE, LATIN AMERICA, AND AFRICA (1945–74)

Time interval	United States	Western Europe	Latin America	Africa
1970–74	15.0	1,134.0	208.6	1,062.4
1965–69	30.3	322.6	158.4	1,189.4
1960–64	13.9	35.7	117.5	813.6
1955–59	13.7	26.9	160.6	996.2
1950–54	16.1	84.8	167.5	77.8
1945–49	25.5	49.9	191.2	109.8

Source: Grossling, B., "A Critical Survey of World Petroleum Opportunities," Project Independence: United States and World Energy Outlook Through 1990, Congressional Research Service, Library of Congress, Washington, D.C., November 1977.

Current Barriers to Exploration in the Developing Countries

There are at least four types of impediments to increased oil exploration in the developing countries. First, present concession or purchasing arrangements between OPEC member governments and international oil companies might be endangered were some of these companies to embark on major new exploration efforts. This is amply demonstrated by the testimony of a former Exxon executive before the hearings of the Senate Subcommittee on Multinational Corporations. When asked by Senator Percy why Exxon turned down an opportunity to develop a 10 billion barrel field in Oman, the Exxon executive specifically replied that he thought it would endanger the Aramco concession because any new oil from Oman would compete with existing oil from Saudi Arabia, thereby angering the Saudi Government should Exxon have to reduce its production of Saudi oil to make way for new oil production in Oman.

> I'm sure there is a 10 billion barrel field there, and I'm absolutely sure we don't want to go into it. I might put some money into it if I was sure we weren't going to get some oil, but not if we are going to get oil because we are liable to lose the Aramco concession.[2]

There was nothing insidious about this remark, as long as the international oil market was competitive. With OPEC dictating the terms today, however, the international oil companies have lost their leverage, or at least have chosen not to exercise it.

The second barrier to increased exploration in the nonoil developing countries by the major international companies is the oil surplus itself. No private firm steps up its investment in new capacity if it projects surplus markets ahead. This is especially true in oil exploration, where the randomness of the discovery process can quickly upset the most thorough projections. If the international oil companies in fact foresee a significant tightening of world markets by 1985, then they would be investing much larger sums in worldwide oil exploration, despite the geological and political risks. But, as captives of OPEC, their incentives today are to cooperate with the contrived scarcity of the cartel.

A third barrier relates to the provision of a market for oil which might be exported from a developing country. Depending upon the type of crude oil and where it is located in the world, provision of transportation to refining centers is not always automatic. While this is not a major constraint, it is an additional cost which must be accounted for in calculating the competitiveness of a potential new oil field.

The last and most serious limitation involves the availability of capital to those smaller companies who have little or no connection with OPEC production, and have traditionally been reluctant to venture overseas in any major way. This reluctance stems from a combination of geological and political risk relative to the amounts of capital which these independent companies can invest. By way of example, $200 million of equity investment, the majority of which would be spent in wildcat exploration, is needed to discover a 1 billion

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[2] Testimony of Howard Page before the Senate Multinational Corporations Subcommittee, 1975.

barrel field and to achieve a rate of return commensurate with the risk and the probable host government's proportion of 75–95 percent. If a $200 million equity investment establishes the dimensions of the petroleum reservoirs, it could take another $800 million to develop the field. This money could typically be borrowed, but interest costs are high. The debt capital would be used for development wells which could establish a production rate of around 200,000 bbls/day, or 70 million barrels per year. Assuming the company can retain $0.50/bbl after it pays its U.S. taxes, the company could then earn a competitive return of 15 to 20 percent on its equity capital. The statistical potential for finding fields of a billion barrels or more is small. Worldwide only some 120 oil fields have been discovered with one or more billion barrels since the birth of the oil industry over 100 years ago. While geological prospects are promising in many parts of the world, unstable host governments and competitive low cost Mideast oil as a potential market threat make the purely private enterprise risks very high.

Geological Potential

According to many geologists, the oil potential of the developing countries is excellent. Dr. Bernado F. Grossling, the senior research geophysicist for the U.S. Geological Survey, estimates that as much as one-half of all the world's undiscovered petroleum could be in the developing countries. Table 4 shows where the oil might be found and how it compares to existing proven reserves today.

TABLE 4.—ESTIMATED OIL POTENTIAL OF THE NON-OPEC DEVELOPING COUNTRIES (AS OF JAN. 1, 1978)

[Billions of barrels]

	Low estimate	High estimate
Region:		
Latin America	215	790
Africa (includes Madagascar)	160	625
South and Southeast Asia	90	300
China	27	172
Total	492	1,887
	Proven reserves	
Non-OPEC:		
United States and Canada	37	
Latin America	20	
Africa	5	
Asia	6	
Western Europe	30	
Communist countries	100	
Total	198	
OPEC:		
Mideast	390	
Africa	55	
Latin America	20	
Asia	15	
Total	480	

Sources: Business Week, July 10, 1972, p. 64. Cited from Bernado F. Grossling, U.S. Geological Survey. Proven reserves data from American Petroleum Institute.

