# REVIEW OF TECHNOLOGY TRANSFER TO THE ORGANIZATION OF PETROLEUM EXPORTING COUNTRIES

## SPECIAL OVERSIGHT REPORT NO. 4

SUBCOMMITTEE ON
DOMESTIC AND INTERNATIONAL
SCIENTIFIC PLANNING AND ANALYSIS

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
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# LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
*Washington, D.C., November 26, 1976*

Hon. OLIN E. TEAGUE,
*Chairman, Committee on Science and Technology,*
*House of Representatives, Washington, D.C.*

DEAR MR. CHAIRMAN: I am glad to submit to you our Subcommittee's Special Oversight Report "Review of Technology Transfer to the Organization of Petroleum Exporting Countries."

The United States has come to rely on the import of petroleum from the O.P.E.C. countries for an increasing share of our total energy needs. As imports have increased, and as the price of these imports have also increased, we have sought to "recycle" the dollars flowing abroad by increasing our transfer of American science and technology to these countries. Our hearings on this subject sought to establish the facts about the trends in type and volume of this technology transfer and to develop an assessment of the possible long-term impact of these activities. Our report makes a number of specific recommendations about American policy in this field.

In the preparation of this report, our Subcommittee had the assistance of Ms. Claire R. Geier, Analyst in Science and Technology, Congressional Research Service, the Library of Congress. Ms. Geier prepared the Summary and Analysis of the hearings.

I commend this report to your attention, to the attention of the Members of the Committee on Science and Technology, and to the Members of the House.

Sincerely yours,

RAY THORNTON, *Chairman,*
*Subcommittee on Domestic and*
*International Scientific Planning and Analysis.*

## SPECIAL OVERSIGHT

Research and development is conducted throughout the Federal Government. Most agencies and departments support research and development to further advances in those fields of science and technology which are related to their mission.

In the House of Representatives these research and development activities are reviewed individually by a number of standing Committees having jurisdiction of the various programs, agencies, and departments. Beginning with the 94th Congress, the rules of the House provide that a continuing review of the entire Federal research and development effort be done. For this purpose the Committee on Science and Technology is charged with the function of Special Oversight in this area. Rule X, paragraph 3(f) provides that "The Committee on Science and Technology shall have the function of reviewing and studying, on a continuing basis, all laws, programs, and Government activities dealing with or involving non-military research and development." This Special Oversight function is to be performed in addition to the legislative and direct oversight function of the standing committees.

The review and the recommendations included in this report are made pursuant to this Special Oversight provision of the House rules.

# RECOMMENDATIONS

The Special Oversight hearings [1] covered by this report were held for the purpose of reviewing the scope and impact of United States science and technology transfer activities to the O.P.E.C. countries. The hearings sought to obtain information about both government-to-government cooperation activities as well as activities involving the private sector in the United States.

The Subcommittee, having reviewed the testimony received in public hearings and the information developed in the background report [2] prepared by the Library of Congress, makes the following recommendations regarding American policy for technology transfer to the rapidly developing, resource-rich nations:

## RECOMMENDATION 1

### A Policy for Scientific and Technical Cooperation with the Rapidly Developing, Resource-Rich Nations Is Needed and Should Be Developed

The transfer of technology and the provision of scientific and technical assistance from the United States to countries with large amounts of natural resources such as petroleum, natural gas, metals, and other raw materials can benefit both the United States and the receiving country. Particularly where the United States buys large quantities of raw materials from a country, sales of technology and provision of scientific and technical assistance can help maintain a balance of payments while assisting the other country in meeting its own goals of rapid industrialization and strengthened agricultural production. Such cooperation can also serve to promote regional development, stability, and peace. The United States has long had a policy for providing technical assistance to the less-developed countries, but no comparable policy exists for those countries that "graduate" from such aid when they achieve a degree of self-sufficiency. A comprehensive policy to govern scientific and technical cooperation with these countries and to clarify under what conditions science and technology transfer should be encouraged and discouraged is lacking and is increasingly needed.

[1] U.S. House of Representatives, Committee on Science and Technology, Ninety-Fourth Congress, No. 50, Subcommittee on Domestic and International Scientific Planning and Analysis, Special Oversight Hearing on *Technology Transfer to the Organization of Petroleum Exporting Countries*, October, 1975.

[2] U.S. House of Representatives, Committee on Science and Technology, Serial UU, Subcommittee on Domestic and International Scientific Planning and Analysis, Background Study *Technology Transfer to the Middle East O.P.E.C. Nations and Egypt, 1970-1975*, September, 1976.



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## RECOMMENDATION 2

### Technical Assistance by the United States Government to the Developing, Self-Sustaining Nations Should Be Provided on a Reimbursable Basis

Experience to date shows that the rapidly developing, self-sustaining nations who wish to receive United States technology and technical assistance for economic planning and development are prepared to pay for such assistance. This is a sound basis for providing scientific and technical assistance because it relieves the American taxpayer of the financial burden of providing such assistance and because it can serve to open the doors for private sector participation.

## RECOMMENDATION 3

### To Enable the United States to Provide Technical Assistance to the Developing Nations on a Sustained Basis, the Federal Government Should Continuously and Vigorously Enhance American Capability in Science and Technology

Given America's present scientific and technological potential and the ingenuity of its people, the only truly inexhaustible resource the United States has is probably science and technology. However, considering the rapid growth of science and technology, and the growing complexity of the relationship of this field to societal problems and needs, this resource, perhaps more than any other, can be underutilized or otherwise inadequately capitalized upon. Recent years produced evidence that there is a need for strenghtening the nation's scientific and technological effort and for giving it stronger support in accordance with serious consideration of national priorities. Unless this is accomplished, scientific and technical assistance to the developing nations could, in the long run, prove to be a process detrimental to the United States, and could fall short of providing a source for sustained growth of the developing world.

