Energy Supply and Use in Developing Countries

A Fresh Look at Western (OECD) Interests and U.S. Policy Options

A Report by the Joint Working Group of the Atlantic Council of the United States and the Member Committee of the United States World Energy Conference.

EDITED BY

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FOREWORD

It is in the interest of the United States and the other industrialized nations that the economic well-being of the developing countries be enhanced. Adequate supply and effective use of energy at reasonable cost are a necessary underpinning for economic development. The impact of energy costs has been especially severe on the economic growth of the developing countries, with their rapidly rising energy demand compounded by their large debt burden and the consequent problem of capital formation.

The developing countries need assistance in assessing, planning, financing, and implementing energy supply programs based on development of indigenous resources as well as imports. Such assistance must address the private energy and industrial sector as well as the government. These issues are critical not only to the economic growth of the developing world but also to the financial and economic well-being of the industrialized nations.

Starting from the recognition that more and new ways are needed to expand private sector activity in strategic and tactical planning, financing, and implementation of the energy programs and projects in developing countries, the Atlantic Council's Energy Policy Committee joined with the United States Member Committee of the World Energy Conference to examine the issues and options related to energy supply, use and financing in developing nations. To do so, we formed a joint working group which we have had the honor of co-chairing and whose members were carefully chosen from among the constituencies of the Atlantic Council and the World Energy Conference to provide appropriate representation from the private sector, the financial community and the key national and international institutions. In addition to the 65 joint working group members identified in the following pages, observers from the U.S. Agency for

International Development, as well as case study authors from the People's Republic of China, South Korea and Taiwan participated in our work. The World Bank was represented on the working group and participated substantively in the project.

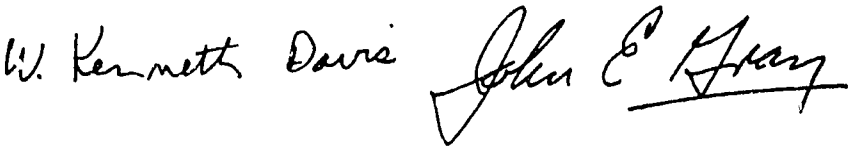
Our intent was to consider the intersecting interests of the developing nations, the newly industrializing countries, and the industrialized democracies, in order to develop recommendations addressed to the U.S. Administration and Congress, to the private energy sector and the related financial community, as well as to the appropriate international organizations. Specifically, we proposed to identify actions to be taken by the governments, financial communities, and private sectors of the OECD countries which would enhance the economics of energy supply and use in developing countries as well as advance both public and private interests in the OECD nations. In the course of five plenary meetings during 1984–1986, and numerous consultations and correspondence, the working group fashioned its consensus into the present Policy Paper, section I. Case studies and substantiating analyses by individual members of the joint working group are found in sections II, III and IV.

As it turns out, our approach, findings and recommendations in section I anticipated in substantial measure Secretary of the Treasury Baker's initiative as it was introduced. They have also proved relevant to World Energy Conference (WEC) interests and were considered by private sector energy leaders and government officials from industrialized, newly industrializing, and developing nations at the WEC Congress in Cannes, France in October 1986.

This project has been made possible, as are all Atlantic Council projects, by the support of institutions and individuals. We especially thank the World Energy Conference, Gulf Oil Corporation, Bechtel Power Corporation, CRA Limited (Australia), Mitre Corporation, Baltimore Gas and Electric Company, Southern California Gas Company, Westinghouse Electric Corporation, and China Airlines, as well as the U.S. Agency for International Development and the U.S. Department of Energy. However, the views and findings contained in the Policy Paper are those of the joint working group, and in the substantiating analyses and case studies those of the individual authors. They should not be construed as an official U.S. government position, unless so designated by official documentation.

The joint working group worked hard and well to produce from diverse experience its collegial policy recommendations in section I. Given the breadth of the issues and range of the options, it is with gratitude to all members and participants that we conclude our work

with substantial consensus. We are most appreciative of the opportunity to have worked within a group of highly knowledgeable people willing to contribute their time and expertise in such a constructive manner.



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PART I

THE POLICY PAPER

CHAPTER 1

ENERGY SUPPLY AND USE IN DEVELOPING COUNTRIES

A Fresh Look at Western (OECD) Interests and U.S. Policy Options

Report by the Joint Working Group of the Atlantic Council of the United States and the Member Committee of the United States, World Energy Conference

Executive Summary

Adequate energy supplies at reasonable cost are critical to economic growth. Many developing countries face serious problems in addressing their need for more domestic energy, as well as improving the utilization of their current energy consumption. Domestic development of energy and its efficient utilization can reduce the high costs of energy imports and provide a stimulus to local economies, such as increased opportunities for local business and the development of infrastructure. However, lack of adequate domestic energy coupled with other prevailing factors—such as coping with large financial debt and prospects for sluggish economic growth in the industrialized world—adversely impacts projected economic growth both for developing countries and the OECD nations.

Accordingly, the Energy Policy Committee of the Atlantic Council of the United States and the Member Committee of the United States for the World Energy Conference formed a joint working group to take a fresh look at Western (OECD) interests in energy supply and use in developing countries. The resulting report examines the prob-

lems, issues and options related to economic energy development and utilization, considering the needs and capabilities of the developing countries as well as related interests of the industrialized democracies, generally the OECD countries. The roles of the various relevant institutions—private, national and multilateral—are also analyzed, in seeking to identify actions which could enhance the availability and efficiencies of energy in developing countries as well as advance both public and private objectives of the OECD countries.

The major issues addressed are as follows: 1) What are the factors that will encourage foreign private energy investment in developing countries, that is, the opportunity to invest with assurances of an ability to earn and to repatriate a fair return on investment? 2) What factors must be stressed if the institutional structure in developing countries is to be made more effective in addressing their energy problems? 3) Should the energy financing and development role of the World Bank and the regional development banks be expanded? If so, how? 4) Can the United States and other OECD governments do more to encourage energy development in developing countries? 5) What can be done to encourage commercial banks and other private institutions to invest in energy development in developing countries?

Conclusions

The working group came to the following conclusions:

1. To enhance economic development in developing countries there should be a significant increase in participation and direct investment in energy development by OECD private-sector institutions. This should be supported by OECD governments and the international multilateral institutions.

2. External investments are more likely to be made in response to opportunities in economies which are increasingly market-oriented. Such investments require a favorable policy environment, under which the prospect of returns on investment flow from a mutuality of interests on the part of both domestic and external institutions.

3. Additional actions can be taken by the developed and the developing nations, along with key international institutions, to facilitate the structuring and functioning of market-oriented decision-making in the developing world, thereby promoting new opportunities for energy investment.

Recommendations

From the above conclusions, the working group makes the following recommendations:

1. Developing countries are urged to undertake a systematic review of their national economic and energy policies, engaging in a program to enhance market-oriented decision-making, and to identify and promote private investment opportunities in the energy and related sectors. Special emphasis should be placed on market pricing, strategic economic and energy planning, institutional relationships, resource evaluation, supporting infrastructure, and the potential for direct investment by OECD private and public sector institutions and multilateral institutions in particular energy projects. To support these reviews, energy investment teams should be assembled, led by the World Bank. They should consist of representatives from other multilateral institutions, OECD governments, and major private companies and financial institutions, and work closely with appropriate national public and private institutions in the developing countries.

2. Developing countries desirous of direct foreign investment in energy projects should encourage greater equity ownership by private enterprise. In those countries where there are insufficient domestic or foreign qualified private sector investors, government corporations would initially have to fill this role. In such cases, there should be opportunities for private companies to purchase the equity at any time from the government company. Both foreign and domestic companies should make a reasonable contribution of their own funds in purchasing equity participation, giving them a vested interest in identifying and managing a sound project. In conjunction with their investments, foreign investors should contract to provide on mutually satisfactory terms the needed technology, supervision, and training of host country personnel.

3. Every effort should be made to meet the aspirations of the developing countries with transnational companies offering in good faith to transfer their energy technology for a fair price as part of a working relationship between the developing country and the company. It should be recognized that an industrial firm's continuing technological progress can often be enhanced by creative work on specific projects by their associate, licensee, or subsidiary in a developing country and that world-wide sourcing of manufactured products is ongoing, with world-wide management of technological development increasingly just ahead. As a result, good faith efforts in this arena would be very beneficial in encouraging foreign equity investment by developing countries.

4. The energy planning process of a developing country should integrate socio-economic development (determined by economic, industrial, financial, political, and demographic conditions) with market pricing of energy supply and use, environmental impacts, and

its institutional structure. Planning emphasis should include a strategy of energy technology transfer and rural energy promotion.

5. In order to attract risk capital, particularly in the form of equity investment, developing countries' investment policies must provide assurances that investors would have the prospect of earning a suitable return and be permitted to repatriate those profits. Whether or not investors will be able to earn a suitable return will depend to a large degree on the commercial risk taken and on the host country's policies concerning pricing, taxes, required equity contributions, share of project revenues, access to markets, repatriation of earnings, and currency convertibility.

6. The OECD countries should continue giving high priority to consideration of national-treatment issues and striving to achieve a comprehensive multilateral agreement on national treatment which would include both developed and developing countries. In addition, OECD countries should stress the importance of adequate arrangements to settle disputes and to provide protection from expropriation. Two such measures are: to continue efforts to negotiate Bilateral Investment Treaties, and to participate in the World Bank's new Multilateral Investment Guarantee Agency which will provide insurance of non-commercial risks.

7. The United States Government, in addition, should expand its effort to promote a greater private sector investment in developing countries. One way is to expand the international energy assistance program in the Agency for International Development (AID), particularly its Office of Energy and Bureau for Private Enterprise. The United States Government could also strengthen its export finance programs in the Export-Import Bank and other agencies to focus on technical assistance and feasibility studies which can play an important role in facilitating the development of energy projects in developing countries.

8. OECD countries and multilateral institutions should encourage commercial banks to invest in energy projects in developing countries. OECD countries should support the efforts of the multilateral institutions to stabilize the economies of the developing countries and to foster economic development, so as to create a more favorable investment atmosphere. These efforts should include increased assistance from the International Monetary Fund and World Bank expansion of its structural-adjustment loan program and its program of issuing partial guarantees to commercial lending to developing countries.

A. Introduction

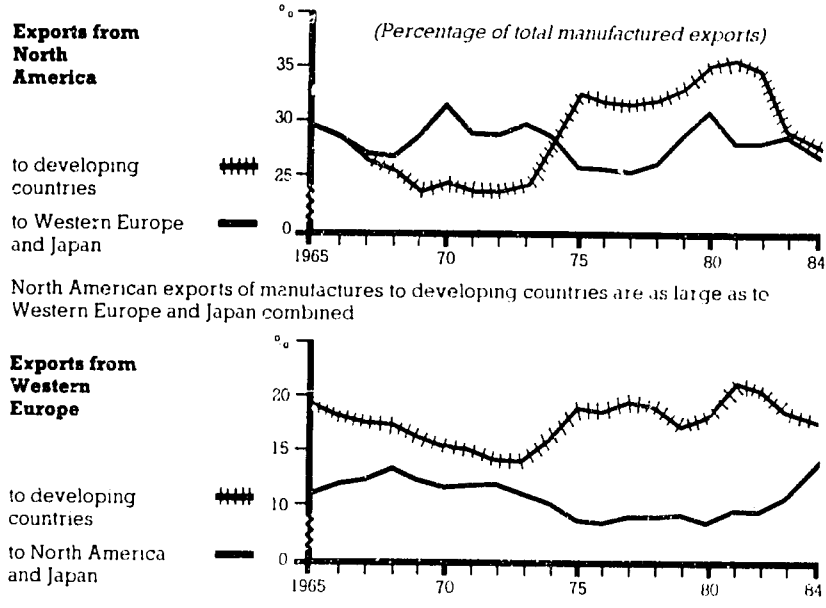
Solving the energy problems of many developing countries has become increasingly difficult. Prospects for financing needed energy projects are not encouraging because of domestic capital formation problems compounded by the fact that due to a lack of investment opportunities, the flow of foreign capital to developing countries has also sharply declined. Capital has been flowing out of some developing countries rather than into them. Their economies are burdened with debt, which to a significant degree was generated by the cost of energy imports and the high interest rates of the late 1970s and early 1980s. They face financial stringency, the possible reduction in needed energy development coupled with sluggish economic growth, and burgeoning protectionism in the industrialized countries. All of this threatens to reduce projected economic growth potential in developing countries, diminish their world trade position, and perhaps endanger even their political stability.