As table 4 shows, the non-Communist world outside of OPEC has only around 100 billion barrels of proven reserves, while OPEC has close to 500 billion barrels. The developing countries, however, could eventually add as much oil to the world's reserves as OPEC has today,

according to Grossling's low estimate, as shown in table 4. According to the high estimate, these developing nations could almost quadruple those reserves.

The outstanding example of this potential is Mexico, whose proven reserves at the end of 1976 stood at around 7 billion barrels, 5 billion of which were discovered in 1975 and 1976. By mid-1978, Mexican proven reserves had risen to 20 billion barrels. As of this writing, the spring of 1980, Mexican proven and probable reserves are estimated at close to 60 billion barrels, with additional potential (or possible) reserves of another 100–150 billion barrels! In other words, the geological potential which had existed prior to 1974 had never been exploited. When OPEC quadrupled world oil prices in 1974, the Mexican Government decided to invest the vast sums needed to turn geologic potential into the actual capacity to produce oil. If it worked in Mexico, it could work in other parts of the world.

According to A. A. Meyerhoff, a prominent consulting geologist writing in the Seventy Fifth Anniversary issue of the Oil and Gas Journal (August 1977), there are some 55 promising new onshore areas around the world, outside of the Communist nations. Of these, around 25 lie in developed Western nations or in OPEC countries. Of the remaining 30 areas, 15 are in Central and South America and the Caribbean, 5 in Africa, and 10 in the developing nations of Asia. Although Meyerhoff gives no potential reserve figures, his survey suggests that the geologic potential is excellent. Offshore, where the giant oil fields have been found, the geologic potential is even greater. According to H. D. Klemme, writing in the same issue of the Oil and Gas Journal, there have been some 60 giant offshore fields found in the past, either partially or totally offshore. These are located either in "inland seas" or in continental shelf areas. Half of these represent the early discovery and development phase of offshore activity and are located partially offshore and partially onshore. The other half are totally offshore, and represent developments since the late 1950's. The totally offshore fields appear to be on average of smaller size than those partially onshore. Klemme concludes that the better potential, therefore, lies in these partially onshore-offshore areas, many of which lie in the world's outer continental shelves. He identifies around 60 potential areas, about half of which are in the non-Communist, non-OPEC developing nations. These include areas off the coasts of Brazil and Argentina, much of the huge coast of West Africa, Madagascar, India, and Bangladesh and Southeast Asia. In these giant fields, he estimates that as much as 40 percent of the world's remaining discoverable reserves could be found, or between 1 and 2 trillion barrels of oil.

The potential thus appears to be excellent, but the time required to explore and develop any one of these frontier areas could be in the range of 5 to 7 years. Nonetheless, these leadtimes are not particularly long, relative to the leadtimes involved in producing synthetic oil or gas from shale or coal. They are much shorter than the estimated time needed to make solar energy economic. In fact, in terms of timing, development of conventional oil and gas reserves in promising geologic areas around the world represents the most rapid answer to any possible tightening of world oil markets in the late 1980's or early 1990's. While any oil discovered in these non-OPEC developing countries would not be under U.S. control, the greater diversity

of supply sources will add importantly to U.S. buying leverage in world oil markets. After all, once the oil is discovered, these nations will want to sell it. And the more of it there is to be sold, the less the upward pressure on oil prices.

Role of Government

U.S. Government financing of oil exploration in non-OPEC developing countries would represent a practical and positive step toward the alleviation of many of the world's energy related problems.

To date, however, the Carter administration has been very slow to respond to proposals in this area. Between the Departments of State, Treasury, and Energy some ideas on funding oil development, rather than exploration, in non-OPEC developing countries have been lingering under the surface for some time. For the most part, however, these proposals focus upon providing assistance after oil (or gas) has been discovered, under the rationale that U.S. Government funds and influence can best be used to reduce political risk which occurs only after oil is discovered. That is, if the private oil operator drills only dry holes, there are no spoils to argue over. Only after oil has been discovered would there be any incentive for a host government to change the terms of the initial agreement. And that's where U.S. Government loans for the development of the already discovered oil could be used to restrain the appetite of the host government. But the exploratory risks, both financial and geological, would still be borne by the private oil company.

This approach, favored by certain Carter administration officials, is not likely to produce a single barrel of oil that would not be had otherwise, although the development process might be speeded up somewhat. The reason is that once oil is found in an exploratory area, private sector development funds can usually be obtained. "Development money is bankable" is the oil industry phrase depicting the fact that banks will loan money to oil operators to drill wells in areas where exploration has already established the existence of oil in large enough quantities to justify development of the field. U.S. Government diplomatic influence can be helpful in preventing a host government from trying to rewrite the terms of an initial contract, but this is usually available in any case, and does not increase the incentive for private operators to explore for oil in frontier areas outside of the United States. A somewhat more positive approach has been taken by the U.S. Government's Overseas Private Investment Corporation (OPIC) in insuring the private oil operator from expropriation or other damages which he might suffer from a host government's action against him. Again, however, neither the geologic nor financial risks are reduced by this insurance program.