## RECOMMENDATION 4

### United States Policy Should Recognize That, Over the Long Term, All Raw Materials, Including Petroleum, Are Exhaustible, and Joint Research and Development on Alternative Materials and Energy Resources Should be Encouraged

Petroleum will continue, until the end of the century, to be an important energy and raw material source, but it must be recognized, as some producing and consumer countries have already done, that over the long term petroleum is too precious to burn as a fuel. Both the United States and the

resource-rich nations, therefore, have a common, long-term interest in reducing their economic dependence on crude oil. The optimum use of these resources and the avoidance of less than optimum use, such as the present flaring of natural gas in some of the producing countries, must be avoided, and cooperative research and development on alternate energy sources and materials and their conservation encouraged.

## RECOMMENDATION 5

### With a Few Exceptions, Such as Sensitive Military and Nuclear Technologies, the United States Should Be Prepared To Provide a Broad Range of Training, Technology, and Know-How to the Resource-Rich, Developing Nations

Competition to provide technology to the resource-rich, developing nations is strong. Countries in Western and Eastern Europe, the Western hemisphere, and the Far East are actively seeking recipients for technology of all types. Transfer of technology in the broadest sense includes: technical training; management training; the use of statistical methods; agricultural technology including irrigation, expanded protein (red meat) production, and food science and technology; road development; ships and port facilities for petroleum, agricultural products, and industrial equipment; telecommunications; building construction; desalination; petroleum technology; solar energy technology; and computers. The receiving countries are aiming at some measure of self-sufficiency in food, consumer goods, and basic industrial products, and their ability to absorb advanced technology will gradually increase. Fears of future competition appear to have limited justification when the expanding markets and the continuing United States advances in science and technology are taken into consideration.

## RECOMMENDATION 6

### Bilateral Agreements To Provide for the Building of Scientific Institutions for Advanced Education and Academic Research Should Be Encouraged

A strong base of scientific institutions will serve the rapidly developing countries well over the long term. It will afford a place to teach and do research for nationals of the country and others, and thus contribute to a reversal of the "Brain Drain". If these institutions are built on the example and traditions of Western universities and research institutions, they will serve to increase cooperation with Western scientists and other professionals.

## RECOMMENDATION 7

### Individual Federal Agencies Should Be Encouraged To Respond to Requests for Reimbursable Assistance

Requests by the rapidly developing nations for scientific and technical assistance offer opportunities to advance the national objectives of the United States. The Federal agencies can help identify qualified talent, suggest commercial opportunities, and assist in many other ways. The Governments of other countries, such as Japan, France, and West Germany, perform an active role in this field, and the United States Federal agencies should, within the limits of the existing law, do the same.

## RECOMMENDATION 8

### A Lead Agency Should Be Designated With Responsibility For Reimbursable Scientific and Technical Assistance To The Rapidly Developing, Self-Sustaining Nations, and Coordination Between United States Federal Agencies Should Be Improved

There exists no focal point in the Federal Government which can provide an overview of technology transfer activity and insure consistency with the policies of the United States with regard to the transfer of science and technology to the resource-rich, rapidly developing countries. Numerous offices of the Federal Government have assumed various responsibilities for parts of these activities as immediate needs arose. The designation of a lead agency, with responsibility for both Federal activities and for assisting U.S. private enterprise, would substantially improve the ability of the United States Government to provide scientific and technical assistance and strengthen over-all policy implementation in this area. It should be kept in mind that the gains to the United States from the establishment of good relations with these countries can be substantial, while failures can injure the United States interests and slow down the producer-consumer dialogue. The Agency for International Development which now has responsibility for so-called concessional (non-reimbursed) assistance does not appear well-suited to this task because the focus on its present mission of providing no-cost, frequently labor intensive technology rather than capital-intensive, high-and medium level kinds of technology and because the resistance of some resource-rich nations to deal with it.

## RECOMMENDATION 9

### A Better Effort Should Be Made To Monitor and Analyze the Kinds of Technology Transfer Taking Place To the Resource-Rich Nations So That Long-Term Trends and Implications Can Be Established

For Western and other nations friendly to the United States, much of the technology transferred from the private sector occurs under a general license which requires no special permits or registration. By the nature of the private sector, with its competitive nature and proprietary information, specific information on exported technology is difficult to secure. Similarly, limited information is available about technology transfers by the U.S. and other governments. Various arms of the Federal Government maintain an awareness of the level of activity and the nature of technology being transferred, but factual data is required for accurate long-range planning and analysis. Such data is not now available.

## RECOMMENDATION 10

### Scientific and Technological Assistance To the Rapidly Developing Nations Should Be Initiated and Periodically Evaluated on the Basis of Practicability, Host Country Commitment, Significance of the Effort, and United States National Interests

Individual scientific and technological assistance projects should be carefully evaluated both before they are initiated and on a periodic basis as they proceed. The criteria of practicability, commitment to the project by the host country, significance of the project or activity, and the contribution to the furthering of the United States national interests should be broadly applied in the evaluation of all such projects.

# SUMMARY AND ANALYSIS OF HEARING

## Introduction

On October 28, 29, and 30, 1975 the Subcommittee on Domestic and International Scientific Planning and Analysis of the House Committee on Science and Technology held hearings on technology transfer to the Organization of Petroleum Exporting Countries, OPEC.

The OPEC organization includes 13 members: Abu Dhabi, Algeria, Ecuador, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia and Venezuela. Over the past five years and especially in the last two years, these nations have been catapulted into a subject of Congressional concern because of their control of oil reserves on which this nation depends. They now have the unusual distinction of being both underdeveloped and rich.

The United States has the technology which the OPEC nations need to industrialize and they have the money to pay for the technology, the know-how, and the services. At the same time the United States can regain some of its petrodollars through the transfer of technology to these countries and to other Less Developed Countries (LDC) where petrodollars might be invested through grants, loans or direct investment. In his opening remarks, Chairman Ray Thornton commented:

> "It has been estimated that these countries control up to 80 percent of the world's proven oil reserves. As the OPEC nations recycle their oil profits to diversify their petroleum-based economies through industrialization, new concentrations of technology transfer are underway. The OPEC nations have the opportunity to compress the industrialization process to perhaps a decade from the usual century which is often required. In this respect, the technology being transferred to the OPEC nations is a unique situation, which may not be repeated in the future. [p. 1][1]

The hearings concentrated on Iran and Saudi Arabia since these are the two countries with which the United States has established Joint Commissions for economic development. If more agreements are established in the future with other OPEC countries, however, the issues and conditions would probably be similar to those noted at these hearings.