The economic well-being of developing countries is vital to the United States and the other industrialized countries of the world. Western economic and security interests are more interrelated with those of the developing world than ever before. Significant numbers of jobs in the West depend on free trade with developing countries. For example, North American exports of manufactured goods to developing countries are as large as those to Western Europe and Japan combined; the same is also true for Western Europe's manufactured exports (see Table I below). From 1980 to 1984, the United States lost an estimated $18 billion in real export earnings and more than one million jobs because of declining exports to the developing countries.[1]

In addition, Western financial institutions have made large commitments there, having been the main source of funding for the developing countries' external debt, which in 1985 totaled $865 billion.[2] And finally, Western security is bolstered significantly by key developing countries.

History shows that adequate supplies of energy at reasonable cost are critical for economic development and growth. Since some form of energy is needed in all sectors of an economy whether it be industry or agriculture, freight or passenger transportation, residences or commercial buildings, greater energy use has been not only a necessary ingredient for, but also a major consequence of, a country's expanding economy. This pattern exists in industrialized, newly industrialized, and developing countries alike.

Table I: Developing Countries are Major Markets



North American exports of manufactures to developing countries are as large as to Western Europe and Japan combined

Western European exports of manufactures to developing countries are consistently higher than to North America and Japan combined

Source: GATT, "Trade Policies for a Better Future", p. 16, from U.N. Statistics. Used with permission.

As energy-use technology has evolved, economic productivity per unit of energy input has increased and the amount of energy required per unit of economic output has decreased. The significant gains made in energy efficiency over the last decade in Western countries as well as in some developing countries have demonstrated the economic advantages, such as the reduction of oil imports and of the foreign exchange drain, of conserving energy through pricing, technical advances, and information transfer. Conversely, in developing countries the amount of energy required to produce additional output is much higher than in developed countries, and failure to provide it can stifle otherwise feasible and desirable developments.

Many developing countries are aware of their energy supply and use problems, but face formidable domestic and international obstacles in addressing them. The industrialized countries have their own set of concerns that could be improved upon to expand a mutually beneficial energy trade relationship with the developing countries.

Accordingly, the Energy Policy Committee of the Atlantic Council of the United States and the Member Committee of the United States

of the World Energy Conference initiated a joint project to focus on the energy problems in developing countries. The report is designed to examine the issues and options related to economic energy development and utilization, considering the needs and capabilities of the developing countries as well as those of the industrialized democracies, generally the OECD countries. The roles of the various institutions—private, national, bilateral, and multilateral—are also analyzed in seeking to identify actions which enhance the availability and efficient use of energy in developing countries as well as advance both public and private objectives in the OECD nations. However, the report does not include a technical assessment of the resource bases in the developing countries.

B. Dimensions of the Overall Problem

The developing countries with few exceptions face complex problems in order to develop a greater domestic capability to produce and use more energy and use it more efficiently. The need to do so should not be underestimated. Developing countries as a whole still import about 40 percent of their commercial energy needs. Oil imports consumed, on the average, 17 percent of the export earnings of the net oil importing developing countries in 1984. When the foreign debt position of many of these countries is taken into account, the issue becomes all the more urgent. With oil demand projected to increase in the future, import costs could force critical choices between energy imports, particularly oil, and imports of essential foodstuffs, raw materials, and spare parts to keep industry going, resulting in economic slowdown and even greater financial problems.

The Energy Dimension

The situation today varies among the developing countries. While some, such as Brazil, have made progress in expanding their domestic energy industries and reducing imports, many have problems in identifying their resource base, acquiring technology, developing the necessary infrastructure, policy planning and implementation, and utilizing energy efficiently. Problems are often less severe for the middle-income countries, since they usually have conditions present, such as a more solidly based economy, larger resource base, and larger domestic market for energy consumption, which are positive factors for commercial investment and development. It is generally the economically poorer countries with smaller resource bases where energy development problems are most acute.

Commercial energy projects (oil, natural gas, coal, and power projects—hydropower, nuclear, and fossil fuel) present a number of major obstacles for most developing countries. They require large amounts of capital and technical expertise, four- to six-year lead times (and sometimes more) to bring the project into production, an adequate level of infrastructure, and definition of domestic resources with commercial potential. The up-front investment needed to develop a single oil field, for example, can easily exceed $100 million and can be greater if the discovery takes place in remote areas, because of the additional infrastructure required. Large-scale power projects can require even more up-front investment and often have long payback periods, depending on the economics and financing of the project.

In addition, many developing countries are experiencing serious shortages of non-commercial or traditional energy sources—fuelwood, agricultural, and animal wastes—which are used throughout the developing world, particularly in the rural areas. This is serious because, first, there seems to be no immediate solution in sight, and second, the impact on forests and agriculture is far-reaching. Deforestation, particularly in the semi-arid and mountainous areas, is causing erosion, siltation, and desertification. As fuelwood supplies are exhausted, animal and crop residues are burned, depriving the soil of valuable nutrients, lowering crop yields, and aggravating foreign exchange problems through increased agricultural imports.

To help address the fuelwood problem, most developing countries are attempting to reforest, introduce trees into farming, and improve their use of renewable energy resources such as solar biomass. These activities range from major investments to uncoordinated demonstration projects. A few countries have developed a full range of policy commitments, institutions, and technical skills for renewables. But many others have little or none of these because of the lack of capital, access to technology, and trained personnel to create and manage the needed programs.

Energy efficiency problems are most closely linked to energy subsidies, a lack of information, and shortages of technical and managerial expertise and equipment. Energy subsidies usually exist to accommodate a country's lower standard of living and a belief among its citizens that low-cost energy is a national birthright. Providing energy consumers with conservation information which is culturally acceptable is necessary but lacking in many countries. Shortages of technical expertise and equipment exist because of the lack of trained personnel and capital, with the latter problem being particularly important.

External Capital Formation and the International Economic Situation

The lack of adequate capital for the energy sector or any other sector of a developing country's economy is among the most pressing problems the developing world faces today. It is also one of the most complex, since capital flows from a variety of domestic and foreign sources, each subject to different factors that together determine the general investment environment. The international economic situation has had an impact on all sources of capital, particularly on external sources which must be looked to for a significant share of the capital needed for future energy development in developing countries.[4]

The international economic situation contains a number of factors which are working against the efforts of many developing countries to acquire adequate capital for energy development. First, the existing world market conditions of oversupply and declining real prices for fossil fuels have reduced profit margins for existing energy projects and hardened attitudes of investors to developing new projects. Energy projects will be more difficult to develop with foreign private capital than was the case in the period 1974–82 when energy prices and profits rose at impressive rates. Declining oil prices will also shorten the required payback period for investment in capital-intensive energy conservation equipment.

Second, many developing countries are in a difficult international debt situation which is unlikely to improve in the immediate future. The increase in indebtedness (projected for 1986 to $896 billion for capital-importing developing countries) in large part will result from new loans to assist debtor countries to service debt, and from the capitalization of deferred interest and amortization.[4] The increased burden of debt has clouded the creditworthiness of a large number of the developing countries with consequential reluctance of most creditor banks to make new loans unrelated to debt renegotiations.

Central to creditworthiness is the ability to expand export earnings so as to be able to service external debts without seeking new borrowing for that purpose. With the revival of economic growth in the United States and, to a lesser extent, in other industrial countries, the exports of some of the developing countries have increased with consequent substantial reductions in their trade deficits. The combined trade deficit of the indebted countries fell from $95 billion in 1980 to $43 billion in 1985 but is projected to increase to $46 billion in 1986.[5]

However, there are further threats to those past improvements: lagging economic recovery in the industrial countries of Europe, the possibility of reduced economic growth in the United States, and an increase in the network of trade restrictions imposed or threatened by the industrial countries, all of which would adversely affect the level of exports of the developing countries.

Third, when the value of the U.S. dollar increased substantially from 1980 to early 1985 relative to other leading world currencies, it increased the local currency costs of imports into most developing countries, especially of oil imports, since to a great extent such imports are priced and paid in U.S. dollars. Also, as the greater part of international debt is U.S. dollar-denominated, a higher-valued dollar substantially increased the local currency cost of foreign debt. Efforts in late 1985 to readjust exchange rates have resulted in an increase in Japanese and Western European currencies against the dollar, but have left the dollar at very high levels against the currencies of developing countries.

Fourth and related to the third point, inflation rates have been high and local currencies have been devalued in many developing countries. This has additionally increased, often very sharply, the local-currency cost of external payments, whether to meet debt service or for the transfer of profits arising from foreign direct investment, and has provoked capital flight, often on a large scale. While some recent progress has been made, curbing inflation still further would arrest the outflow of capital and improve the environment for the inflow of investment funds from abroad.[6]

Dealing with the energy investment environment, and energy development problems in general, largely depends on a range of institutions—private, governmental, and international. A change in policies will most likely be needed in order to address more successfully the energy problems in the developing countries, and the roles of these institutions and their relationships with each other need to be examined, along with the associated policy issues.

C. The Roles of the Private Sector, Governments, and International Organizations: Status and Prospects for Change

A number of institutions and their policies determine the process of energy development in developing countries. They include private sector companies and financial institutions in industrial and developing countries, as well as governments and their policies at the unilateral, bilateral, and multilateral levels. And finally, there are

the key international organizations that include in their mandate assisting developing countries in their energy development. These include: the World Bank, the regional development banks, the United Nations, the Organization of Petroleum Exporting Countries (OPEC), and the International Monetary Fund (IMF).

The International Private Sector

Today the structure of energy development in developing countries is significantly different than it was just a few years ago. Two main changes have taken place. First, there is less direct foreign participation in developing countries by the private transnational energy companies whose role has been primarily replaced by state-backed companies, and more indirect participation in the form of supplying technology, certain key managerial services, and international marketing capabilities. One consequence has been less direct foreign investment in developing countries and more local control of domestic energy industry operation. And second, in the international capital markets the third-world debt situation has sensitized foreign commercial banks to such a degree that their current role in financing projects in developing countries is only a fraction of what it was five years ago.

Historically, foreign private investment has played a crucial role in developing energy in the developing countries. Until the late 1960s, foreign direct investment from transnational and independent energy companies predominated in the industry's investments in these countries. But desires of the host countries to exercise control over a basic natural resource industry and to participate in energy ventures led to new forms of investment, such as production-sharing contracts, service contracts, joint ventures, and risk contracts, which changed the structure of the international energy industry. Most of these contractual arrangements included little foreign equity participation. One exception was the joint venture which contained substantial amounts of foreign direct investment from both state- and privately-owned energy companies, with the host country usually retaining majority ownership.

The transitional energy companies have also felt the effects of the changing international market conditions for energy. They are now operating under different circumstances than in 1980 when energy prices and profits were high. Declining profits coupled with uncertain world financial and economic conditions have led some transnational energy companies to reduce activity and investment in energy.[7]

If there is to be greater foreign participation of private energy companies in the developing (host) countries, non-commercial risks to these companies will have to be reduced and the potential for exportable profits increased. With many host countries in financial difficulty and experiencing energy supply and use problems, private energy companies with their technical and managerial expertise and equipment, as well as large capital resources, offer a promising alternative for further development.

However, transnationals will have to make every effort to adapt to the culture of the host country. This can include: first, mandatory in-depth language and cultural training for all expatriates and their spouses who will be located in the host country; second, admonitions to their expatriate managers to live in the host countries' native communities rather than in foreign enclaves and careful selection of employees for foreign service who are sensitive to cultural differences; third, a policy of developing native replacements for expatriate managers and technicians; and fourth, participation in educational institutions in the host country. A high priority should be the foreign investors' desire to encourage developing countries' managers to strive for promotion to home office positions.

Host Country Policy

Host country energy policy has significantly changed over the last twenty years. Many developing countries asserted domestic control over their natural resources by nationalizing industry, renegotiating existing contracts, or creating state enterprises. Private ownership in the power sector was virtually eliminated in many countries. New energy institutions were formed in a somewhat uncoordinated manner or not formed at all because of a shortage of trained personnel. These trends continued during the oil price shocks of the 1970s and the foreign debt explosion of the 1980s.

In the aftermath, a number of patterns have emerged. For example, much of the commercial energy development and its accompanying institutional structure that has taken place in developing countries has been for concentrated use in a few urban zones. This was largely due to the industrialization policies which were popular at the time, but which, as it turns out, were at the sacrifice of capital and manpower requirements of rural areas of the developing countries. The consequences have been a neglected agricultural sector and food shortages (particularly in the urban areas), with increasing populations and continued low incomes in the rural sector.

Other institutional problems in the energy sector of many developing countries have continued.[8] Institutional difficulties exist in

planning, investment, and pricing decisions, and in overall integration with other energy producing and consuming sectors. A major shortcoming on the supply side in some countries is the lack of any agency to plan and manage traditional energy resources, such as fuelwood and animal wastes. Forest departments were not equipped to regulate the production and use of wood for fuel purposes; and improved utilization of animal wastes and the development of new energy sources usually do not receive the priority attention they deserve, especially when they are managed by the government ministries with more general areas of responsibility.