The U.S. Export-Import Bank has in the past financed drilling equipment for oil exploration in developing countries. In some cases the borrowers were the national oil companies of the host governments; in other cases, the equipment loans were made by private banks to private operators drilling in the developing countries with Ex-Im Bank loan guarantees. In February, Congressman Hyde (R.-Ill.) introduced H.R. 1965, "The U.S. Export-Import Bank Energy Development Act."

The bill proposes to establish an Energy Development Facility with the Ex-Im Bank to foster increased energy exploration and production on a worldwide basis. Presumably, the Ex-Im Bank program would focus largely on the non-OPEC developing countries, since the industrial countries and the OPEC countries have access to funds and expertise in the private sector without the aid of the Ex-Im Bank. Loan guarantees, insurance, and extensions of credit would be made directly to eligible host governments with the stipulation that the borrowing country purchase American oil-related goods and services. Any oil discovered and ultimately produced would be sold to the highest bidder at auction, with only U.S. citizens eligible to bid. This latter clause presumably refers to U.S. refiners or oil traders, who would not then resell the oil to third party foreign users. A revolving fund of $2 billion is proposed, with profits and losses ultimately absorbed in the general account of the U.S. Treasury.

While the Ex-Im proposals deserve support, they omit two important additional elements needed for an effective oil proliferation program. First, the proposed Ex-Im Energy Development Facility would be passive in that it would react to proposals, rather than seek out promising new oil plays. Second, such a government financing facility should enlist the support of the independent U.S. oil wildcatters, perhaps sharing both risks and rewards.

The Ex-Im Energy Development Facility proposes cofinancing with the World Bank's new energy development program. This program, as approved by the World Bank in January of 1979, projects a total investment of about $5 billion over the next 5 years, including contributions from the Bank's affiliate, the International Finance Corporation. (A detailed statement of the World Bank's program is given in the appendix.) This program is the largest governmental effort of its kind, excluding the communist countries. Its main thrust is to aid the non-OPEC developing nations, whose relative burdens of high cost oil imports have been substantially heavier than those of the developed nations. Prior to the initiation of this program, the World Bank had made investments to develop proven reserves in some of the developing countries. The new program, however, will include both exploration and production, with exploratory investments including both the initial geological and geophysical survey work as well as exploratory drilling.

The World Bank's involvement will be directly with the government of the country where oil exploration is to be carried out. That is, the Bank may initiate projects or react to proposals from the host government. The Bank will also advise the host government in its dealing with private sector participants, presumably the oil companies who will be doing the exploration work. That is, funds will be made available to the developing nation to work with a potential private oil company. But there is no incentive provision in the World Bank program to encourage private operators who lack capital and foreign experience into these developing nations where oil reserves might be developed by those who would compete with the present OPEC/Multinational Oil Company production and distribution system. In other words, only those in the established international oil industry would probably enter into these World Bank sponsored oil plays in the developing nations. There is little or no provision made for the

independent U.S. (or Canadian) wildcatter. And that's where direct U.S. Government involvement is needed—to challenge the supremacy of OPEC and the relationships which the cartel has developed with the major international oil companies.

Recommendations for U.S. Government Action

When the private sector in the U.S. cannot or will not perform a function which is clearly in the public interest, then it is an accepted practice for government to see that the job gets done. When the Soviet Union fired the Sputnik rocket into space in 1956, the U.S. Government quickly reacted to what was perceived as a potential threat to American national security. Although further U.S. Government involvement in the private sector can often create more problems than it solves, the political and economic dimensions of our present oil problems are so far reaching that some government involvement has become necessary. The trouble is that government has never focused on the true nature of the crisis—OPEC control of world oil supplies and prices. Although government should not be encouraged to interfere in the free market system, which it in fact is doing in the domestic oil business, a stronger government role in the international oil business should be developed, because the free market no longer operates internationally due to the market control exercised by the OPEC cartel. Federal Government financing of foreign oil exploration would in fact help to bring about a more competitive market in the international oil trade by providing alternative sources to OPEC production.

A federally financed program of wildcat exploration in non-OPEC developing countries is, therefore, required. Government funds should complement private sector capital, and the Government should be entitled to its share of those benefits which normally accrue to those who bear the front-end risk. The Japanese, for example, have financed oil exploration in many parts of the world through a wholly owned government corporation, the Japanese Petroleum Development Company. This company operates worldwide and is largely a financial entity whose role is to enter joint ventures with operating oil companies. The Japanese provide a portion of the exploratory funds, will help in securing development loans should oil be discovered, and in some cases exercise a certain influence over royalty and tax terms with host governments. In return, the Japanese get first call on any oil which may be produced, as well as the usual financial returns. Many other industrial countries maintain actual operating oil companies which engage in the search for oil on a worldwide basis. Only the U.S. Government has virtually no effort in this area.