The subjects considered at the hearings included:

"(1) What science and technology agreements exist between the United States and the OPEC member nations?

"(2) What is the magnitude and kind of competition from other industrial nations?

"(3) What is the level of dialogue between the science and technology offices of the Federal government involved in international matters and between the Government and American industry?

[1] Numbers in brackets indicate location in printed hearings report.

"(4) Is the Federal Government studying the long-range impacts on the receiver and the supplier of technology?

"(5) What is the ability of the OPEC countries to absorb technology?" [p. 2].

Overall the Subcommittee was interested in establishing the long and short range impacts of U.S.–OPEC technology transfer.

The following is a summary of the major issues raised during the hearings with the comments, interpretations and solutions presented by the witnesses. Since the area of technology transfer to the OPEC nations is relatively new, the testimony emphasized organizational developments to date and the problems and prospects encountered at this stage of relations. It is interesting that the subject area is so new that a review of current periodicals revealed a dearth of information on the concept of technology transfer to these nations. Thus, the witnesses had little previous information or studies on which to rely. The Subcommittee hopes to develop the subject of these hearings in greater depth at a later date.

## Overview

The United States has many reasons for taking an interest in technology transfer to the OPEC countries. First, it hopes to regain some of its excess petrodollars through the sale of technical goods and expertise. Second, it hopes to foster peace and stability in the Middle East by helping these countries develop the infrastructure necessary to industrialization. Third, by transferring technology to OPEC countries the U.S. may be able to assist other developing countries through capital from OPEC and our own technical expertise.

The immediate concern of those U.S. agencies directly involved is planning the development of an infrastructure in anticipation of greater technology transfer in the future. Federal agency involvement in lending assistance and expertise to both Saudi Arabia and Iran (as well as ongoing cooperative agreements with several other developed and developing nations) is now at a level that cannot expand much further. The U.S. Federal agencies are primarily responsible for domestic research and development and do not have adequate staff and funding to carry on the work of the Joint Commissions. Greater involvement was suggested for the private sector while insuring a means for monitoring their activities. Efforts currently underway are diffuse, involving the Department of State, the Agency for International Development (AID), the National Science Foundation, the Departments of Agriculture, Treasury and Commerce, and in each case funds for such efforts as well as personnel are drawn from other parts of the budget. The diffusion of the Federal Government's efforts has also impeded assessment of ongoing research and development efforts.

The Joint Commissions with both Saudi Arabia and Iran appear to have been effective in bringing government experts together to discuss priorities, resources, and levels of effort with regard to their individual countries. The Joint Commissions also have responsibility to encourage private activity in approved areas; but at present there is no monitoring of private activity and the extent and nature of private involvement are not clear. Since they operate on a govern-

ment to government level, they have potential for encouraging greater growth and significant research and development. As an example of current efforts to date, the U.S.-Saudi Arabian Joint Commission on Economic Cooperation requested the National Science Foundation to undertake a survey of the requirements for an effective science and technology base in Saudi Arabia. The findings of the survey, which are detailed later in this discussion, illustrate this agency's activity in determining the level of knowledge, current and future needs and other requirements for creating a scientific and technical infrastructure in an underdeveloped society.

In view of the present dispersion of effort in reimbursable technical assistance among several organizations, some witnesses underscored the need for a central focus for reporting, assessing, and insuring adequate funding and for maintaining a balance in the transfers. Given the relatively low, but growing, level of current effort, this could be undertaken with present structures or could be handled by a separate agency or office created for such a purpose.

Economic risks such as threats to U.S. labor or the possibility of OPEC turning into another Japan seem unlikely at least for the next several decades. Although testimony indicated this could be a future possibility, most witnesses felt that the U.S. could protect itself by pricing its technology high enough to insure an adequate return of money for its own research and development investment. It was suggested that in this way the U.S. could always remain several steps ahead of potential competitors by maintaining a continually high level of technological development, but specific mechanisms for implementing this approach were not elaborated upon.

Security risks at this point seem minimal because of the current low level nature of transfers. Although it would be unwise to transfer high level technology for security reasons alone, it would also be counterproductive because the OPEC countries do not yet have the ability to absorb high technology. One witness suggested that the U.S. introduce high technology concepts without relinquishing all hardware through the sales of frameworks and services, e.g. computers. This would be especially useful for collecting and disseminating information and developing management skills.

Finally, it was suggested that if the United States does not sell technology to the OPEC countries some one else will. If the U.S. is selective in the types of technology it transfers, bearing in mind the level of resources and current needs of both nations, it should be able to be instrumental in assisting in the technological advance of the OPEC nations as well as regaining some of its petrodollars. The question arises, however, whether such selectivity is possible at present, given the dispersion of responsibility through several agencies and the lack of a central coordinating mechanism in this area.

## Analysis of Hearing

### DEFINITION

Technology transfer, including specifically reimbursable technical assistance which was of interest in these hearings, can be defined narrowly as the transfer of advanced technology or broadly as the transfer of any components of advanced technology. The latter definition

includes the exchange of hardware and software, information, advisory teams and manpower.

Dr. Oswald Ganley of the Department of State, defined technology transfer as:

> ". . . transactions and interactions resulting in an improved technological capability of the transferee in return for value (monetary or non-monetary) to the transferor. It is a flexible term, the precise meaning of which is related to the specific context in which it is being used. Its subject matter may include such things as systems, hardware-materials, software-information, training, management, and others. The term does not include the mere sale of consumer products." [p. 5].

### U.S. INTEREST IN TECHNOLOGY TRANSFER TO OPEC

The United States has a number of reasons for wishing to transfer technology to the OPEC countries. These countries are wealthy but not highly developed. They are, therefore, in an unusual position of being able to expedite their own industrialization by buying advanced technology and services. Since the U.S. purchases a substantial amount of oil from the OPEC countries they have acquired a significant amount of U.S. petrodollars. One way of regaining some of these petrodollars is through the sale of technology to those OPEC countries that have decided to industrialize. A second reason for U.S. interest in technology transfer to OPEC is the promotion of stability in the Middle East. Most of the witnesses agreed that the industrialization of the OPEC nations would contribute to stability and peace in the Middle East. Finally, another reason for U.S.–OPEC technology transfer is the expectation that the OPEC countries may invest their capital and U.S. expertise in other developing third world countries.