In many developing countries, the finances of the electric power sector have deteriorated because the sharp increases in fuel prices and borrowing costs of the late 1970s have not been matched by increases in utility tariffs or rates. Ensuing reliance on government financing of power investment has meant that investment had to be curbed when pressures on government budgets became severe. As a result, inability to raise domestic financial resources has delayed investment in the power industry in many countries, leading to power shortages and heavy economic losses due to such disruptions.

A World Bank study defined key problems in the power utilities as well as in the other energy institutions of developing countries.[9] In the power sector, the problems include: 1) low power tariffs which impair the operating revenues of utilities and force them to undertake additional borrowing that imposes a heavy debt service burden in later years; 2) operational inefficiency, which is evidenced by heavy losses in distribution of power, bad metering, and poor collection of bills; and 3) slow government capital funding, which results in utilities borrowing short-term money at high interest rates.

Subsidized pricing of other types of commercial energy has caused major problems. While many national oil companies in developing countries have characteristics of a commercial company, they must sometimes sell oil and gas domestically at prices regulated by the government and held below costs. Losses incurred on subsidized domestic marketing and refining operations have a direct impact on these companies' overall profitability, and therefore on their ability to generate investment capital. Often, exploration and production expenditures are the first to be affected by overall profitability and liquidity problems.

However, while some developing countries continue to maintain inadequate economic policies, others have re-examined their policies and are taking corrective action. Several countries have increased efforts to privatize some state-owned enterprises and to improve the investment and general business environment, in order to attract domestic and foreign investment.

The policies of developing countries related to attracting foreign investment and other forms of participation in their energy and industrial development are closely linked to how these countries perceive the role which their own domestic private sector should play in this process. If national energy companies, public or private, are subjected to uncertain governmental energy policy, a negative atmosphere for foreign investment will most likely result. In addition, while asserting an interest in private foreign investment consistent with national development plans and laws, some governments have maintained a combination of incentives and disincentives that offer little to attract potential foreign investors.

OECD Policies

Most OECD governments encourage direct investment flows to developing countries, aimed at a positive contribution to the host country's economy, and benefits for the investing country, including improved export opportunities, preferential access to natural resources such as energy, and positive international economic interdependence and trade. By the 1950s and 1960s, the United States, the United Kingdom, Germany, Japan, and France had established incentive schemes which offered a broad range of facilities to investors and industrial vendors in developing countries. Since the early 1970s, other OECD countries have adopted such incentive measures and also become members of the Development Assistance Committee (DAC) of the OECD.

Investment incentives used and measures taken by DAC countries to ensure equitable treatment of capital invested abroad and income derived from it can be grouped as follows: 1) investment guarantee facilities covering political rather than commercial risks outside the investor's control; 2) information and promotion activities; 3) official financial support for private enterprises investing in developing countries; and 4) activities of public corporations which have a dual function as investment banks and development institutions, with considerable leverage in mobilizing other foreign and local capital.

A number of DAC countries have concluded bilateral investment promotion and protection agreements with developing countries. The agreements are designed to provide protection against discriminatory action by the host country as between locally-owned enterprises and those with foreign ownership. Foreign investment covered by the agreement is usually not exempt from expropriation or nationalization, but the host country agrees in such cases to provide adequate, prompt, and transferable compensation. Most investment protection agreements contain arbitration clauses for cases of liti-

gation, often by reference to the rules of the International Centre for he Settlement of Investment Disputes (ICSID) established under the egis of the World Bank.

In an effort to strengthen cooperation among DAC governments, nembers adopted the Declaration of International Investment and Multinational Enterprises in June 1976. It includes a set of guidelines or multinational enterprises, principles concerning "National Treatnent" of foreign-owned enterprises, and principles regarding the se of investment incentives and disincentives. The policy of National Treatment could become a model not only for OECD members, ut also for governments of the developing nations in an effort to mprove the international investment climate.

Jnited States Policy

The U.S. Government has established a number of official develpment assistance (ODA) programs and agencies aimed at improving he investment climate in the developing countries. Guidelines for he future course of U.S. development assistance specify that:) development assistance should promote private sector activity in pen and competitive markets in developing countries; 2) developing ountries should have access to appropriate technology in order to mprove their economies and living standards; 3) U.S. assistance hould focus on promoting institutional capacities of developing ountries to enhance long-term development; and 4) U.S. assistance hould be provided to countries having appropriate national policies /hich encourage and stimulate economic development.[10] These new uidelines will set the tenor for U.S. participation in such assistance oth in its bilateral domestic programs and in its role in multilateral stitutions.

Within this policy context, the principal domestic programs and gencies to enhance the investment climate in developing countries nclude the following:

Bilateral Investment Protection Agreements: The United States as recently begun a program to negotiate a series of bilateral inestment treaties (BIT) with selected developing countries. A draft reaty has been developed, based mainly on language drawn from Jnited States Friendship, Commerce, and Navigation treaties and ther countries' existing bilateral investment agreements. Key elents of the U.S. draft include: most-favored-nation treatment for oreign investment; recognition of international law standards for xpropriations and compensation; free transferability of capital, reurns, compensation, and other payments; and use of international rbitration procedures (normally at the International Centre for Set-

tlement of Investment Disputes) for settlement of a specified range of host government-investor legal disputes. In September 1982, the first BIT was signed with Egypt. Negotiations have been concluded with several countries and preliminary negotiations are underway or expected to begin shortly with several other developing countries. The United States has also completed 114 bilateral investment protection agreements with developing countries, which provide procedurally for the operations of the U.S. Overseas Private Investment Corporation (OPIC).

The Overseas Private Investment Corporation: OPIC encourages the participation of United States private capital and skills in the economic and social development of developing countries. Its primary programs are: 1) political risk insurance against losses due to expropriation, inconvertibility, and war damage; and 2) investment financing through loans and loan guarantees. The Corporation operates on a self-sustaining basis, and takes into account the economic and financial soundness of the project, its contribution to the development of the host country, and its consistency with U.S. balance of payments and employment objectives.

The Agency for International Development (AID): AID helps developing countries deal with their energy problems by providing assistance to accomplish the following objectives: 1) reduce economic instability caused by overdependence on imported oil; 2) ensure availability of energy for sustained development; and 3) foster private enterprise energy development and management.

The assistance provided by AID includes expanding fossil and renewable indigenous resources; increasing energy productivity; satisfying basic energy needs for household as well as agriculture and rural industries; promoting policy reform to improve functioning of energy markets; building local private sector capabilities; and increasing the flow of technical and financial resources from the U.S. private sector.

AID is currently attempting to increase private sector participation and investment by the U.S. and host-country business communities in energy projects, as well as leveraging investments by the World Bank and other capital funding sources. This approach is based on early collaboration with the business sector, the World Bank, and the others in defining the terms and creating the conditions that will stimulate private sector participation. The AID approach includes:

1. *Identifying Promising Energy Solutions:* The most promising conventional, renewable, and conservation technologies and systems are identified that have the greatest potential for alleviating energy

problems in developing countries by increasing use of indigenous energy resources and improving efficiency of energy use. An example is the cane-to-energy concept that would be supported by substantial private sector investment and is currently being tested in Jamaica. This concept has replication potential in several dozen other countries.

2. *Establish Core Teams to Develop "Bankable" Projects:* For each candidate energy solution, AID intends to form a core technology transfer team. This team would be comprised of a limited number of U.S. industrial firms, academic and financial institutions, and international organizations that have academic and financial institutions, and international organizations that have experience and interest in the candidate energy concept and are willing to participate technically and financially in implementing a project concept in interested countries. Working with AID, the team will explore the interest and commitment levels of the host government and local businesses, and determine barriers to application of the candidate project. Should the project concept be attractive to all parties, then the team will assist in defining and implementing a private sector-oriented AID energy project in the interested country.

Energy is no longer a key priority for AID, and total energy funding has declined. Several points should be stressed: 1) AID's energy budget represents only 4 percent of the Agency's total budget and is increasingly concentrated in very few countries; this compares with approximately 25 percent of the World Bank's budget allocated to energy; 2) other bilateral donors devote larger fractions of their official development assistance to energy, recognizing its fundamental importance to economic development; 3) increased energy inputs are key to AID's priority agriculture program; reliable sources of energy are required for irrigation, fertilizer, processing and transport; and 4) the central Office of Energy is projected to have its budget reduced significantly, making it increasingly difficult to provide Agency-wide technical and policy coordination and leadership and backstopping to field missions.

Export-Import Bank: To aid in financing and facilitating U.S. exports, the Eximbank's authority and resources are used to: assume commercial and political risks that exporters or private institutions are unwilling or unable to undertake; overcome maturity and other limitations in private sector export financing; assist U.S. exporters to meet foreign officially-sponsored export credit competition; and provide leadership and guidance in export financing to U.S. exporting and banking communities and foreign borrowers.

In late 1985, the Eximbank became more active in helping U.S. exporters meet foreign officially-sponsored export credit competition by being given an additional $300 million, which supports an additional $1 billion in low-cost financing. Attention is focused on use of the "mixed credits"—combinations of conventional export credits with outright foreign-aid grants, designed to reduce the customers' carrying costs—which tend to discourage American exporters from bidding on certain foreign projects.[11] The Reagan Administration's negotiating objective is to end the abusive use of mixed credits by requiring that they include at least 50 percent foreign-aid grants, rather than the present internationally agreed 25 percent. This would discourage the use of mixed credits by making them too costly.

In addition to these programs, the U.S. Government as well as governments of other industrial countries support energy development in the developing countries through contributing a significant percentage of the funding for the multilateral development institutions and their programs.

Multilateral Institutions

The role of many multilateral institutions became more important during the 1970s, because the financial and technical resources available to them increased significantly. They tended to act as financial institutions, providing technical assistance, making loans, and issuing grants for energy as well as non-energy projects in the developing world.

Their commitments are shown in Table II below. Energy projects as a percentage of the total operations of these institutions have ranged from 34 percent for the Asian Development Bank to 27 percent for the Inter-American Development Bank, 25 percent for the World Bank—International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA) and the International Finance Corporation (IFC)—15 percent for the Organization of Petroleum Exporting Countries (OPEC) Fund, and 9 percent for the African Development Bank.

Because of difficulties in the funding of multilateral programs, including energy, a process of review is taking place within individual agencies, as well as among the donor countries which provide the bulk of their resources, and in the international community at large. Prior to this review the multilateral agencies had followed these energy financing patterns in the developing countries: First, most multilateral borrowing went for the development of electric power (90 percent in 1975–80), while the bulk of oil and gas development was financed by export-related credits and commercial

Table II: Loan and Grant Commitments By Multilateral Agencies

Commitments — *$ Million*

Agency	Concessional							Non-concessional						
	1970	1978	1979	1980	1981	1982	1983	1970	1978	1979	1980	1981	1982	1983
IBRD	–	–	–	–	–	–	–	1 508	6 548	6 939	8 282	8 [illegible]	9 480	11 647
IDA	594	2 859	2 676	3 784	3 522	2 832	2 963	–	–	–	–	–	–	–
IFC	–	–	–	–	–	–	–	113	446	310	745	728	377	594
IBD	440	683	776	824	569	792	412	192	1 106	1 249	1 424	1 668	1 892	2 541
African D. B.	–	–	–	–	–	–	–	11	206	274	297	323	399	574
African Dev. F.	–	186	228	273	311	358	344	–	–	–	–	–	–	–
As. D. B.	40	388	424	477	531	546	703	212	778	835	958	1 147	1 185	1 190
Car. D. B.	–	40	49	27	39	22	15	–	9	39	(14)	16	29	28
EEC/EIB	93	1 149	1 655	1 570	1 496	1 800	1 558	(2)	171	574	517	443	411	287
of which: Grants	92	883[a]	1 248	1 117	1 294	1 433	1 298	–	–	–	–	–	–	–
UN, grants	499	1 730	2 214	2 487	2 848	2 755	2 739	–	–	–	–	–	–	–
IFAD	–	118	385	396	377	340	279	–	–	–	–	–	–	–
Arab OPEC Funds	–	333	354	428	537	621	451	–	178	466	515	709	531	720
of which: Grants	–	23	23	37	77	67	19	–	–	–	–	–	–	–
Total	1 666	7 486	8 761	10 266	10 230	10 066	9 464	2 038	9 442	(10 686)	12 752	14 002	14 304	17 581
of which: Grants	591	2 636	3 485	3 641	4 219	4 255	4 056	–	–	–	–	–	–	–

a) Including STABEX.