The first principle of Federal financing of oil exploration in the developing nations should be to enter the planning process at an early phase. An agency of government should be established to keep an inventory of new exploration possibilities, a flow of information on both geological and political developments in these areas, and a financing capability to enter into joint ventures with private sector capital sources which might have an interest in starting an oil exploration program. In fact, this agency should publicize its information and financing capabilities to the oil industry and to existing financial institutions, so that a flow of proposals into the agency will be established. A second principle should be to share the risk of private capital

during the exploration phase. A flexible policy on the proportion financed by the government on any particular deal should be followed, but some operating guidelines on the total portfolio of exploration loans could be established. For example, a rule that the Government share on the totality of its financing should not exceed 50 percent of the private sector capital might be a reasonable way to start. In addition, portfolio diversification in terms of geology, geography, and political risk would be important and businesslike operating criteria. A third principle should be to finance only independent oil operators, or at least those who have only limited involvement with OPEC oil sources. Some discretion in this regard would have to be given to the administrator of the proposed agency, but the clear intent of the enterprise should be to encourage a greater diversity of worldwide oil supplies than exists at present.

The initial capital of this government fund would have to be in the range of a billion dollars, if the effort is going to have any substantial effect on the direction of worldwide oil exploration. Worldwide exploration expenditures outside of the United States and Canada, the Communist bloc, and the OPEC countries, are probably no more than $2 billion annually, so that if the proposed government agency were to spend $200 million per year over 5 years, it would amount to around 10 percent of existing expenditure in those areas. But this 10 percent could make a difference! First of all, if the 50 percent rule proposed were adhered to, then the billion dollars of government financing would be coupled with another billion dollars of private sector funds. Thus $400 million per year might be expended in this type of exploratory effort over a 5 year period. This could involve as few as 2–3 new deals per year to as many as 20, depending on sizes of the potential ventures. To the extent that $200 million invested in wildcat exploration might eventually identify 1 billion barrels of new oil reserves, the expenditure of $2 billion over a 5 year period could ultimately yield 10 billion barrels of new oil reserves. Using a 15-year producing life, this could mean adding 2 MMB/D of production to world supplies, or about 4 percent of the non-Communist world's current consumption.

These figures deliberately exclude development funds, which could run four to five times the exploration expenditures. Nevertheless, the estimated costs for conventional exploration and development are typically far lower than the costs of developing synthetic supplies (oil shale or coal based oil or gas). Even in the smallest fields of the North Sea, probably the most expensive conventional oil to date, exploration and development costs never ran more than $6 to $7 per barrel, which is only 25 to 30 percent of the estimated costs of these synthetics. In the relatively more hospitable climates of the developing nations, per barrel costs would probably run far lower than those in the North Sea. Thus, the broad proposition makes sense financially.

The policy also makes sense economically, if our goal is to limit future upward pressures on international oil prices. While $1 billion seems like a lot of money, the cost to the U.S. economy of a $1 per barrel increase in OPEC prices is a $3 billion loss of direct consumer purchasing power, plus 2 to 3 times that much in indirect ripple effects. And the costs to the world economy are three times as great as to the U.S. economy! As a result, I believe that such Federal Government investment would yield the highest and most rapid return of any new supply proposal now being considered in the energy field.

Possible Criticisms

Politically, such a program of Federal Government financing of oil exploration in non-OPEC developing countries raises a number of serious criticisms. The first objection will come from the U.S. taxpayer who can legitimately ask whether his tax dollars are not better spent in the United States and by the private sector. The fact, is, however, that the United States exploratory effort is at an all-time high (despite environmentally motivated delays). Financial incentives for new oil in the United States are the highest in the world and the political risk to the oil operator is the lowest in the world. The problem is that the geological potential in the United States is probably not sufficient in itself to ultimately yield enough oil to challenge OPEC's dominance over world oil supplies. If the dilution of the cartel's price setting powers is a worthy goal of national energy policy, then restriction of Federal Government energy investments to the United States alone only impedes the achievement of that goal. The United States has a substantial number of independent oil operators who have the technical knowledge and experience to find oil anywhere in the world.

These men also have the risk-taking penchant which made the oil and gas industry the dominant energy source which it is today. What they lack is the capital to venture overseas in a major way. U.S. Government financial and diplomatic assistance would be a powerful vehicle to unleash that capability.

Another objection to this proposal will come from those in private industry or academia who will argue that the Federal bureaucracy would be incapable of operating such a financing agency. That criticism is not without some merit, largely because Federal conflict-of-interest rules are so rigid that experienced oil men and bankers could be barred from working for this agency. Nevertheless, a separate corporation could be established, analogous to Comsat which could take responsibility for their program. Being less political than a specific branch of government, this new Federal Oil Financing Corporation could enlist the type of experienced people who would be needed. Regardless of where the agency were housed, however, it would have to utilize a substantial amount of private sector skills in assessing particular ventures and thereby prevent needless growth in personnel and redtape. The U.S. Government should be able to find individuals with the skills and experience to successfully administer such an agency.