#### *Level of U.S.-OPEC Technology Transfer*

Testimony at the hearings underscored the modest level of technology transfer to OPEC now and in the foreseeable future. While the OPEC nations are in a position to pay for advanced technology, they have only recently begun to build the necessary infrastructure for using such technology. Thus, current efforts are primarily of an informational and educational type intended to lay the groundwork for a scientific and technical base. Dr. Ganley commented that ". . . one of our early goals is to improve and increase the infrastructure of universities, of trained manpower, and of research laboratories to make it possible for the country to increasingly absorb more sophisticated technology." [p. 17]. But, he added, ". . . at the beginning it will have to go rather slowly." [p. 17].

Currently the United States has cooperative science and technology agreements with only two OPEC countries, Iran and Saudi Arabia. In both cases, there is a need to establish a scientific and technical base as well as to create institutions for their continued growth. Dr. Robert Hughes, Assistant Director for National and International Programs of the National Science Foundation, in commenting on a needs survey conducted by the NSF for Saudi Arabia, noted ". . . at the moment we are setting up the institutional arrangements to make possible future transfers of technology. In the case of Saudi Arabia we think it will be many years before there is any large scale transfer

other than turnkey operation where plants are sold, moved in and operated for them." [p. 357].

*Means of Technology Transfer*

Dr. Victor Basiuk, a private consultant from Arlington, Virginia, stated that currently there are two mechanisms for handling technology transfer with OPEC. Either the Special Technical Services (STS) division in the Agency for International Development (AID), or the individual Joint Commissions established for scientific, technical and economic development facilitate the transfers. The latter each handle transfer in their own way in the absence of a central coordinating office. The former is ". . . the central point within the U.S. Government to assist non-AID countries in obtaining on a reimbursable basis, U.S. technical assistance where public agencies are involved." [p. 321]. Some witnesses suggested that the OPEC nations are averse to operating through the STS because of its association with AID and the implication that they are accepting charity. They prefer the Joint Commission structure because this places the cooperation on the government-to-government level and is based on reciprocity.

In the realm of private industry, the Department of State, when contacted by one of these nations, refers action to the Commerce Department Action Group for the Near East, CAGNE. These referrals are made through the national desks or through the Bureau of Oceans and International Environmental and Scientific Affairs (OES).

### THE AGENCIES AND TECHNOLOGY TRANSFER

Overall Federal agency involvement comes primarily through the Joint Commission category. When the Joint Commissions are created they are usually established through a Ministry of Economics, in one of the OPEC nations and a U.S. Department or agency which becomes the "lead agency." "The [U.S.—Iran] Joint Commission itself is chaired by the Secretary of State and the Iranian Minister of Economic Affairs and Finance." [p. 8]. According to Dr. Ganley, who acts as chairman for the U.S.—Iran Committee on Science, Technology and Education, the function of the Joint Commissions and their various committees ". . . is to define and agree on areas for mutual cooperation, to set priorities for program action, to provide a forum for policy discussions related to interests, to insure continuous facilitative high level attention in both governments to aspects of cooperation, and to coordinate, where useful, the identification of resources which can contribute to cooperative programs and assist in their application." [p. 8].

Once the Joint Commissions have been established, the lead agency can recruit other agencies to participate in their different committees. Thus, the Department of Treasury is the lead agency for the U.S.-Saudi Arabian Joint Commission on Economic Cooperation. It has requested that the National Science Foundation assume responsibility for the work under the Committee on Science and Technology. Similarly the Department of Agriculture has been active in the U.S.-Iran Joint Commission activities as well as those of the U.S.-Saudi Arabian Joint Commission.

Although this arrangement has been satisfactory for the creation and early implementation of the work of the Joint Commissions, it appears that eventually the private sector will have to absorb more of the actual work if the Joint Commissions are to be effective.

To date agency teams have been asked to assess the needs of the OPEC countries, send advisory teams, alone or to accompany technology, and staff the Joint Commission. Once the initial assessments have been made, however, and more personnel is required, the Federal agencies have to decline increased commitment. As noted in the overview, the Federal agencies are responsible for domestic research and most of them do not include line items in their budgets for international cooperation (especially in terms of particular countries). Moreover, the United States maintains Joint Commissions with countries other than Iran and Saudi Arabia and the staff drawn from the agencies is usually the same for the work of all these Joint Commissions. Dr. Ganley discussed this in his testimony:

> "For instance, in the Middle East in addition to Iran and Saudi Arabia, we also have joint commissions with Egypt, Israel, Tunisia, India, and Jordan. There are in addition 11 U.S.-USSR joint commissions. That will be a subject of further hearings by your committee I believe on 18 November. And then there is a large number of other such bodies, all of these calling for expertise from essentially the same people. Some very visible difficulties are starting to appear. The system is simply starting to become overwhelmed. In the Department of State, we believe very strongly, and many of the technical agencies fully concur with us, that these relationships are extremely important to the United States." [p. 11.]

The issue is not just overloading of agency staffs but of eventual neglect of domestic research. Dr. Ganley suggested that ". . . the Congress provide the necessary resources to permit the technical agencies to carry on this important work without having to divert monies and people from domestic research programs, which as previously stated, are so vitally necessary to provide the innovative dynamism to keep U.S. technology second to none." [p. 9.]

There are some benefits, however, to this use of Federal agency personnel as Dr. West, Administrator of the Economic Research Service in the Department of Agriculture, commented:

> "We do not send any but good people overseas. So anytime you take a good person, then you do effect domestic programs. . . . But if you look at long-term objectives, we feel that technical assistance has a high priority, particularly in these countries where the Federal Government has set some priorities above what we consider to be the development priority, that is the recycling of dollars and peace and political stability in this area. This is one reason why we do not send any but good people overseas. A person here is a cog, albeit an important cog, in a big wheel. He goes overseas and he is the wheel. That is why a good man can really accomplish a lot over there, whereas a person who is not quite that competent can do his part here but will be carried along as part of the big wheel. Now we need really capable people overseas—because they are there by themselves and everything hinges on him.