Source: OECD, "Development and Cooperation: Efforts and Policies of the Members of the Development Assistance Committee", p. 215. Used with permission.

capital. This pattern reflects the long history of oil and gas financing by the private sector.

Second, low income countries were and remain heavily dependent on multilateral and concessional bilateral capital flows for the external financing of energy projects—drawing from them 79 percent of their total public external borrowing for energy during 1975–80. In contrast, middle-income countries obtained about 80 percent of their external borrowing for energy in the form of export-related and privately-financed capital.

Traditionally, commercial financial institutions have lent almost exclusively to the middle-income countries, as they are more capable of servicing external debt on market terms. As the international orientation of commercial banks is also influenced by the activities of their major corporate clients, these banks tend to lend more for oil and gas in projects where international oil companies are involved. In contrast, multilateral agencies and bilateral concessional capital flows to low-income oil importing countries account for about 30 percent of these institutions' total energy lending to developing countries.

On the whole, new commitments from export credit agencies and private financial institutions are now severely restricted by the degree of creditworthiness of the borrower. The same consideration may also restrict a developing country's ability to attract direct foreign investment. For middle-income countries whose creditworthiness is in question, as with most if not all low-income countries, expansion of multilateral and bilateral energy lending will be necessary if energy investment in these countries is to be expanded.

Expanded funding prospects for multilateral agencies in the future are mixed. Funding of the United Nations programs increased in 1984, the first increase since 1979, and then increased again in 1985. Funding of the African Development Fund was increased by 50 percent for the period 1984–86, reflecting the donors' concern for the problems of sub-Saharan Africa. But the Inter-American Development Bank's funding, which has evolved in the direction of growing cooperation with the private sector, has remained about the same. However, in the case of the Asian Development Bank, the United States has lagged behind in fulfilling its pledged contributions, a key factor in the Bank's "soft loan" fund being underfunded. The U.S. situation is a result of the Reagan Administration's concern that the private sector be more involved in recipient countries.

Funding for the World Bank and its affiliate, the IFC, looks secure, while funding for its IDA programs is uncertain. The energy commitments in the IDA program, which lends to the poorer countries,

are about 16 percent of the total World Bank energy commitments. However, the World Bank has recently given notice that although its lending for energy projects will remain 25 percent of all bank lending, it is increasing its role as an analytical, policy, and technical advisor and a catalyst for new funds for energy projects from non-Bank sources. In addition, the IFC in its latest five-year plan (1984–88) is expanding its role as a mobilizer of private capital for energy projects by increasing its commitments from $20 million to $100 million over this period—still a small sum relative to the requirements of the overall situation.

Indeed, if funding of energy projects is maintained by the multilateral institutions, or even slightly expanded, potential funding from the multilateral institutions will still not come close to compensating for the negative factors that will retard external and domestic capital formation for energy projects in the developing countries. Even this could be overly optimistic, particularly in the case of the OPEC funding because of current oil market conditions. This portends a significant capital shortfall for any domestic energy development plans the developing countries might have for the future.

D. Improving the Energy Situation of Developing Countries

A number of issues must be addressed if developing countries are going to be able to expand their domestic energy supplies and improve the efficiency of energy use to meet future needs, while at the same time avoiding further exacerbation of their balance-of-payments situations. These issues are affected by the evolving world economic and financial environment.

For example, some direct investment will be focused on the newly industrialized countries in Southeast Asia for the foreseeable future because of the projected high rate of economic growth in the region. Latin America, however, could receive less direct investment because of the current debt overhang, among other factors. Putting it another way, the countries in Latin America will have to make their investment terms at least as attractive as those in the Asian countries in order to lure foreign investment capital, that is, by providing credible assurances of their ability to repay loans and permitting the transfer of profits through the generation of foreign exchange.

These issues are also interrelated and interdependent. Addressing one issue successfully can mean the energy situation in the developing countries would improve, but not necessarily if the other issues are either not addressed or worsen. Such an issue not specifically addressed in this policy paper is the geological potential of a de-

veloping country's resource base—how it varies and its implications for the country.

An underlying objective is assumed in the treatment of the included issues—to encourage greater private sector participation, particularly foreign investment, in improving the energy situation in the developing countries. Critical factors point in this direction: 1) private market forces have a proven record of reacting to incentives created to stimulate energy supply development and greater efficiency of energy use; 2) the private sector in the OECD countries often has available capital and the necessary technical expertise; and 3) a number of OECD governments, especially the U.S. Government, are urging that greater emphasis be placed on private sector participation in official development assistance programs.

Thus, the key tasks ahead are first, to discern how the host government and bilateral and multilateral agencies can best support and encourage such private sector participation in appropriate energy projects; and second, how best to elicit greater involvement of the OECD private sector in the development of energy supply and efficient use in the developing countries.

1. *Issue:* What are the factors that will encourage foreign private energy investment in developing countries, that is, the opportunity to invest with assurances of an ability to earn and repatriate the return on investment?

A key factor is the willingness of developing countries to allow free market forces a greater influence over the development of their energy sectors. This would have a positive effect on attracting risk capital (equity capital) which is particularly important for projects in the exploratory and early developmental phases. Attracting equity financing would provide needed capital as well as the credit support necessary for commercial financing of projects. In order to attract equity investment, developing countries must provide more assurances that investors have the potential to earn an adequate return. Whether or not investors will be able to earn their return will depend on the host country's policies concerning pricing, taxes, required equity contributions, participation in management and decision-making, share of project revenues, access to markets, repatriation of earnings, and currency convertibility.

In addition, there are a number of factors that should be considered in light of the current state of agreements and contracts in each of the energy sectors.

Oil: There is no single ideal agreement or contract for development of oil resources. Each contract needs to be tailored to the specific

situation and conditions at hand, in light of the desires and needs of all parties. Oil companies have come to terms with the new contractual forms, and have developed ways of operating under production-sharing and service contracts to earn a reasonable return on investment. Some desirable features for such contracts include:

- Provisions that prevent double taxation in the host and home country (requires coordination with legislative and tax authorities);
- Designation of one government entity or "lead agency" to deal with regarding all areas of operation;
- Careful spelling out of each party's rights and obligations, disposition and pricing of production, and arbitration and resolution of disagreements;
- Adequate cost-recovery provisions;
- Reasonable work programs/commitments.

A contract should be carefully structured in order to be applicable to other results in addition to "the most likely outcome." This may allow the economic development of even small, high-cost fields. A contract that is structured to handle the optimistic scenario will be more likely to be judged fair in the eyes of the host country and therefore less likely to be subject to abrogation.

Increasing competition among developing countries to attract exploration spending by the transnational oil companies is prompting a growing liberalization of tax and investment regimes. Some countries, for example, are shortening the period of cost amortization, or are offering to share the risk capital by way of a joint venture arrangement.

Natural Gas: Recent gas agreements by Brazil and Pakistan illustrate the ingredients of gas policies being formulated by developing countries. It is perhaps too early to determine whether these agreements provide the right answer. The approaches are summarized below:[12]

- Under Brazil's new *service contracts*, a foreign investor finding gas stands to recover costs and receive a cash reward from the start of commercial output. The amount is set by a formula that takes into account international market prices, competing supply sources, and alternative fuels or feedstocks.
- Pakistan's *conventional tax and royalty regime* now provides negotiated prices on both "old" and "new" gas, aimed at achieving

various discounted cash flow rates of return on investment (and raising some of the world's lowest gas prices). "New" gas could eventually reach 90 percent of fuel oil parity.

It is seen as indispensable that developing nations assure contractors they can sell gas at realistic competitive values, and that a precise methodology for gas pricing be spelled out in the overall petroleum exploration agreement. Where commercial finds exceed local needs, exports must be allowed, or the state or others should be sold the excess. By contrast, most agreements now result in gas associated with oil simply being flared or sold to the state at cost, while non-associated finds are sometimes taken over by the state without compensation.

Coal and Geothermal: Major coal contracts in recent years have been negotiated with China and Colombia, and are nearing completion in Botswana, Madagascar, and Tanzania. These contracts tend to delegate management responsibilities to the mining companies and contain economic incentives, and are generally protected by stabilization guarantees against later changes.[13] Colombia's arrangement with the mining companies is different because the state enterprise shares a substantial amount of the project's financial burden in exchange for a significant portion of the project's revenues.

Investment contracts in geothermal energy have taken place in the Philippines and, most recently, in Indonesia. The essential issue in these agreements is the sale of the energy produced. Indonesia uses as a pricing mechanism a combination of a fixed price, an inflation escalator, and a mechanism tying petroleum price developments to geothermal energy prices. The government committed itself to purchasing the energy produced and allowed the companies involved foreign exchange privileges for the generated revenue.

Power Plants: New foreign investment resources have come primarily in the form of public financial flows, such as official bilateral or multilateral loans, often at concessional terms. Although some of these loans have been undertaken in conjunction with private foreign investment in the extractive industries, rarely is it found in public utilities. However, when private foreign involvement is found, it is usually as party to either a turnkey or technical assistance contract.[14]

Turnkey contracts have been important in the development of nuclear power plants in a number of developing countries such as Brazil. These contracts have also been used extensively as the basis of major infrastructure investments in a number of oil-exporting countries, notably in the Gulf region where firms from countries like Korea and Brazil have been successful in bidding for contracts. Tech-

nical assistance contracts have gained considerable importance in public utilities and infrastructure investments in many developing countries. One reason is that these contracts have often been used in projects involving official loans, and are required by the lenders.

Turnkey and technical assistance contracts can involve an investment of the contractor's equity, although they usually just supply the capital equipment and technical assistance.[15] It is the official lenders, notably the World Bank and the regional Banks, that often play a leading role as suppliers of capital.

Energy Conservation Projects[16]: Undertaking energy conservation measures in developing countries is often limited by the inability or the reluctance of energy consumers to finance such measures. Some commercial or industrial firms may have had access to energy-efficient production technologies, but lacked sufficient internal cash or an ability to raise capital. Other firms able to raise capital were reluctant for reasons which include: competition for available capital between energy-related investment opportunities and investments required to maintain or expand market share and production output level; and a lack of tax-related incentives needed to achieve an adequate return on an investment in conservation measures.

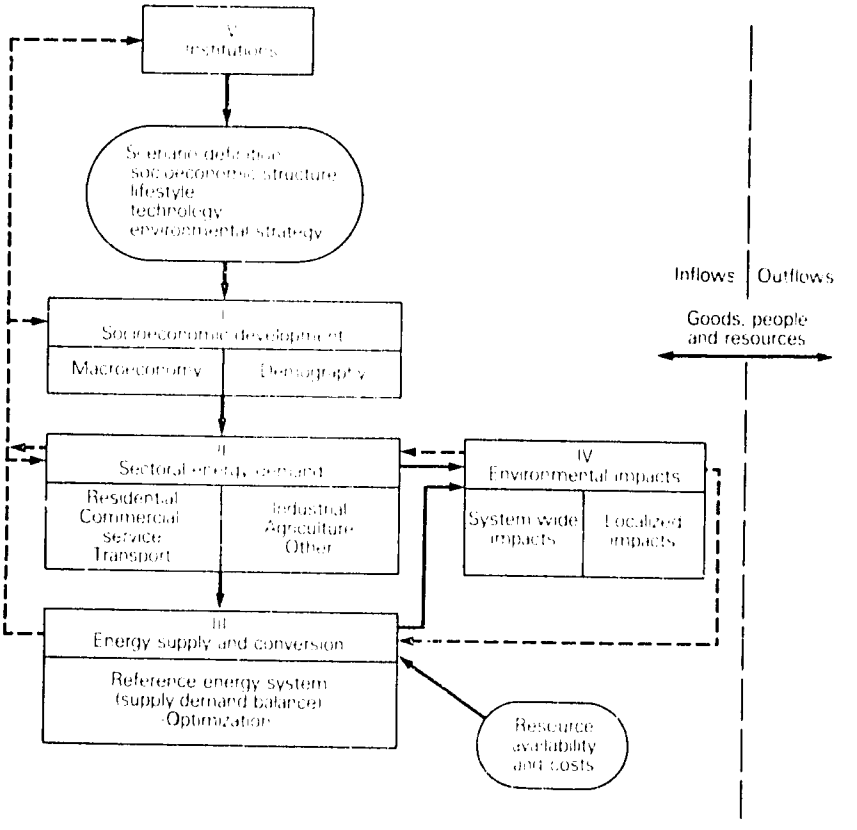
When the industrialized countries were confronted with such disincentives, innovative investment approaches were created to make energy conservation more attractive. These approaches have the potential for success in the developing world as well. They include: 1) a shared-savings arrangement; 2) a joint-venture arrangement between an energy user and an external investor; and 3) a variable-payment loan.[17]

Shared-savings arrangement: This arrangement pairs an energy user unable to finance an energy conservation measure with an external investor willing to finance such a project. In return for providing project financing, the investor receives a share of the value of energy savings and usually any tax-related benefits associated with ownership of the investment.