A final criticism of this proposal could come from the foreign policy establishment itself. They may argue that such a program would complicate our diplomatic relations with the developing countries where some of the money would be invested, with OPEC governments who might have a natural suspicion of our motives, and with our oil consuming country allies who might want to purchase the oil. All of these complications would arise only if substantial amounts of new oil were in fact discovered. And that is precisely the "bridge we should be prepared to cross." That is, we should welcome these potential complications, because it would mean that other governments would be recognizing the increased leverage which the United States would have gained in international oil negotiations.

Recommendations

Smaller U.S. oil companies, with little or no experience overseas and without the capital to wait out the political delays, might be convinced to venture overseas if a serious government commitment of both money and diplomatic influence, were forthcoming.

An initial survey of independent U.S. oil men should be conducted, preferably on a confidential, discreet basis, to ascertain their interest. Although independent oil men are generally conservative politically, their recognition of the gravity of the problems and their expertise in oil exploration might convince some of them to support such a program. Besides, the inherent financial opportunities which such a program would present to these people should be the overriding element.

To be specific, I would recommend that a tentative description of the financing plan be developed, along the following lines:

Role of Government Financing Facility

To accumulate geological and geophysical data; to maintain expert staff in the areas of geology, reservoir engineering, and financial evaluation; to develop contacts in the international oil exploration business, both in the private and public sectors.

To maintain and publicize a flow of relevant information concerning oil prospects, oil operators, oil drilling contractors, bankers, and government officials.

To finance jointly with U.S. oil firms exploration efforts in non-OPEC developing nations. Only independent U.S. operators could qualify; those companies with more than 20 percent of their world production in OPEC countries would not qualify.

If oil is discovered, the U.S. Government would receive its proportionate share jointly with the private oil operator. The U.S. Government could sell its oil or import it directly for storage in the Strategic Petroleum Reserve.

Once such a description is finalized, a survey questionnaire should be developed to obtain advice from independent oil men as to the best approach for organizing, staffing, and financing such a facility. A number of trade groups and professional associations might be interested in providing such advice. In addition, it is recommended that several outstanding industry leaders be brought into the planning at an early phase, perhaps serving on a Presidential Advisory Board.

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APPENDIX

A Program To Accelerate Petroleum Production in the Developing Countries [1]

SECTION IV. PROPOSALS FOR EXPANDED ASSISTANCE IN ENERGY DEVELOPMENT

69. The recent experience of the Bank in energy development, particularly in the new fields of oil and gas production, points to a clear need for more assistance to the developing countries, especially those that are net importers of oil, the main energy fuel.

70. Forty-eight of the 74 developing countries which import oil depend on it for at least 90 percent of their commercial energy requirements; only four (India, Korea, Pakistan and Zambia) are less than 50 percent dependent on oil owing to the extensive use of coal, natural gas or hydro-electric power. The oil deficit of these countries as a group is now thought to be larger than was estimated in 1977. Although oil production has increased, consumption is increasing more rapidly owing to a faster rate of growth than was foreseen at that time. Many developing countries are passing into the energy intensive phase which the developed countries experienced during their rapid industrialization and urban growth. However, unless their energy deficit can be narrowed by exploiting indigenous sources of energy more fully, scarce foreign exchange will have to be diverted to imports, which would reduce the growth rate of which the countries are capable.

71. This concluding Section reviews the areas of activity that can lead to greater energy production, and proposes an expanded program of assistance by the Bank.

National Energy Planning

72. Under the new conditions of the supply and price of energy, developing as well as developed countries need coherent policies to address national energy needs and an appropriate strategy to implement them. The importance of helping the oil importing developing countries at this general level has been stressed throughout the paper. The various elements of an energy program have to be pulled together and fitted into the totality of the government's economic and financial plans. Assistance is needed in many cases to create, or reorganize and strengthen, an energy planning authority and to train the necessary administrative and technical staff. Assistance is also required in some countries to revise petroleum and minerals legislation, as well as official regulations and fiscal measures which affect the energy sector.

73. The elements of an energy policy include a strategy that will maximize the use of the most efficient energy sources, make more effective use of existing resources, promote conservation, increase knowledge of the country's resource potential and its development, and develop or adapt techniques for using traditional fuels more effectively. The Bank would be prepared to expand technical assistance in energy planning and lending for research and development in the more efficient use of traditional fuels. Such support would aim at improving present technology, adapting it to village conditions, reducing unit cost and expanding marketing systems. There is very large scope for disseminating existing or adapted technology more effectively. Usually such activities would be financed as components of other projects but, in larger countries, a small separate project may be warranted. As noted in para 67, the Bank is already supporting the application of solar energy technology. This too can be expanded but the focus of Bank country activities will remain on the adaptation, application and marketing of non-hydrocarbon technologies rather than on the basic research.