> There is also another aspect of this. The opportunity to be the wheel over there is tremendous for their training, and these people come back much more capable and with a broader experience . . ." [p. 201].

In spite of the experience gained by Federal agency personnel in working overseas, Dr. West agreed with Dr. Ganley that ". . . a real problem with us [is] in that our appropriations do not include working overseas." [p. 204]. Reimbursement, when it does not come from Saudi Arabia or Iran, for example, comes from AID, or under the authority of section 661 of the Foreign Assistance Act. But there is no central funding mechanism.

### THE NEED FOR PRIVATE INDUSTRY PARTICIPATION

To alleviate the burden for cooperation under the Joint Commissions it was suggested that private industry assume a greater responsibility for technology transfer to the OPEC countries. This would not cancel the work of the Joint Commissions but would complement it. The Joint Commissions would continue to establish initial relations in the scientific and technical sphere and would perform some initial surveys but would not have the financial burdens or demands on Federal agency personnel that it now supports. It is important, moreover, that the OPEC countries understand the limits of the government role via the Joint Commissions. Dr. West noted that it ". . . has been a little difficult to get over to these countries . . . the different role of the United States Government in development, compared with their countries where there is more government and less private participation. But in our country, the government plays a facilitating role, and most development is by the private sector". [p. 200]. Mr. Louis Bowden, Deputy for Saudi-Arabian Affairs with the Department of Treasury noted that Government expectations for the private sector role ". . . derives both from clear expressions of Congressional intent and the Foreign Assistance Act as well as strong feelings of my Secretary, Mr. Simon, as to how this kind of thing should be done." [p. 216]. Dr. West also commented that U.S. private industry has been eager to establish transactions with OPEC but has been frustrated in its business dealings in that after arrangements are made, no positive action results. A number of transactions, however, have been concluded and Dr. West submitted a list entitled "U.S. Agricultural Exports to OPEC Doubled in 1974" for the record.

The witnesses who commented on private sector activity did not necessarily imply that this sector has been inactive. The feeling was more one of not being fully aware of the extent of private sector activity. The Department of Commerce monitors transactions involving items that might be on the CoCom (Coordinating Committee for NATO) prohibitive list but does not maintain surveillance of all private transactions with OPEC. Unless private industries and companies report on their activities there is not now a way to monitor them. Chairman Thornton questioned Mr. Bowden on the need for such reporting. "While you do not have control over the transfer, do you keep records? Does the Commission make an effort to monitor the exchange of technology or is this also done by Commerce or some other institution?" [p. 217]. Mr. Bowden replied that the Joint Com-

missions monitor all government exchanges and, through Joint Commission monitors established in the recipient countries, they are well informed of private exchanges. He felt that the Joint Commissions are aware of most transactions although it is impossible to keep records on all transactions. At the request of Chairman Thornton, the Treasury Department has prepared a list of all known companies now selling technology to Saudi Arabia. [pp. 218–220].

In trying to determine how private industry initiates contact with foreign countries, Mr. Thornton asked Dr. Ganley, "Does a private company initiate a contact with a counterpart in a foreign country, or is there governmental suggestion in some way that there should be a contact? Does the importing country contact the private company with a request?" [p. 17]. Dr. Ganley replied that private companies work in all of these ways, depending on the situation. He noted the reasons why so many companies are frustrated in their dealings with members of OPEC:

> "After [initial contacts,] . . . usually rather difficult and long negotiations begin as to exactly what is expected, and many of these negotiations are not concluded. They fail for one reason or another. Success or failure frequently depends upon the specific knowledge of an individual company in the particular country. It depends upon the ease with which the recipient country deals with American companies." [p. 17].

Dr. Basiuk suggested that one method of coordinating private sector activity with OPEC would be through a separate organization, in some respects similar to the Overseas Private Investment Corporation (OPIC), which would both help the OPEC countries in planning their technological advance and assist American companies and, as needed, U.S. government agencies, in transferring appropriate technology and hardware.

### ASSESSMENT OF FEDERAL AGENCY EFFORTS

Besides suggesting a more active role for the private sector, some witnesses indicated that the efforts of Federal agencies be better coordinated to facilitate program assessment. Many Federal agencies are currently involved in the work of the Joint Commissions, including the Department of State, the National Science Foundation, and the Departments of Agriculture, Commerce, Treasury and others. In each case funds are derived from the general departmental budget and the personnel are drawn from similar pools. Because of these scattered efforts it has been difficult to assess the effectiveness of ongoing research and development. Mr. Thornton questioned Mr. Bowden about impact studies on the long-range effects of the technology transfer. He asked, "Have projects and studies been undertaken as to anticipate impacts?" [p. 215], and,

> "Have studies been made as to possible use of the technology transfer to Saudi Arabia as a replacement for aid programs to other developing nations? I am thinking particularly of your statement with regard to irrigation where you suggested that Saudi Arabia, as it was able to solve these problems, has indicated a willingness to share that problem solving capability with other nations." [p. 223].

Mr. Bowden replied that at the present there are no such studies underway. Although general studies had been made in the past he added that "I am not aware of any one who would focus particularly on Saudi Arabia because this is a relatively new field—we anticipate that the technology flow in the near term will not be all that great." [p. 215]. Mr. Conlan also questioned Dr. Hughes of the NSF about assessment of ongoing efforts, ". . . I am just wondering if you have any information for us or analysis as to whether quality of research is really significant, or is it more of a cultural interchange?" [p. 354]. More specifically he asked, "what specifically has NSF done to assess the quality and return on our investment in foreign science programs, and what is the NSF assessment of these efforts in turn, of the quality of work done? [p. 355].