Joint-venture arrangement: This is essentially a variation of the shared-savings arrangement. The external investor provides most or all of the required capital investment and the energy user provides the site or opportunity for investment. In this case though, the investor and energy user have more flexibility in tailoring the joint venture arrangement to suit their specific risk/return objectives. This flexibility makes the arrangement attractive for the large industrial projects where both the energy user and the external investor wish to control the construction and operation of the project.

Variable-payment loan: In contrast to the other two arrangements, this one entails providing external funds through debt rather than equity-oriented financing, and ownership of the conservation improvement accordingly rests with the energy user. The payment schedule is structured so that the debt payment will probably be less than the value of energy savings during that period. In addition, loan payments can vary directly with the value of energy savings; that is, the higher the cash flow from the savings during a period, the higher the energy user's principal payment, perhaps offsetting lower savings and corresponding debt payment in another period.

Table III: Basic Areas Of Analysis In The Energy Planning Process



Source: Wesley K. Foell, "Energy Planning in Developing Countries", *Energy Policy*, Vol. 13, No. 4, August 1985, p. 351. Used with permission.

2. *Issue:* What factors must be stressed if the institutional structure in developing countries is going to become more effective in addressing their energy problems?

The experience of the last few years has highlighted the inadequacies of hastily drawn up *ad hoc* measures to meet the energy crisis. Effective management of the energy sector calls for the formulation of a comprehensive national energy plan and its efficient implementation. The long gestation periods of energy projects, their high capital intensity, the trade-offs between producing or importing more energy and lowering the current consumption of energy, and the possibilities of reducing the energy intensity of economic activities over time, all make energy planning a complex process. The implementation of energy plans calls for coordinated and sustained action on many fronts.

Efforts of such complexity and magnitude require appropriate institutional arrangements if they are to be successful. Although institutional arrangements differ in each country, the following are factors that are worthy of consideration for any developing country's institutional structure.

Integrative Analysis: The energy planning process has basic components which individually are subject to analysis; however, how the components interact and affect one another is perhaps even more critical to analyze. Major components of the energy planning process that have to be integrated include: socioeconomic development (determined by economic, financial, political, and demographic conditions); sectoral energy demand; energy supply and conversion; environmental impacts; and the country's institutional structure (see Table III on facing page).[18]

The Energy Planning Process: A mainstay of integrative analysis is the application of consistent sets of assumptions, such as about lifestyle and technology, across all sectors. Another is that the process should be continuous and iterating among the various components. And third, all the relevant institutions of the country must participate in the planning process and its implementation.

Technology Transfer Strategy: Two questions have to be asked when formulating a strategy for coping with the burden of energy imports. First, is the solution to reduce energy imports, or is it easier to pay for them by instituting a new non-energy policy such as export promotion, utilizing any comparative advantage a country might have in a particular sector of its economy? And second, if increasing domestic energy production is chosen, how should the transfer of the relevant technology take place—by importing the technology, by

fostering a domestic capability in the technology, or through a combination of these?

In either of the energy solution cases, most likely foreign licensing (or joint ventures) will be required, particularly if the technology is needed within a short period of time.[19] That is because the alternative to acquiring foreign technology is to invest in research and development (R&D) and design engineering on a scale comparable to that already undertaken by foreign suppliers. Experience shows that successive step jumps in technology generally cannot be mastered without sufficient design and operating experience at each stage.[20]

However, in cases where there is a desire to develop a technology capability over the long term, and local firms do not have the resources to undertake R&D on a sufficient scale, government assistance may be justified. This is why some developing country governments now sponsor energy technology institutes. The work of these institutes is geared to the requirements of client organizations and local equipment producers, as opposed to strictly scientific objectives which are divorced from industrial needs.

Rural Energy Promotion: The rural energy situation in many developing countries is now considered grave. Traditional energy sources such as fuelwood probably will, for many years to come, continue to supply many of the energy requirements in rural areas. Thus, there is a strong case for increasing this resource base through reforestation, through more efficient production and use, and through better control and management of the dwindling forest resources. In addition, a strong case can be made for the development and increased utilization of new and renewable sources of energy, initially to ease the pressure on traditional energy resources and eventually to shoulder a significant share of the energy requirements in the rural areas.

A number of technologies for the development and utilization of new and renewable sources of energy are already feasible; others are already in use.[21] Many of these technologies are modular in character and can have long-term advantages for the rural populations of the developing countries. They include solar energy, small scale hydropower, geothermal energy, wind energy, and technologies for biomass conversion. Determining the scale and type of technology needs careful examination such as economic and social analysis and the local capabilities for system maintenance.

Strategies to address the rural energy problem should be evolved as an integral part of national energy and rural development policies and programs. Institutions and training should be strengthened to identify needs, and then to design, select, and implement programs. To help assure adoption of the most useful, economical, and practical

systems, the private sector should be brought in at an early stage in the system selection process. Utilities in developing countries need to become familiar with renewable energy systems, as well as the advantages of private energy generation from decentralized systems, including cogeneration. These actions cannot be implemented without increased levels of financial commitment from the public and private sectors sharply focused on the most appropriate renewable systems for each country.

3. *Issue:* Should the energy financing and development role of the World Bank and the regional development banks be expanded? If so, how?

The World Bank and the regional development banks can play an expanded role in promoting private sector involvement in developing country energy projects.[22] The banks, including the World Bank's International Finance Corporation, can assist the private sector in the formation of government/private sector partnerships and thus increase the role of co-financing with private funding sources. Co-financing can help leverage limited resources as well as attract the participation of commercial lenders and other funding agencies, including export credit agencies, in energy projects.

Although the World Bank is the largest and most active agency involved in energy projects in developing countries, its lending is quite small relative to the investments required in this sector, and will most likely continue to be constrained by funding availability. In reacting to this, and also to the need to improve the investment climate in developing countries in order to stimulate greater commercial flows to them, the World Bank has taken several initiatives. First, it has upgraded its role as an analytical, policy, and technical advisor and as a catalyst for new energy project funds from non-Bank sources. Second, the Bank has revived its earlier proposal for a multilateral investment guarantee agency (MIGA), which was set aside in 1973 for lack of support by member countries.

Multilateral Investment Guarantee Agency: The basic objective of the proposed new multilateral investment guarantee agency is to encourage greater flows of resources to productive energy and non-energy enterprises in developing member countries by guaranteeing foreign investments against certain noncommercial risks: confiscation or nationalization, or exchange restrictions which prevent or limit the transfer of earnings. The agency will, in addition, furnish information on investment opportunities, prepare studies, give advice to its members on formulating and implementing policies to-

ward foreign investment, and cooperate with other international organizations engaged in related areas. The agency's operations are broadly delineated in its convention, elaborated in its policy rules, and more precisely defined in its contracts of guarantee. This will permit it sufficient flexibility to adjust coverage to changes in investment arrangements and gradually expand operations as it builds up financial reserves and gains experience.

This version of MIGA differs in many respects from previous proposals in which the agency would have no share capital and would have conducted operations exclusively on behalf of sponsoring member countries. The new features—which include primary reliance upon share capital, a willingness to leverage this capital, and a greater role for the host countries—should give the agency broader scope in which to operate and greater flexibility, thus making it of particular interest to developing countries.

Although the agency would focus primarily on private sector direct investment, eligible investments could include any other transfer of assets. The scope of eligible investments could be expanded as the agency's resources increase and it becomes better able to develop its risk-measurement rules. At the outset the investments covered might include equity participation and equity-type loans; eventually, they could also encompass profit-sharing, service, management and turnkey contracts, arrangements concerning industrial property rights, international leasing arrangements, and arrangements for the transfer of know-how and technology.

The proposal to establish the MIGA was approved by the World Bank's Board of Governors at the Annual Meeting in Korea in October 1985 and has been formally transmitted to member governments for ratification. It will enter into force upon the ratification by five capital-exporting and fifteen capital-importing member countries whose total subscriptions amount to at least $360 million.[23] While most industrial countries have their own political and transfer risk guarantee agencies, the advantages of a multilateral agency with broad powers, such as co-insurance and re-insurance capabilities, make the World Bank MIGA proposal deserving of full support.

4. *Issue:* Can the United States and other OECD governments do more to encourage energy development in developing countries?

In establishing their priorities, the United States and other OECD countries could give greater recognition to international investment and help reduce or eliminate measures impeding the free flow of investment worldwide. Income to OECD countries from greater for-

eign investment improves the balance of payments, enhances export capacity, creates domestic jobs, imports new technology, and improves productivity. Promoting foreign investment could come at the multilateral and bilateral levels. Bilaterally, the United States and other industrial countries continue to make impressive progress on promoting such investment by negotiating bilateral investment treaties.

Multilateral Approaches: Multilateral approaches include encouraging institutions such as OECD and the multi-national financial institutions to consider unresolved investment issues, including: 1) technology transfers—ensuring adequate patent protection with an added ability to ensure reasonable returns on research and development expenses; 2) national treatment—over the long term, seeking to achieve a comprehensive multilateral agreement on national treatment which would include developed and developing countries; and 3) nationalization, compensation, and disputes—seeking adequate dispute settlement arrangements and protection from expropriation which are critical elements in the assessment of the investment climate in any developing country.

United States Policy: On the unilateral level, new possibilities exist for the United States to promote private investment in energy. First, programs of the Eximbank and other government agencies could be strengthened to focus more on financing technical assistance and feasibility studies, as a preliminary step toward facilitating the financing of energy projects in developing countries. Expanding these programs could fund "soft currency" transactions, provide export credits in conjunction with aid funds, and perhaps provide tax relief in relation to imports from such projects to help obtain markets for the output of projects. Also the insurance programs of the Eximbank could be expanded to allow contractors to undertake projects in debt-burdened countries that would otherwise present too great a political or commercial risk.

Second, the Bureau for Private Enterprise (PRE) in AID could be upgraded to become more active in the international energy sector. Formed in 1982 to promote the use of private enterprise in development through a revolving loan fund and grant program, PRE has agri-business as its priority. The dual focus of energy and agriculture would be of benefit particularly to the lower-income developing countries where neither problem can be resolved alone. A more active PRE and a higher AID priority for energy programs could result in greater participation on the part of the U.S. business community in a developing country, an attractive complement to the usual AID

policy of dealing directly with the government of the developing country.

5. *Issue:* What can be done to encourage commercial banks to invest in developing countries for energy development?

Although large commercial banks in the developed countries have the financial capacity and a strong self-interest in helping to deal with the international indebtedness of the developing countries, a considerable slowdown in lending has taken place. Efforts to increase equity ownership by private enterprise will likely increase private commercial bank financing of energy projects. In addition, the World Bank and the International Monetary Fund need to encourage commercial banks to reverse this slowdown by a system of partial guarantees and cofinancing policies.

International Monetary Fund: If the path to better economic performance is to be smoothly managed, continued close involvement of the international financial community, including the International Monetary Fund, will remain vitally important. In appropriate cases the procedure of enhanced surveillance by the Fund can be a useful technique for providing analysis and policy advice. For some other countries, continued financial assistance from the Fund will be needed to encourage the participation of private lenders in financing a medium-term program of structural change in the country's economy. This is particularly true for the drought-stricken countries of sub-Saharan Africa.

At the Annual Meeting of the IMF in October 1985, it was agreed to set aside $2.7 billion for a special Trust Fund earmarked to help low-income developing countries, such as the sub-Saharan African countries, promote economic growth. The special fund would be financed by repayments due over the next three to four years on past loans made by the IMF to ease the shock of higher oil prices. The loans will be on concessional terms and will assist countries in making structural adjustments in their economies.[24]

At the same meeting, U.S. Treasury Secretary James Baker proposed that, in order to link resumed economic development in developing countries with continued efforts to deal with their external indebtedness, a concerted effort be made by the creditor banks in OECD countries, the IMF, the World Bank and other development banks, and the OECD governments. On condition that the debtor countries continue to redress their financial imbalances with IMF guidance and help, the creditor banks would provide up to $20 billion in new credits over a three-year period, and the World Bank

would provide non-project loans. Efforts are currently being made to carry out that plan.

World Bank Structural Loans and Guarantees: The World Bank could expand its program of structural-adjustment loans to developing countries. These loans are long-term and are considered well-suited to foster economic development in helping countries overcome current account deficits. The loans provide immediate, quick-disbursing balance-of-payments support so that countries can continue to import essential items needed to maintain levels of production and to finish investment projects. These loans also enable countries to expand exports by providing foreign exchange for inputs needed in export-oriented industries. Finally, the loans require that a country outline a broader adjustment program aimed at adapting the economy to the new international conditions. The United States has encouraged the World Bank to apply as much as 20 percent of its new lending to these kinds of loans, which could be worth up to $2.7 billion annually.