74. The Bank's sector and sub-sector work, which will be geared to the expanded program for energy, is intended to help member countries draw up national plans and policies that will ensure as rapid and efficient exploitation of their energy resources as possible. The present program covers only 35 of the 60 countries

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[1] Prepared by the World Bank, January 1979.

which stand in need of help. The work will be expanded as rapidly as possible to the others, and additional work will be undertaken in conutries where only some of the sub-sectors have been covered. Assistance will be given in resolving particular legal and administrative problems, and in the training of local personnel. Provision for these activities will be made in the technical assistance, engineering and production loan and credits referred to below. Where a loan or credit is not immediately in prospect, every effort will be made to find a suitable expert and a source of finance.

75. Assistance in all the areas mentioned above is available from a variety of agencies. The U.N. system, for example, offers assistance through the UNDP, the regional Economic Commissions, UNIDO, the Centre for Natural Resources, Energy and Transport, The Centre on Trans-National Corporations, and through such specialized agencies as FAO, IAEA, UNEP and WMO. Bilateral agencies, including the national oil companies of some industrialized countries, are also in a position to help and several have done so. The Bank will work with these agencies in order to draw on their experience and specialized knowledge and to avoid duplication of effort.

Pre-Development Activities

(i) Survey Work

76. The discussion in Section III emphasized the need of the Non-OPEC developing countries, particularly the oil importers, for help in exploring for petroleum. Some 54 developing countries are believed to need assistance for the survey phase (paragraph 48). Not all of them will require financial help from the Bank; some should be able to fit such activities, short of exploratory drilling, into their UNDP programs or obtain funds from other sources. Nor will a large number be ready to commission surveys and evaluations at any one time. This is particularly true of the non-producing countries, many of which do not yet have the experience or institutions to define the work that has to be done. There is nevertheless a large scope for Bank assistance. For geological and geophysical survey work, it is proposed that the Bank be prepared to make technical assistance loans and credits. As indicated in paragraph 49, the funds required are likely to range between $500,000 and $5 million per project. Starting with the countries that have the best prospects, and taking account of the Bank's own staff capacity, some 8 to 10 technical assistance loans a year could be made during the early 1980s. Given the wide range of costs involved, it is not possible to estimate precisely the funds required, but as a rough approximation Bank/IDA Energy Technical Assistance lending might be in the range $20 to $25 million a year from FY81 onwards.

(ii) Exploratory Drilling

77. The important and difficult phase of exploratory drilling, as explained in paragraphs 50–53, comes between the completion of survey work and the delineation of a petroleum deposit by appraisal drilling to the stage where it is ready for exploitation. It was suggessted in July 1977 that the Bank could help member countries and foreign collaborators to negotiate an acceptable agreement for exploration and production, if invited to do so, and confirm its willingness to consider making a loan for the eventual production facilities or related infrastructure. The first example of such an agreement is the joint venture for potential crude oil and natural gas development established under agreements signed on November 14, 1978 between the Government of Pakistan, the Pakistan Oil and Gas Development Corporation and Gulf Oil Corporation, after extensive negotiations during which the Bank was asked to review and comment on the various draft agreements. The Bank has since written to the Government of Pakistan noting the latter's intention to request Bank assistance in financing the cost of production facilities if and when a commercial discovery is made, and in arranging additional financing from other sources; and expressing out willingness to consider doing so provided the project met the usual Bank criteria. The possibility of Bank participation in other arrangements of this kind is under discussion in a number of countries.

78. The Bank's presence at this critical stage, and its agreement to consider making a loan for production facilities if an exploitable deposit is found, should contribute to a greater willingness of host countries, on the one hand, and foreign collaborators on the other to reach agreement on the terms of a contract for exploratory drilling. However, the possibility of eventual Bank participation is likely to attract foreign organizations to invest risk capital in exploration only in a relatively few countries which are deemed to have particularly good prospects for producing an exportable surplus of petroleum. In the majority of OIDCs it

seems necessary for the host country itself to take all or part of the risk of exploration, and it is proposed therefore that the Bank help such countries to do so.

79. While investing in petroleum exploration is inherently riskier than in conventional Bank projects, the enhanced prospects for the economical development of petroleum resources in developing countries, together with measures that can be taken to minimize the technical risks, should make it prudent for OIDC's to borrow from the Bank for exploratory drilling in appropriate cases. Measures to reduce the technical risks would include ensuring that high quality geological and geophysical surveys had been undertaken in all cases, including a probability analysis, in financial and technical terms, of the risks and benefits, and had revealed favorable prospects for the discovery of petroleum in commercial quantities. Exploratory drilling would be carried out in stages and in limited areas, with a careful review of the findings at each stage before proceeding to the next or, if the results are clearly unpromising, terminating the exploration program (and canceling the balance of the Bank loan or credit). The best available technical expertise would be provided to the borrowers to assess the results of the surveys and exploratory drilling.

80. The relationship between the borrowing country, its national oil company (if any), foreign organizations in particular cases and the Bank could take a variety of forms. Some countries with a well-established national oil company may be able to carry out an exploratory program on their own, under a Bank loan. Countries which lack the experience to do exploratory work themselves would be encouraged to enter into a contract with an interested foreign private or state-owned company and assisted in obtaining fair terms under an appropriate type of petroleum exploration and production agreement. The Bank would make a loan or credit to the government to cover its share of the costs of exploration. In countries that have an experienced national oil company, the Bank would make a loan or credit to the company for exploration which the latter could carry out either by itself or in association with a foreign partner.