According to Dr. Hughes, programs are continually under review but there is no formal methodology for assessment. Under the bilateral and Joint Commission arrangements the working groups meet periodically to study the areas in which cooperative programs or exchanges might be implemented. The programs are monitored by the working group and the parent group. Mr. Conlan's point, however, was whether anyone outside of the working groups or the Joint Commission, that is those working on the projects, does the assessment. He said "You must have someone higher up who was not involved in the funding to assess the value, someone other than the recipients?" [p. 356], Dr. Hughes replied:

> "The value of the research that goes on is assessed post facto, every time a new proposal comes in. Because when a renewal proposal comes in, one has to view the value of the specific research accomplished. I think I understand your point about management, but the value of the research is continually reviewed . . ." [p. 356]

Mr. Conlan then suggested that the NSF develop ". . . some kind of methodology for assessing just what we did get out of it [a project] from each one of those commissions so that you are then in a better position to decide which way you want to go, and what kinds of proposals coming up into your system would be advantageous." [p. 364]. Dr. Hughes agreed with this.

### THE JOINT COMMISSIONS

The primary focus of the hearings was on the two OPEC countries with which the United States has cooperative agreements, Iran and Saudi Arabia. For both of these agreements the major implementing mechanism is the Joint Commission which was discussed in detail by several witnesses. This structure has been more effective than bilateral agreement and academy to academy agreements in that they place cooperation on the government to government level. At this level there is greater room for continued growth and longevity in cooperative activities. In discussing the Joint Commission structure, Dr. Ganley noted that ". . . the recent creation of Joint Commissions . . . are establishing a more systematic framework for our long-term relationships in many fields of common interest." [p. 7]. And, Mr. Bowden commented "These joint commission arrangements are first and foremost a conscious and integral part of the United States peacemaking

efforts in the Middle East. We believe that through the economic development of the Middle East, political stability will be enhanced." [p. 212].

*The U.S.-Iran Joint Commission*

In science and technology, the primary intergovernmental mechanism under the Joint Commission is the U.S.-Iran Committee on Science, Technology and Education, co-chaired by the Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs and the Iranian Under Minister of Science and Higher Education. Under the Joint Commission there are joint committees on agriculture, economics, nuclear energy, and manpower training.

As noted above, the function of the Joint Commission and the various committees, is to define and agree on areas for mutual cooperation, to set priorities for program action, and to provide a forum for policy discussions.

Testimony indicated that Iran is more developed than Saudi Arabia with a deeper layer of trained professionals. Thus, the Joint Commission efforts have concentrated on more specific areas than on developing an infrastructure *per se*. Dr. West testified concerning the efforts in agricultural development and Dr. Ganley discussed the overall work of the U.S.-Iran Joint Commission.

One problem noted by Dr. West regarding Iran was what he called an overenthusiasm concerning the feasible speed of development. Although Iran has a number of trained people, the country lacks sufficient numbers of people trained in managerial skills. Thus programs have proceeded more slowly than originally anticipated by the Iranians. Dr. West commented: "I think they have done some good planning; but I think they did get more enthusiastic than even the huge resources which they have would allow." [p. 202]. Moreover, he noted the Iranians had exaggerated concepts of the amount of personnel and resources that the U.S. was able to invest in these efforts:

> "I think when we talked in the Agriculture Subcommitee and different people within the Ministry of Agriculture they thought that all of this was going to come from some big fund, and they would be able to hire all of these people in addition to their present budget. I think they had some rude awakening, and they had to back up and reassess several things." [p. 202].

In the agricultural sector Dr. West noted that the Iranians are buying a tremendous number of dairy cattle as well as equipment. In many cases, he said, the Iranian government is subsidizing the purchases as in the case of the dairy cattle, but most of it is going to the private sector. In such cases Dr. West indicated that there have been some problems in getting payment from Iran, a difficulty caused by a lack of management techniques more than anything else.

When questionned about this by Chairman Thornton, Dr. West replied:

> "One problem in Iran is that it is very authoritative, all the way from the Shah on down, and at whatever level one makes a decision, they do not consult with the people below. . . . Very often a decision is made but it is not communicated, and so there is someone down the line who is supposed to implement something like paying for transportation, and he may not have gotten the word." [p. 210].

He also added that, although sometimes late, the charges are being paid. Besides agriculture, projects are under discussion in fertilizer production, manpower, housing and urban development, oceanography, radio-astronomy, seismic studies, geological and mineral surveys and remote sensing applications. Dr. Ganley noted that: "In each of the S&T areas initial suggestions on U.S. interests and institutional competences have been developed, primarily by the National Science Foundation, and forwarded to the Iranian Government." [p. 7].

*The U.S.-Saudi Arabian Joint Commission*

Although there are Joint Commissions for both Iran and Saudi Arabia, it appears there has been more background study on Saudi needs. For example, at the request of the Treasury Department, the National Science Foundation conducted a needs survey for a scientific and technical base in Saudi Arabia. The U.S.-Saudi Arabian Joint Commission on Economic Cooperation was the first commission of this type with a Middle East country, formed after the United States and Saudi Arabian Government issued a Joint Statement on June 8, 1974. It was signed by the United States Secretary of State and the Saudi Arabian Second Deuputy Prime Minister and Minister of the Interior. According to Mr. Bowden, "It specified that the Joint Commission on Economic Cooperation would be co-chaired by the Secretary of the Treasury for the United States, and Minister for State for Financial Affairs and National Economy of Saudi Arabia. All services provided by the United States Government were placed on a fully reimbursable basis." [p. 213].

In attempting to respond to the particular needs of the Saudi Government, Mr. Bowden added, the Joint Statement established working groups in four areas: industrialization, manpower and education, agriculture, and science and technology. Dr. Hughes summarized the NSF survey on the Saudi Arabian needs for scientific and technical infrastructure, and the working group on science and technology was discussed in general by Mr. Bowden.

*A Survey of the Science and Technology Base in Saudi Arabia*

As mentioned above, the Department of Treasury, upon signing the Joint Statement with Saudi Arabia, requested the National Science Foundation to undertake a needs survey in Saudi Arabia to determine the requirements for building a scientific and technical base. In effect, the NSF became the lead agency for the working group on science and technology under the Joint Commission.