The World Bank also could expand its program of issuing partial guarantees for commercial lending to developing countries. Such a formula was recently tried in a $1 billion commercial loan to Chile, which was facilitated by a World Bank offer to guarantee $150 million. If expanded, this approach should give commercial banks more encouragement to lend to the developing world, since their risk would be shared by the World Bank.

E. Conclusions

1. To enhance economic development in developing countries, there should be a significant increase in participation and direct investment in energy development by OECD private sector institutions. This should be supported by OECD governments and the international multilateral institutions, such as the World Bank, the regional development banks, the United Nations, the Organization of Petroleum Exporting Countries, and the International Monetary Fund.

2. External investments are more likely to be made in response to opportunities in economies which are increasingly market-oriented. Such investments require a favorable policy environment, under which the prospect of returns on investment flow from a mutuality of interests on the part of both domestic and external institutions. Mutuality of interests can be expressed in terms of:

- realistic economic and energy development plans;
- provisions for repatriation of earnings and service on loans;

- complementary institutional infrastructures;
- supportive national policies and practices;
- mutually acceptable contracting practices;
- protection against non-commercial risks;
- the prospects of satisfactory results in the form of economic, political, and social benefits.

3. Additional actions can be taken by the developed and the developing nations, along with key international institutions, to facilitate the structuring and functioning of market-oriented decision-making in the developing world, thereby promoting the development of new opportunities for energy investment. These actions will add new impetus to energy investment in the developing countries, building on the strengths of domestic institutions of the developing countries, of OECD government institutions, and of the financial and energy institutions in the international private sector.

F. Recommendations

1. Developing countries are urged to undertake a systematic review of their national economic and energy policies, engaging in a program to enhance market-oriented decision-making, and to identify and promote private investment opportunities in the energy and related sectors. Special emphasis should be placed on market pricing, strategic economic and energy planning, institutional relationships, resource evaluation, supporting infrastructure, and the potential for direct investment by OECD private and public sector institutions and multilateral institutions in particular energy projects. To support these reviews, energy investment teams led by the World Bank should be assembled. They should consist of representatives from other multilateral institutions, OECD governments, and major private companies and financial institutions and would work with appropriate national, public and private institutions in the developing countries. Such teams would offer analytical assistance and act as a vehicle to sources of investment capital in the private, bilateral, and multilateral institutional sectors. This principal recommendation is based on the belief that the World Bank's presence and leadership and the catalytic role it has embarked upon could measurably encourage OECD private interests and developing country national interests to respond more constructively to each other.

2. Developing countries desirous of direct foreign investment in energy projects should encourage greater equity ownership by pri-

vate enterprise. In those countries where there are insufficient qualified private sector companies, government corporations would initially have to fill this role. In such cases, there should be provisions by which at a later date private companies could purchase the equity from the government company. Both foreign and domestic companies should make a reasonable contribution of their own funds in purchasing equity participation. This gives them a vested interest in identifying a sound project and in its efficient management. Foreign investors should contract to provide, on mutually satisfactory terms, the needed technology, supervision, and training of host country personnel.

3. Every effort should be made to meet, when possible, the aspirations of the developing countries with transnational companies offering in good faith to transfer their energy technology for a fair price as part of a total relationship between the developing country and the company. Technology does not stand still, and an industrial firm's continuing technological progress can often be enhanced by creative work on specific projects by the associate, licensee, or subsidiary in a developing country. World-wide sourcing of manufactured products is ongoing; managing world-wide technological development may be just ahead. As a result, good faith efforts in this arena would be very beneficial in encouraging foreign equity investment in developing countries.

4. The energy planning process of a developing country should integrate socioeconomic development (determined by economic, industrial, financial, political, and demographic conditions) with market pricing of energy supply and use, environmental impacts, and its institutional structure. Planning emphasis should include a strategy of energy technology transfer and rural energy promotion.

5. In order to attract risk capital, particularly in the form of equity investment, developing countries' investment policies must provide more assurance that investors will have a reasonable prospect of return commensurate with their investment and risks and be permitted to repatriate those profits. Whether or not investors will be able to earn a suitable return will depend to a large degree on the commercial risk taken and on the host country's policies concerning pricing, taxes, required equity contributions, share of project revenues, access to markets, repatriation of earnings, and currency convertibility.

6. The OECD countries should continue giving high priority to consideration of national treatment issues within the OECD and striving to achieve a comprehensive multilateral agreement on national treatment which would include both developed and developing

countries. In addition, OECD countries should do whatever they can to provide adequate arrangements to settle disputes and to provide protection from expropriation for their private sector. Two such measures are: to continue efforts to negotiate Bilateral Investment Treaties; and to participate in the World Bank's new Multilateral Investment Guarantee Agency which will provide insurance of non-commercial risks.[25]

7. The United States Government, in addition, should expand its efforts to promote greater private sector investment in developing countries. One way is to expand the international energy assistance program in the Agency for International Development, particularly its central Office of Energy which provides the bulk of technical and programmatic expertise and Bureau for Private Enterprise which promotes the use of private enterprise in development through a revolving loan fund and grant program. The Bureau currently has agribusiness as its priority; the dual focus of energy and agriculture would be of benefit particularly to the lower-income developing countries where neither problem can be resolved alone. A more active Bureau and AID energy staff promoting private sector initiatives could result in more active participation on the part of the U.S. business community in a developing country.

8. The United States Government could also strengthen the export finance programs of the Eximbank and other agencies to focus on technical assistance and feasibility studies which can play an important role in financing the development of energy projects in developing countries, e.g., expanding these programs to fund soft-currency transactions, to provide export credits in conjunction with bilateral aid funds, and perhaps provide tax relief in relation to imports from such projects to help secure markets for the output of projects. Continued U.S. Government efforts to end the abuse of mixed credits by foreign governments is applauded.

9. OECD countries and multilateral institutions should encourage commercial banks to invest in energy projects in developing countries. Efforts to increase equity ownership by private enterprise will likely increase private commercial bank financing of energy projects. OECD countries should also support the efforts of the multilateral institutions to stabilize the economies of the developing countries and to foster economic development, so as to create a more favorable investment atmosphere. These efforts include continued assistance from the International Monetary Fund and the possibility of the World Bank expanding its structural-adjustment loan program and its program of issuing partial guarantees to commercial lending to developing countries. For example, the IMF plan to set aside an

additional $2.7 billion in a Trust Fund for assisting low-income countries to promote economic growth is to be commended. The plan would provide funds with longer pay-back periods.

And finally, the Joint Working Group supports the proposal, introduced at the October 1985 meeting of the IMF and the World Bank in Seoul, Korea, that would, first, encourage U.S. commercial banks to increase their lending to financially-troubled developing countries by $20 billion over the next three years; and second, would call upon the World Bank along with the Asian Development Bank and other multilateral lending institutions, to increase their projected current annual lending rates from $18 billion to $27 billion over three years.

Notes

1. "Solving The Third World's Growth Crisis." *Business Week*. August 12, 1985. p. 36.

2. *World Economic Outlook*. IMF. October 1985. The estimate for 1986 is $896 billion.

3. World Bank. *The Energy Transition in Developing Countries*. Washington, D.C. World Bank. 1983. p. 69.

4. Table 45. *World Economic Outlook*. IMF. Washington, D.C. October 1985. p. 100.

5. *Ibid.*, p. 79.

6. *World Economic Outlook*. April 1985. *op. cit.* p. 57.

7. One participant suggested that there should also be an acknowledgment of the reluctance of international energy (mostly oil) companies to develop resources merely for internal use in countries where the deposits seem relatively small and insufficient to support large-scale exports. Yet from the host country's viewpoint such developments may be of great importance.

8. Sankar, T.L. "Institutional Aspects of Energy Planning and Plan Implementation." *Energy Planning in Developing Countries*. Oxford University Press. 1984. pp. 125-133.

9. World Bank. *The Energy Transition in Developing Countries*. Washington, D.C. World Bank. 1983. pp. 76-78.

10. *Budget of the United States Government*. Fiscal year 1986. U.S. Government Printing Office. February 4, 1985. pp. 8-21.

11. "The Ex-Im to Foreign Governments: Back Off." *Business Week*. November 18, 1985.

12. "Incentives Are the Key to World Gas." *Petroleum Intelligence Weekly*. New York. July 9, 1984. p. 4.

13. Walde, Thomas. "Third World Mineral Development in Crisis." *Journal of World Trade Law*. Volume 19, Number 1, January/February 1985, p. 11.

14. Oman, Charles. New Forms Of International Investment In Developing Countries. OECD. Paris. 1984. p. 64.

15. The newly evolving "enclave" concept would provide for external investment, ownership and operation of power plants; the external owner would sell power to national institutions for the period required to "pay off" this investment, with the power plants then reverting to national ownership.

16. Some ideas for this section came from: Fisher, Michael D. "Innovative Approach to Financing Energy Conservation Investments in Developing Countries." *Natural Resources Forum*. United Nations. New York. Volume 9. Number 2. May 1985. pp. 97–105.

17. *Ibid.* p. 98.

18. Foell, Wesley K. "Energy Planning In Developing Countries." *Energy Policy*. Volume 13, Number 4. Butterworth & Co. Great Britain. August 1985. p. 351.

19. John Chessire and John Surrey. "Energy Technology Acquisition For Third World Development." *Energy Policy*. Volume 13, Number 4. Butterworths. Great Britain. August 1985. p. 318.

20. *Ibid.*, p. 319.

21. Shem Arungu-Olende. "Rural Energy." *Natural Resources Forum*. United Nations. New York. Volume 8, Number 2, April 1984. p. 123.

22. See also Issue 5 for discussion of the Baker Plan which proposes that the role of the World Bank be expanded as one way to encourage U.S. commercial banks to invest in developing countries.

23. *IMF Survey*. October 25, 1985. p. 328.

24. *Ibid.*, pp. 305 and 329.

PART II

STATEMENT OF THE PROBLEM

CHAPTER 2

ENERGY PROBLEMS IN DEVELOPING COUNTRIES*

by the
Energy Department
World Bank

I. Introduction

The early 1986 decline in oil prices has provided some relief to the hard pressed economies of many oil importing developing countries. Nevertheless, energy issues continue to be a major concern of decision makers in these countries, as well as in most oil exporting developing countries. Energy investments remain large, and oil imports (or exports) still represent a major outlay (or source) of foreign exchange. Most importantly, the availability of adequate energy supplies at an acceptable cost is still a necessary condition for economic growth, and lower short-term oil prices will do little to resolve many of the longer-term problems of assuring adequate growth and the efficient production and allocation of energy supplies.

While the drop in crude oil prices on international markets in early 1986 attracted worldwide comment and reactions ranging from euphoria by oil consumers to despair on the part of high-priced oil producers, most of the fundamental energy-related problems identified in the 1970s have not disappeared. In fact, the oil price decline and the accompanying price-related uncertainties have created their own new set of problems for developing countries. Energy sector investment programs must now be re-examined. Fiscal policies need to be refocused. Issues related to increased fuel switching flexibility

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and near-term interfuel substitution must be addressed. And, of course, the plight of oil exporting developing countries such as Mexico, Nigeria, Indonesia, and Egypt, faced with large reductions in foreign exchange earnings, raises difficult questions regarding their near and intermediate term economic and financial prospects.

At the same time, fundamental longer-term energy problems still persist in developing countries. These include fuelwood shortages and deforestation, inadequate resource mobilization to support increasing commercial energy investment requirements, the chronically poor performance of many energy sector enterprises, and inefficiencies in the production and allocation of energy resources.

II. Oil Price Change and the Energy Sector: Investment and Fiscal Implications

Background

The oil producing industry responded to the high oil prices of the late seventies and early eighties at a pace determined primarily by technological limits. By the early 1980s relatively high cost oil in the North Sea, Alaska, Brazil, and India, among others, had been brought into production, and capital intensive gas transport systems had been developed in Algeria, Indonesia, Malaysia and the USSR, among others. At the same time, consumers invested in energy conservation measures in industry, transport and the residential sectors. Partly as a result of the energy conservation measures, energy/GDP ratios fell between 1970 and 1984 by 24 percent in the United States and 19 percent on average in other OECD countries. A shift into coal, natural gas, and nuclear power also reduced the share of oil in total energy consumption. The combined effect of greater non-OPEC oil production, interfuel substitution away from oil, and conservation reduced oil consumption in OECD countries from 46 percent of total commercial primary energy consumption in 1974 to 38 percent in 1984.