81. Such an arrangement, under which the risk would be shared with the host country, assisted by a Bank loan or credit, is likely to attract foreign investors to invest capital for exploration in a wider range of countries. However, there may well be countries in which even this arrangement would be an insufficient inducement to foreign investors because of the small size of the petroleum reserves or for other reasons. In these cases exploratory work would have to be carried out by exploration companies under service contract arrangements which the Bank would finance through a loan or credit to the government.

82. A number of member governments have indicated informally that they would be interested in taking Bank loans for petroleum exploration under the type of arrangements described above. Bank loans and credits for exploration would be made on the same terms as engineering loans and credits, namely 10 years of repayment with a suitable grace period, and like them would be re-financed from a subsequent loan or credit for production facilities. However, although exploration loans and credits would be made only in cases where survey work indicated that there are reasonable chances of success, there would be less assurance than in other sectors that a project loan would follow. To reduce the annual repayment burden, provision would be made in the loan agreement to extend the term of the loan to the normal limit for the country in the event that the exploratory drilling did not lead to a project suitable for Bank financing before the expiry of the grace period. A similar arrangement would be made in IDA credits for exploration.

83. In para 50 it was noted that the costs of a major drilling program are in the range $10 to $50 million; and there may be more than one program in a country. In the case of loans (credits) to national oil companies, or where the loan financed the costs of a service contract, the Bank loan would cover an appropriate share of the entire cost, depending on the circumstances of the country. In countries that entered into an agreement with a foreign collaborator under which the latter shared in the financing, the Bank loan (credit) would cover no more than half the foreign exchange cost. It is very difficult at this stage to forecast the demand for Bank financing of exploratory drilling and therefore to estimate the amount of lending for this purpose. In the early 1980's the program might contain 8 to 10 such loans and credits a year.

Project Preparation

84. Full use would be made of engineering loans and credits, and the Project Preparation Facility, to ensure that borrowers are given adequate help in preparing production projects for financing. Engineering loans (credits) would be used to finance appraisal drilling for oil and natural gas and activities required to establish

the economic value of coal and lignite deposits. For oil and gas, appraisal drilling can cost up to $25 million per program, and engineering loans (credits) for projects of that size may be needed in some cases. For coal and lignite, the requirement is much lower, about $2–$3 million unless transportation engineering is also needed. The terms of engineering loans and credits would be standard, namely 10 years of repayment with an appropriate period of grace, and would be refinanced from the eventual loan (credit) for production facilities. Most such projects are likely to require the financing of appraisal drilling by the Bank, so that the number of engineering loans and credits would be about as large as the number of production projects in the program, which could reach 12 to 15 a year by FY83.

Production Investment

85. Estimates were made in July 1977 of the investment requirements of the OIDCs for exploration, production and downstream activities in oil, gas and coal. Revised calculations for oil and gas have been made which are shown in Table 8. The new estimates are that the annual investment requirements of the non-OPEC developing countries for petroleum and gas are about $6.8 billion (in 1977 dollars) of which a little less than 20 percent is for natural gas and the rest for oil. The annual investment requirements of the OIDCs are nearly $4 billion.

TABLE 8.—INVESTMENT IN OIL AND GAS BY NON-OPEC DEVELOPING COUNTRIES: ESTIMATED ANNUAL REQUIREMENTS, 1976–85

[In millions of 1977 U.S. dollars]

	Annual average	
	Oil [1]	Gas [2]
Developing countries with per capita incomes in 1976 of:		
$1,051 and above:		
Net oil exporters	1,000	450
Net oil importers	1,575	225
Subtotal	2,575	675
$626 to $1,050:		
Net oil exporters	200	152
Net oil importers	750	100
Subtotal	950	252
$251 to $625:		
Net oil exporters	930	50
Net oil importers	420	100
Subtotal	1,350	150
Below $250:		
Net oil exporters	100	10
Net oil importers	650	138
Subtotal	750	148
Subtotal, net oil exporters	2,230	662
Subtotal, net oil importers	3,395	563
Grand total	5,625	1,225

[1] Includes investment requirements in oil and gas exploration, development of oil, production of oil and associated gas, and crude oil pipelines in all non-OPEC developing countries. The exploration stage is assumed to account for 25 to 30 percent of total investment requirements in the upstream phase. The relative costs of the various exploration activities are approximately 5 to 10 percent for geological surveys, 15 to 30 percent for geophysical prospecting and 60 to 75 percent for drilling.

[2] Refers only to investment in development of nonassociated gas and gas pipelines: excludes investment in liquified natural gas (LNG) projects except in Malaysia.

Note: Investment requirements for oil relate to the projected output in the non-OPEC developing countries of 8.40 m bdoe (of which 2.85 m bdoe in OIDC's) by 1985 (see table 1 and par. 10). They are not comparable with the estimates made in July 1977 because: (a) they are expressed in 1977 rather than 1975 dollars; (b) they cover only upstream investment (including crude oil pipelines); (c) the real costs of petroleum development are now estimated to be significantly higher; and (d) the earlier estimates were related to a level of output that was considered feasible if maximum efforts were made.