Prior to visiting Saudi Arabia in May, 1975, NSF and Saudi officials ". . . submitted a plan calling for the establishment of a Saudi Arabian National Center for Science and Technology (SANCST). Its purpose: To promote the orderly growth of science and technology in Saudi Arabia and to serve as a focal point for United States-Saudi Arabian scientific cooperation in a number of areas." [p. 331] This plan was endorsed at the first Joint Commission meeting in February, 1975 with the agreement that a U.S. survey team would visit Saudi Arabia to assess their existing scientific and technical base. The assessment was necessary to determine realistic objectives for the SANCST. The needs survey conducted by the NSF established a useful precedent for future U.S. cooperative agreements with developing countries, because it provided that the

projects agreed upon and the technology transferred would be responsive to the immediate needs of the country.

Dr. Robert Hughes of the NSF commented on the survey findings and conclusions, summarized below. The survey findings included:

Saudi Arabia has an underdeveloped although rapidly improving level of scientific activity;
the kingdom is progressing towards its goal of having a majority of its students achieve the baccalaureate level;
graduate training programs are just beginning and will probably develop slowly;
research in universities is practiced at a low level;
research institutions outside the universities also are largely undeveloped;
a number of testing and process control laboratories operate with modern equipments and techniques;
the shortage of adequately trained Saudi nationals at all levels will probably continue for a number of years.

Based on their findings the survey team offered several recommendations:

the country should continue to emphasize the development of higher education institutions;
specialized research institutions, outside the universities but linked to them, should be developed rapidly;
strong links with the United States and other foreign laboratories should be emphasized in the development of university and other research institutions;
the SANCST should be created as soon as possible.

The needs survey facilitated the formulation of policies and programs designed to meet the needs for a science infrastructure in Saudi Arabia to be performed through the SANCST.

Dr. Hughes noted the other objectives of the SANCST as follows:

"Organization and support of joint international-Saudi Arabian research programs.
Creation and management of a system of national research laboratories to focus on applied research of interest and need unique to Saudi Arabia.
Establishment and maintenance of a scientific and technical manpower information system as an aid to science planning and effective use of scientific and technical personnel.
Organization, operation or sponsorship of effective science information institutions and activities, including international conference, symposia, and research publications—all useful in achieving the center's objectives.
Cooperation with universities, laboratories, and other research centers to encourage research, exchange of knowledge and experience; and avoidance of duplicate efforts." [p. 333].

Concerning the SANCST, Dr. Bowden commented, "I would only like to say that SANCST provides a remarkable opportunity for the United States and international scientific community to participate in developing an institution which will have the potential to respond and to serve unique development needs and challenges." [p. 214].

*The U.S.-Saudi Joint Commission Office*

To enhance the communication between the two sides of the Joint Commission the Department of Treasury has also established a Joint Commission office at Riyadh staffed with a director, assistant director and four program monitors. This office has been instrumental in facilitating communication and monitoring work on a daily basis with their Saudi counterparts. Planned projects include the development of industrial standards, housing construction, and food and drug standards, and corresponding vocational training.

## POLICIES FOR TECHNOLOGY TRANSFER TO OPEC

As noted above, more than one witness pointed to the need for centralized funding for Joint Commissions efforts, centralized reporting and assessing of program effectiveness, and to the need for greater cohesion between the activities in the private sector and the government. These suggestions all point to the need for more centralized policy direction in this field.

Dr. Basiuk discussed why the United States should have specific policies for dealing with the OPEC countries. He said, ". . . the problem there is that the OPEC countries are rather conservative about where they invest. They want security of investment and they find that the United States is probably the most secure country for this purpose." [pp. 317–318]. However, extensive investment by OPEC nations in the United States may produce a backlash. Thus, the most desirable means of regaining petrodollars according to Dr. Basiuk, would be through reimbursable technical assistance although, he added, this has problems of its own:

> "Oil-producing countries realize that the huge oil revenues are a short-term phenomenon and many of them are energetically applying themselves to industrial development in order to provide a more solid foundation for their economies for the future." [p. 318].

Although he felt that the United States could expand the scope of reimbursable technical assistance significantly, he noted that there is no effective policy and organization for this purpose. The potential for expansion is particularly promising if other LDC's, where petrodollars are invested and the so-called "graduates" of AID, are included.

Dr. Basiuk presented three organizational options for the conduct of U.S.-OPEC technology transfer. First, things can remain as they are considering the current low level of activity; second, the Special Technical Services (STS) section of AID could be given principal responsibility but would require expansion to be effective. The STS could also serve as a buffer for post-AID countries seeking technology transfer. It was noted the OPEC nations, however, seem reluctant to deal with AID because of its reputation as a humanitarian agency. Third, either the first or second option could be a temporary policy until ". . . a separate agency—let's call it Agency for Technology Export and Cooperation (ATEC)—is established." [p. 323]. Such an agency would be mission oriented and thus unencumbered, could maintain liaison with AID's Office of Science and Technology in

dealing with industrial assistance, would be more palatable to OPEC than AID and conceivably, like OPIC, ". . . a separate agency could be established with no cost to the United States Government except for initial seed money." Dr. Basiuk went on to suggest that in addition to foreign governments, perhaps United States companies could contribute to the expenses of the agency, considering that U.S. private enterprise would be a major beneficiary of its activity" [p. 323]. It would, however, add to the already large number of Federal agencies, and could be a problem if not linked with key policymaking bodies and staffed with competent personnel.

*Economic Considerations*

In terms of technological competition, most witnesses agreed that the OPEC countries presented no threat now or in the near future to U.S. trade on the world market. They could, however, be considered future competitors, a factor that must be weighed in United States policy formulation. Is there any possibility that a number of OPEC countries could develop as Japan did, presenting a threat in terms of United States labor? Congressman Myers asked:

> Isn't it true that the development of Japan and the Far Eastern nations—the nations where there is an extreme abundance of labor—resulted by their putting themselves into the international market in a relatively quick manner at the expense of American labor as a result of being able to use in many cases American technology combined with sufficient capital whether supplied internally or externally.
>
> I think one of the concerns that Americans probably would have in the transfer of technology would be: Does it pose a real threat to the basic soundness of jobs here at home? In 25 years it seems to have become a threat to many industries." [p. 223].