In late 1985, Saudi Arabia, together with Kuwait and the United Arab Emirates, decided to increase oil production, reportedly to recapture a "fair market share" of world oil production, in line with their official OPEC production quotas. The effect of this sudden increase in production, acting on an already over supplied oil market, fueled an international crude oil price softening in which oil prices fell from around US$30 per barrel (US$220 per ton) in November 1985 to around US$15 per barrel in April 1986, with isolated cargos occasionally selling on the spot market for US$10 per barrel or less.

In the short run, the fall in exploration activities worldwide brought about by the reduced price of oil will likely reduce the reserve-to-

production capacity in many countries. In the longer run, a reduced petroleum production capacity in many countries outside the Middle East could result in a renewed upward pressure on prices. However, there are a number of factors which could potentially dampen any future price rebound and keep the equilibrium price of oil below peak levels (in real terms) reached in 1980. Firs , partly because of the fuel diversification objectives and the avail ibility of low cost domestic supplies, gas and coal could further pe netrate the oil market. Second, energy conservation options have not been fully explored in many countries. Third, in the transport sector where petroleum fuels have been the only efficient energy source apart from small amounts of LPG and CNG, technology improved during the period 1975–85 in the production of methanol and ga , oil from natural gas, and synthetic gasoline from gas and coal, at prices competitive with crude oil of no more than US$40 per barrel in 1985 dollars.

This therefore means that two key threshold levels of oil prices might be projected. The first, (above, for example, the US$20/bbl range), at which fuel oil loses share to coal and in some regions natural gas in the power and industrial end-use markets. The second threshold (above, for example, US$40/bbl in 1985 terms), where alternative transport fuels and new fuels begin to look attractive on a large scale.

The Fuel Substitution and Investment Impact of the 1986 Reduction in Oil Prices

Oil price changes clearly affect consumption of and ultimately investment in all commercial and non-commercial energy sources. In countries with less regulated energy markets, the recent fall in oil prices has been partially or completely passed on to consumers. This has in some instances already increased the demand for oil products. In the many developing countries where fuel prices and supplies are more heavily regulated, there has been more of a lag in any market reaction to new lower international oil prices. While flexibility in fuel switching in the short-run is in many instances limited, in the longer run, provided oil prices remain below alternative fuel prices, oil consumption will certainly increase.

One consequence of the greater oil price uncertainty over the foreseeable future is expected to be that larger energy consumers will consider investing in more flexible equipment to increase fuel switching capacity in order to take advantage of any future price fluctuations. This has already partially happened in many developed countries. The same process of fuel diversification and investment

in fuel switching capacity is expected to proceed in many of the middle income developing countries. Some of the poorer developing countries, however, may have difficulty bearing the higher capital cost of investments that allow for greater fuel flexibility (e.g. dual fired power plants). They could therefore remain relatively more vulnerable to sudden fuel price fluctuations.

Natural gas investments most likely to be affected by lower fuel oil prices are those involving longer distance pipelines and liquefied natural gas, because of the very high up-front fixed costs. Natural gas development for domestic use in countries with lower cost supplies and relatively short distances to the market should, in many instances, remain economically attractive. Also, where gas pipeline networks have already been constructed, as in Bangladesh, Pakistan, Yugoslavia and Argentina, the incremental cost of additional gas production will likely be lower or at the least no greater than fuel oil costs. Where gas resources have been discovered but not developed, as in Tanzania and Papua New Guinea, the choice between gas and fuel oil is likely to be more difficult, and will depend, to a large extent, on the potential size of the domestic market and on the relative cost of alternative fuels.

The power sector consumes the largest share of public sector investment in many developing countries. The issues of planning in this sector have also been made more complex given current energy price uncertainties. The severe domestic and foreign exchange resource constraints and debt service obligations that many developing countries face (especially those in Latin America), together with uncertainties of fuel prices and exchange rates, have tended to increase the attractiveness (in power system planning) of those options characterized by flexibility, shorter construction periods, and lower capital costs. New power plants constructed at tidewater to use imported fuels might in many instances be equipped for dual firing (coal/oil) to take advantage of any future shifts in relative fuel prices. Thus, for a relatively modest increase in capital costs, such countries would be able to acquire greater flexibility in fuel switching, in a period of potential significant fuel price volatility. More generally, thermal plants with lower capital costs, shorter construction periods and smaller sizes could provide greater flexibility in adapting to changing supply costs and demand conditions.

The renewable energy sector in most developing countries should not be affected in a major way by lower oil prices. There may be some additional substitution at the margin in the urban household energy area, of kerosene for woodfuels, but, in general, the lower price of oil alone should not cause major near-term changes in the

consumption for energy generation purposes of wood products, animal wastes, and other residue energy sources. Wind and solar applications have not in the past provided large amounts of energy in developing countries, and in any case, the applications were very site-specific. This probably will not change.

Fuel Pricing and Fiscal Policy Implications of Recent Changes in Oil Prices

When oil prices were increasing during the 1970s, most oil importing countries quickly realized the need to increase the price of petroleum products to international price levels. This was usually palatable, first, because the fiscal impact of subsidizing oil prices was larger than most governments could absorb, particularly the oil importing countries, and second, because subsidizing prices would increase consumption and result in even higher subsidies. By the late 1970s and early 1980s in most countries the petroleum price adjustment process was completed in terms of price levels, although tight controls on petroleum prices kept them rigid in terms of adjusting quickly to international fluctuations. There were, however, exceptions to the price adjustment process, in particular in a few countries that were net oil exporters. In the countries that maintained low petroleum product prices during the 1970s, demand did grow at relatively high rates. Also, investment decisions tended to favor energy intensive industries and consumption patterns.

While many factors must be taken into account in evaluating reasons for differences in rates of economic growth in individual countries during the 1970s, the evidence on one point is fairly clear. Many of the countries that fostered more market oriented economies and that increased petroleum prices to reflect international levels generally had relatively strong economic growth. On the other hand, a number of oil importing countries where the public sector influence dominated the economy and the government shielded consumers from balance of payments difficulties experienced relatively stagnant economic growth.

The current situation of reduced petroleum prices is not, however, symmetrical with that of the rising prices of the 1970s. Windfall gains can give a country more room for maneuvering. Energy policy makers in many countries are now facing decisions on how the current benefits from the fall in oil prices should be allocated between the government, consumers and energy companies. To what degree should retail prices follow the market? Should prices be maintained at higher levels with government capturing the benefits for fiscal reasons? Should the incentives aimed at encouraging oil companies

to explore be maintained, improved or reduced? Should oil importers defer some domestic energy developments? What should be the near-term strategy for further improving energy conservation and efficiency?

The application of strict economic efficiency criteria would suggest that fuel prices be adjusted to reflect international market levels. Among other things, this would assist export industries to remain competitive. However, in some countries facing large public sector deficits, governments could be tempted to reap the benefits of lower oil prices by increasing fiscal revenues. In those countries government should, nevertheless, carefully analyze the means by which revenues are to be raised; are fuel taxes an optimal way to raise fiscal revenues as compared to, for example, taxes on energy enterprise profits.

Apart from economic efficiency or fiscal criteria, it is also important that policy makers consider political criteria in adjusting prices. In many countries, while downward price adjustments are relatively easy, there have historically been major political and social problems involved in increasing prices. Governments in adjusting shortrun prices should take into account the major uncertainties and probable price fluctuations in the petroleum market in the foreseeable future. Partly as a result, care should be taken that energy efficiency programs are not arbitrarily abandoned and that current lower oil prices do not unnecessarily detract attention from efficiency in use.

III. Enterprise Efficiency—The Fundamental Longer-Term Energy Sector Issue

In spite of the near-term decline in oil-related investments resulting from the decline in oil prices, overall energy-related investments in developing countries will remain high, requiring large amounts of financial resources often in conditions of extreme resource scarcity. To assist in minimizing the magnitude of this new investment and to attract capital for it, developing countries must, among other things, set energy prices to reflect real costs, increase energy sector institutional and organizational efficiency, strengthen market forces, and, where feasible, increase private participation in energy enterprises. In fact, these factors are directly linked. That is, by creating an environment in which investment funds can be attracted from a variety of government and non-governmental sources, countries must often also provide an environment in which there are incentives to increase allocative and management efficiency, and vice versa.

In many ways, the problems of inefficiency in the energy sector are similar to those found in other sectors in developing countries. The difference is that the energy sector is larger than most other sectors, absorbs such a high proportion of total government investment, and that bottlenecks in energy supply have multiple impacts on the rest of the economy.

Sector Efficiency

In many developing countries during the last 35 years several factors, including economies of scale, nationalistic feelings and the desire to eliminate foreign ownership of what are sometimes deemed to be essential sectors of the economy, have resulted in a trend towards large, centralized government-controlled energy and industry enterprises. In the 1970s, especially following the rapid rise in oil prices, the perceived need to shift towards new least-cost power system configurations involving more lumpy, capital-intensive projects (hydro, coal, nuclear) accelerated this process. This was partly because of the reluctance or inability of private firms to undertake expensive and long-term investments given the economic and political uncertainties inherent in many developing countries. Similarly, government policies which do not encourage private ownership, which do not allow legitimate increases in financing, wage and fuel costs to be passed on to consumers, and the uncertain prospects of the timely development and availability of indigenous resources (gas, coal, geothermal, water disputes) have also on occasion served as a deterrent to private investment.

In conjunction with the reduction of private ownership in the energy sector in many developing countries over the past decade, there have been compounding effects of relatively rapid growth, increasing technical complexity, uncertainty of future costs and energy supplies, increased uncertainty about demand forecasts and the magnitude of the financial resources required, and strong social and political pressures in part arising from significant price inflation. These in turn have strained management resources and have resulted in more rigid government controls and regulation.

Lack of Autonomy for Government-Owned Energy Enterprises

Despite achieving some economies of scale and possibly some improved coordination in planning, overall this increased dominance of large, government-owned energy producing and consuming enterprises in developing countries has coincided in many cases with a marked deterioration in performance.

While numerous problems have plagued developing country energy enterprises, it can be argued that the most pervasive has been undue government interference in organizational and operational matters which should best be left to senior enterprise management. Among other things this interference has influenced procurement decisions, sometimes mitigates against the choice of least-cost production options, results in an inability to raise prices to meet revenue requirements, restricts access to foreign exchange, mandates low salaries tied to civil service levels and promotes excessive staffing. This has in turn brought about generally inadequate enterprise management and organization, a flight of experienced and capable staff due to uncompetitive employment conditions, weak planning and demand forecasting, inefficient operation and maintenance, high technical and non-technical losses as well as weak financial monitoring, controls and collections.

To begin to reverse situations such as this, incentives must be restored in developing countries for energy enterprise managers to be cost-conscious and efficient, and to offer responsive and reliable service and products to consumers. Given that managerial training and experience in developing countries is generally the most scarce resource, it is critical that energy sector issues of various complexities be addressed by that level of management best suited to analyze the problem and implement a solution. This means that senior government, ministry-level officials should address only those issues related to broad sector policy, strategy, and performance expectations.

Organizing publicly-owned energy enterprises as corporations with their own board of directors (a board which includes some representation from consumers) is a first step towards prioritizing sectorial management responsibilities. Experience has shown that adequate professional management autonomy is difficult to attain in developing countries when energy and industry enterprises are more closely tied to government, such as being a part of a government department.

With senior government officials focusing on the critical issues related to energy sector strategy, policy and global expectations for enterprise performance, enterprise management could be relatively free from day-to-day government interference. To the extent possible, energy enterprise management should be assured of a continuity of the top management team even in the face of frequent political changes in the government. They should not have to secure government approval for normal technical, procurement and expenditure decisions. Top enterprise management should be able to make these decisions in the course of implementing the investment, operations and performance program agreed with government, and within national government development policy and any regulatory guidelines.

Government must discuss with energy enterprise management any relevant national macroeconomic and social goals and the exact extent to which government finds it necessary for the enterprise to trade off efficiency-oriented pricing and investment program activities for more global national and socio-political objectives. In particular, agreement should be reached on any designated financial cross subsidies to be maintained within the sector (such as kerosene subsidies or lifeline power tariffs) and on any specific investment to be undertaken which may be financially marginal (rural electrification). In reaching these agreements, energy enterprise management should clearly spell out the net financial and to the extent possible the economic efficiency costs of such programs, so that governmental officials can explicitly weigh these costs against the perceived benefits in social, political or macroeconomic terms.

In granting a wide degree of managerial autonomy, the government would agree with senior enterprise management on a set of specific objectives which the enterprise would pursue, and on a set of indicators which would be monitored by government which reflect senior management's success or failure in pursuing the agreed objectives. At regular intervals, government and consumer representatives together with senior enterprise management would review the indicators and discuss performance problems.