Source: World Bank Staff Working Paper 289, April 1978 (per capita income limits are expressed in 1976 dollars).

86. It is proposed to step up the work of preparing oil and gas projects so as to increase the number of loans for petroleum projects to 10 to 12 per year. Work on coal/lignite projects will permit 2 to 4 loans to be considered by the Board annually during the years FY80 to 83. Thus the total program for fuel mineral production by the early 1980s would include 12 to 16 projects. To this must be added the proposed lending for pre-production activities, including survey work, exploratory and appraisal drilling, and preliminary engineering. The lending amounts can be estimated only approximately at this stage, since the size of the projects may vary considerably. Allowing for price increases, the program could reach about $1,500 million (current dollars) by FY83. As a proportion of Bank/IDA lending, lending for fuel mineral development would increase from about 5–6 percent (present program) to 10–11 percent in FY83.

87. For the period FY79–83, IFC is planning investments of about $130 million in energy. This represents about 5 percent of the total IFC program for the period. The cost of the projects so financed would be in the range $650–$750 million, or $130–$150 million a year. IFC's program is in addition to the expanded Bank/IDA program described above.

Contribution of Bank Financing to Oil and Gas Development

88. The proposed Bank lending program, rising to $1,500 m. (current dollars) five years from now would include $1,230 m. for oil and gas projects. About 60 percent of the lending would be for production facilities and would cover up to 20 percent of the total cost. The balance would be for pre-production activities, contributing a larger share of the costs, perhaps two-thirds on average. The total cost of the projects assisted by the Bank in FY83 would be in excess of $4 billion. Bank financed projects for oil and gas development would thus represent a substantial share of the up-stream investment requirements of the Non-OPEC developing countries in the sector.[2]

Summary of Expanded Program

89. The Bank Group can help the OIDCs to find and exploit their indigenous energy resources more effectively by expanding its program of operations and technical assistance. The following is a summary of the proposals for increased Bank Group activities in the energy sector:

(i) National Energy Planning

Some 60 OIDCs need help in devising national plans and policies for the sector, and in creating or strengthening a national energy authority. The Bank's present program of sector and sub-sector work for 35 of these countries will be extended during the next five years to cover the remainder. Help will also be given to resolve particular legal, technical and administrative problems and in training local personnel. Financing of experts will be provided in technical assistance, engineering and production loans and credits and if necessary in the Bank's administrative budget.

(ii) Pre-Development

(a) *Survey Work.* Fifty-four countries need assistance in evaluating and updating data from earlier surveys or in commissioning new surveys. Where assistance is not available from another source, the Bank would finance such surveys with technical assistance loans or credits. Costs would range between $0.5 and $5 million per case, and the total is tentatively put at $20 to $25 million a year, from FY81, covering 8 to 10 operations. The terms of energy technical assistance loans/credits would be standard, namely 10 years, including an appropriate period of grace.

(b) *Exploratory Drilling.* The Bank is willing to help and advise member governments and foreign collaborators in concluding agreements for petroleum exploration and production; and to confirm its willingness to finance the eventual production facilities, provided the project meets its usual criteria. One such arrangement has already been concluded and others are under consideration. The

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[2] See Table 8. The total investment requirement of $6,850 m. a year in 1977 prices would be equal to $9,660 m. in 1983 prices using the Bank's commitment deflator. A tentative estimate of the total cost of Bank financed activities in FY83 is $4,200 million or 43 percent of the latter figure. However, total investment should rise considerably as a result of the Bank's assistance.

Bank would consider making loans (credits) to OIDC member governments to cover the latter's share of exploration costs undertaken in association with a foreign private or state-owned company. In countries where foreign investors are unwilling to invest capital in petroleum exploration, the Bank would make a loan or credit to cover the costs of exploration done by an exploration company under a service contract. Exploration loans would be for 10 years, with a suitable grace period, and would be re-financed from a subsequent loan for production. If a production loan was not made within the grace period, the exploration loan would be extended to the normal limit for the country. A similar arrangement would be made for exploration credits.

(c) *Project Preparation.* Engineering loans and credits would be made to finance pre-appraisal drilling for fuel mineral projects; and the PPF would also be used to finance preparatory work within the normal limits. The terms of engineering loans would be standard and would be subject to re-financing from any eventual loan for production.

(iii) Lending for Fuel Mineral Production

An expanded program of lending is proposed, rising to 12 to 16 operations in FY83, of which 10 to 12 would be for oil and gas, and 2 to 4 for coal and lignite. Depending on the extent to which Bank assistance increases up-stream investment in the oil and gas sector of the NODCs above the level assumed in Table 8, Bank financed activities in FY83 would represent one-third to two-fifths of such investment.

The program outlined above would be revised annually, based on the Bank's evolving experience in the sector.

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