Mr. Bowden replied that he did not perceive a threat to American labor from technology transfer to OPEC ". . . simply because they are starting from way back and they have a long way to go." [p. 223]. Along similar lines, Chairman Thornton stated that he felt many fears resulting from our export of technology are probably based on the assumption that the state of our technological development would remain fixed.

Another concern, again based on the United States experience with Japan, was that the United States might build OPEC to the point that their own technology would be competitive with ours, or that they would no longer offer a market for United States technology. Dr. West was asked whether he thought that by building their food production capability we would decrease their need to import agricultural products. Dr. West replied that he saw no problem for about forty years. He said:

> "That might happen in 40 years from now, but I would say that for the next two decades or more their demand for agricultural products will increase much faster than their capability of producing them. This would result in their buying more and more agricultural products from us." [p. 209].

Several witnesses suggested that the United States could insure itself against technological competition by pricing its technology to provide

for an adequate return on its research and development investment which, in turn, will insure continued growth of U.S. technology. Dr. Hughes noted:

> "The basic argument, that the flow of technology among nations need not be detrimental, is based upon the concept that each nation which transfers technology must get a return that will renew and replenish its own technology base. The return will pay for the research and development that goes into the technology that was transferred." [p. 335].

Mr. Thornton, then asked, "How do you value the research and development which underlies a technological improvement, and how do you avoid selling yourself short by simply putting a price on a technological improvement which reflects the cost of the materials and the cost of construction and a return to shareholders who sell that particular product?" [p. 335]. Dr. Hughes commented that the matter of adequately pricing technology to cover the research and development is currently being studied but as yet there is no formula.

Finally, Mr. Thornton raised the issue of proprietary rights and the possibility of third party usage of United States technology: "It occurred to me that the question of proprietary rights and innovations might be a problem area in international transfer of technology and my question is whether those proprietary rights do follow the technology into the foreign countries? . . . Is there any restriction or prohibition against the further transfer to a third country?" [p. 19]. Dr. Ganley commented that the question of patent and proprietary rights is an important problem with which the Department of Commerce is currently concerned. Although the United States Government has participated in promoting effective patent laws among nations for several years, there is no one law internationally recognized. The World Intellectual Property Organization became a U.N. agency in December 1974. Dr. Ganley felt that this agency could provide fully adequate protection as we know it. However, the current system is frustrating and often results in complicating negotiations for technology transfer.

*Security Considerations*

Although the question of security risks to the United States was raised at the hearings, the issue was not the main focus for the three days of hearings. In reply to questions about whether the OPEC countries might sell our technology to third countries or use it against our interest, Mr. Bowden stated:

> "The technology placed in their hands without some one who is familiar with that technology and putting it to work will probably not help much because they simply do not have the people skilled in that area to make use of the technology, whether it be within their own country or a third country." [p. 223].

Nevertheless, it was recognized that the question of long or short range threats to United States security could not be discounted. Speaking of the transfer of computer technology Professor Licklider noted that the transfer of technology in an area even as sensitive as computers need not be of concern if technology transfer was interpreted in its broad meaning. He suggested that some frameworks and systems

for computer understanding be transferred primarily to help those countries develop information dissemination services and management capabilities. He suggested:

> ". . . it is important for us to develop framework in the form of a computer-communication network, within which to deal with OPEC and other countries, and to export services which have a continuing economic value, services that are more or less held within our control but can genuinely help them much more than hardware alone, hardware plus software or even specific systems." [p. 429].

Dr. Huskey of the University of California, commenting on fears that the OPEC countries might surpass us economically or militarily by misusing United States computer technology stated:

> "I am less worried about the capability that they get under this kind of transference than Prof. Licklider because I feel that if we have a vigorous activity, we will always be out ahead. I think this is consistent with my experience, particularly in India." [p. 437].

Finally, Dr. Huskey seemed to sum up the feelings of the other witnesses by noting; "My last major point is sort of the pragmatic point: If we do not offer them this kind of technology, then somebody else will, so we might as well. We probably won't make any particular friends by doing it, but at least we can avoid making enemies." [p. 437].

To sell technology merely because it can be purchased elsewhere is not reason enough to engage in technology transfer, especially in politically unstable areas. However, the testimony offered over the three days of hearings indicated that the transfer of technology to the OPEC nations and other LDC's where petrodollars might be found could offer real benefits to the United States. This does not seem to discount the possibility of certain costs, but they can be avoided by a better integrated and more comprehensive approach, coupled with efforts to assess the impacts of the transfers. Overall, the hearings affirmed that technology transfer to OPEC, even as presently conducted, could probably assist the United States in regaining some of its petrodollars, and might foster peace and stability in the Middle East.

# APPENDIX

## List of Witnesses

### HEARINGS ON TECHNOLOGY TRANSFER TO THE ORGANIZATION OF PETROLEUM EXPORTING COUNTRIES

October 28, 1975:

Dr. Oswald H. Ganley, Acting Deputy Assistant Secretary of State for Advanced and Applied Technology Affairs; accompanied by Addison E. Richmond, Jr., Director of the Office of Bilateral/Multilateral Science and Technology Affairs, Department of State.

Dr. Quentin M. West, Administrator, Economic Research Service; accompanied by Dr. Howard Steele, Leader, Middle East Program, Foreign Development Division, Economic Research Service, Department of Agriculture.

October 29, 1975:

Lewis W. Bowden, Deputy for Saudi Arabian Affairs, Department of the Treasury; accompanied by Kenneth Harbinson, Program Officer for Science and Technology, Department of the Treasury.

Dr. Victor Basiuk, Consultant on Science and Technology Policy, Arlington, Virginia.

October 30, 1975:

Dr. Robert E. Hughes, Assistant Director, National Science Foundation.

Dr. J. C. R. Licklider, Professor of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, Massachusetts; accompanied by Dr. Philip S. Nyborg, Director of the Washington Office, American Federation of Information Processing Societies.

Professor Harry Huskey, Professor of Information and Computer Science, University of California at Santa Cruz.



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