Given the above, government should expect the management of the autonomous public sector energy enterprise to pursue the agreed performance objectives, implement agreed programs on time and within budget, and follow the policies laid down by its board of directors. Particularly in developing countries where government resources are at a premium, the government should expect the enterprise to pay normal taxes and duties, market rates of interest for all new debt including that from government, and dividends on government equity at a rate that would attract equity capital to enterprises with similar risk profiles. Government officials must also be assured that equipment procurement procedures of the enterprise are sufficiently transparent to minimize the possibility of a situation developing in which there are conflicting objectives with regard to procurement. Such problems have been minimized in a number of countries by procuring as much equipment as possible through some form of competitive bidding, with strict bid evaluation rules being adhered to.

Enterprise Management

In conjunction with restructuring the sector, major changes could also be made by management within many energy enterprises. The enterprise's organizational structure may be inadequate for the size

of the sector development effort required. Job descriptions and requirements, service standards and staffing norms, and lines of delegation of authority are in many instances not well defined. Administrative and financial controls are loose, and in some areas, non-existent. Management is timid and lacks objectives, personal work programs, and accountability. Financial management has little influence on planning and day-to-day decisions. Sufficiently comprehensive management reporting and information systems which address each level of management and which can be used to hold middle- and low-level management accountable are not in place. No one unit is responsible for long-range fundamental planning and economic analysis. Commercial forms of accounting are often not used or do not produce timely signals for decision making and for assessing performance. Billing and collection of receivables are slow and not well monitored, with few sanctions (such as disconnection) available to management; among the worst nonpayment offenders in many developing countries are government agencies. Finally, in many instances decentralization of administrative work and of technical, operational, and billing and collection responsibilities are unduly delayed as the size and complexity of the enterprise increases.

Fundamental to dealing with these issues within a typical growing and increasingly complex public sector energy enterprise in a developing country is the principle of delegation. This involves the 'freeing up' of all levels of enterprise management from the day-to-day management of activities and people that lower-level managers could manage as or more effectively. Specifically, in many developing country enterprises, middle managers are not yet delegated responsibility for all of the client services in a given area or region. If adequate delegation were undertaken, provided the middle-level staff are trained and competent, senior managers would only be concerned with providing the area or functional managers with clear service, output, distribution, or sales objectives to be monitored through agreed performance indicators, the means to achieve them, the latitude to innovate to improve supplies or service at lower cost, and the opportunity to seek training in modern management techniques and systems.

Divestiture: Other Options for Energy Sector Organization

The natural monopoly characteristics of some energy enterprise functions, as well as the perceived national interest to use energy enterprises as a general policy tool, are in many countries accepted as sufficient reasons for maintaining large public sector monopoly organizations. Nevertheless, given the observed problems inherent

in stimulating management of developing country monopoly enterprises to be cost-conscious, innovative, and responsive to consumer needs, there may be a need for more fundamental change. It could be worthwhile to consider trading off some amount of the perceived economies of scale in some energy enterprises for other organizational structures which provide a greater built-in set of incentives for management efficiency and responsiveness to consumers. In particular, varying the forms of ownership and regulation in the various energy subsectors should be considered.

The options for variations in ownership and, if necessary, regulation are numerous. Options for private and cooperative ownership of energy enterprises could include both local and foreign participation as well as joint ventures. As long as a given regulatory framework prevails, it can be argued that the form of ownership (private or public) would not by itself affect operating efficiency. The main point is that, to the extent possible, the introduction of competitive market forces should be encouraged. One means by which this might be achieved could be for governments to divest themselves of either all or part of some government-owned enterprises, functions, or organizational structures. In so doing they might provide an environment in which governments, enterprise managements, and energy consumers are all better off.

A first step towards divestiture could be for government-owned energy enterprises to competitively contract out activities or functions better handled by others. For example, there are opportunities for a power, oil or gas company to increase reliance on competitive subcontracting. Obvious candidates, which many companies already subcontract on the basis of competitive bidding, include civil works such as buildings, dams, tunnels, ducts, pipelines, access roads and towers, seismic surveys, drilling, well servicing, etc. Power and gas companies have even subcontracted on a competitive basis the installation of local distribution networks. Depending on available local expertise, some portions of the billing and collection process, meter reading, or meter or other routine maintenance activities can be subcontracted or involve outside entities. Among the advantages of such arrangements have been lower costs and greater programming flexibility brought about partly by a reduction in problems associated with public sector labor unions, work rules and general 'featherbedding'.

Also, in the power and gas sectors, some degree of enterprise management independence (and certainly a delegation of responsibility) might be gained by the separation of distribution (retail) functions from bulk supply (field development/generation and transmission)

functions. A possible case would be completely independent organizations for field development/generation, bulk transmission and retail distribution.

There are also opportunities for divestiture on a spatial basis. For example, larger countries can, and sometimes do, choose to have independent regional power or gas grids and numerous private petroleum distribution companies competing in different parts of the country. Power and gas distribution companies could be separate by municipality, with perhaps limited overlap in some fringe franchise areas, and have the right to purchase from various suppliers, when feasible. If private ownership were allowed, one advantage might be that at least the large power and gas consumers could also be legitimate shareholders who would be concerned not only with service efficiency but also with the financial viability of the company.

Power generation also has potential for efficiency improvements through divestiture. While the bulk power transmission and distribution functions might be regarded as having more natural monopoly carrier type characteristics in most developing countries, this is not so with generation. In fact, there is substantial scope for competition in power generation with independent (perhaps foreign-owned enclave) producers (or cogenerators) selling to a central grid (or common carrier), as in the case of large industrial cogeneration. For example, in the United States the Public Utilities Regulatory Policies Act of 1978 (PURPA) specifically encourages small privately owned suppliers to generate electricity in various ways for sale to the public grid. As a result there are now a large number of small companies producing and selling electricity presumably at costs below those incurred by some large utilities through conventional generation. Similar laws have been passed elsewhere and are beginning to have an impact.

In fact, with appropriate legislation allowing the breakup of national or regional power monopolies and with innovative contractual arrangements, widespread cogeneration and free generation might be encouraged. Larger countries might find small entrepreneurs ready to invest in small hydro or similar generation facilties. The advantage to the power company would be a de-emphasis on large lumpy capital-intensive projects together with the fact that the cogeneration and free generation companies would put up all or part of the capital and be paid only out of revenues from power sold at guaranteed prices. For larger enclave generation facilities (perhaps peat, coal, or nuclear), the concept would be that a foreign investor put up the plant, mobilize equity and other financing, operate and maintain the plant for an agreed period, and be repaid out of power sold at guaranteed prices convertible in foreign currency.

IV. Energy Sector Investment Financing Issues and Options

As economic activity picks up, commercial energy demand in the developing countries could grow at a rate close to 4 percent, which is substantially above the projected growth in world oil demand. Given such projections, one of the primary problems developing countries will face over the next decade is that of how to finance the resources necessary to meet demand.

Already in the early 1980s, domestic energy investments accounted for about 25 percent of total public sector investment in developing countries with, as can be seen from Table I below, wide variations among countries.

Even with lower oil prices, the long-term financing requirements of the energy sector will remain large, especially when considered in relation to developing countries' ability to mobilize new capital. Estimates of new energy investment necessary to support a 4 percent average annual growth rate in commercial energy demand in developing countries have been as high as US$80 billion per year. Of this amount, roughly 70 percent could be for electric power and the balance for coal, oil and gas.

In the power sector in developing countries, if the growth of demand were to be 6 percent per year, 285,000 megawatts of new generation capacity would be required over the next ten years. Based on a generation mix of 55 percent thermal, 35 percent hydro and 10 percent nuclear, the investment required for an integrated power system expansion of this magnitude would be about US$560 billion, or US$56 billion per year, not counting additional investment needed to replace generating capacity being retired. In most countries the financial and technical constraints are such that the government will be unable to find sufficient financing and technical manpower to implement such an investment program. They will be unable to

TABLE I: Estimated Annual Energy Investment as a Percent of Annual Total Public Investment During the Early 1980s

Over 40%	30–40%	20–30%	10–20%	0–10%
Argentina	Ecuador	Botswana	Benin	Ethiopia
Brazil	India	China	Egypt	
Columbia	Pakistan	Costa Rica	Ghana	
Korea	Philippines	Liberia	Jamaica	
Mexico	Turkey	Nepal	Morocco	
			Nigeria	
			Sudan	

Source: World Bank data.

obtain the resources, among other reasons, because consistently low power tariffs do not allow sufficient generation of the funds internally, because the government tax base cannot support higher government equity contributions, and because for many countries foreign borrowing is now being tightly constrained.

The environment for the power sector as well as other energy sectors is, therefore, one of financial constraint, both in foreign exchange and domestic currency. Even after a successful effort to minimize the capital costs of energy investment programs, the financing requirements for developing countries will remain substantial. In the power sector the major action required to mobilize domestic resources will be to raise power tariffs to a level which will finance a reasonable share of the investment program, say at least 25 percent. For many developing countries, the tariff increase required to accomplish this would be in the range of 25 to 75 percent in real terms. Such an increase will be difficult for many countries to implement.

In the petroleum sector, the financial problem is somewhat different, since in most developing countries the majority of the exploration and development work is carried out by international oil companies (IOCs). Reduced oil prices have brought about a substantial decline in aggregate investment by IOCs, worldwide. The implications for developing countries are clear. To attract additional IOC investments, the acreage offered must be clearly promising and show a capability for low cost production, and the joint venture terms must be attractive. Equity participation from the IOCs will only be available where expected returns are high. This situation will prevail until uncertainties are reduced and oil price expectations are substantially more optimistic than they are today. Government oil planning strategists must therefore concentrate on looking for ways to maintain at least a minimal level of foreign expertise and risk taking, for which the IOCs have historically been well qualified, with the government perhaps providing a higher percentage of front and risk capital. In exchange, contracts could be structured so that the government would get a greater proportion of the benefits from substantially higher world oil prices, when and if prices rise.

At the same time, developing countries should consider newer and more innovative approaches to energy sector financing. The following is a selection of instruments and approaches being explored in a number of developing countries. Most of them are already in use in industrialized countries.

(a) Non-Recourse and Limited-Recourse Financing (also known as Project Financing)—In this type of financing lenders do not have recourse to assets of shareholders other than those in the specific

project financed. The lenders appraise the project and rely exclusively on the cash flow from the project itself to cover the debt service payments. This type of financing does not represent a use of countries' or investors' general credit which is one of its principal attractions. Several developing countries are considering the use of this instrument, including Turkey and Pakistan.

(b) Leasing—This instrument can take many forms and may include individual pieces of equipment or the whole plant. In some cases assets are owned by local investors and in others by foreign investors in which case it is known as cross-border leasing. One variation of a leasing arrangement would be to have a power utility sell existing generation plant to private investors to operate, and agree to buy power at rates which would provide a satisfactory return to the shareholders. The proceeds of the sale would be a source of additional financing for the utility. The advantage to the private sector investor is that there is an immediate return on investment. A privately owned utility in India recently sold some assets and leased them back, enabling the utility to free funds for other purposes while continuing to use the assets. Indonesia is also considering lease financing for some projects.

(c) Private Power Generation or Distribution—One objective of this approach is to transfer from publicly owned utilities to third parties the burden of financing additional generating or distribution capacity. Private power generation may take the form of cogeneration or free generation. In the case of free generation, the utility would contract to buy the power at a price which would cover the debt service on the generation investment and provide a return to the private shareholders. For co-generation, the national utility could agree to buy power at rates which are equal to its avoided costs. Large private firms, suppliers of equipment, and local investors in joint ventures could have an interest in these types of operations. As discussed earlier, non utility free power generation and co-generation has grown substantially in the United States as the result of the PURPA legislation. Pakistan and Turkey, among others, have also adopted policies to allow private-sector power generation, and several other countries are drafting such legislation. Private investors in distribution systems could buy power from the national company or private sources and sell at a mark-up enabling an adequate return on investment. Local investors may have an interest in this type of arrangement.

(d) Counter-trade—Some countries facing foreign exchange constraints are making deals to pay for imports of energy related equipment, in whole or in part, with domestically produced goods.

(e) Development of Instruments to Finance Local Costs—Many ideas are being explored in different countries to help finance local investment costs, which in some cases are considered a more critical problem than obtaining foreign exchange financing. At the root of the problem is the need for instruments that are attractive to local investors. In some cases this implies the need to offset the loss of value of the currency because of local inflation. In other cases the investment must compete with alternatives outside the country to prevent capital flight. Another possibility is the creation of financial intermediaries capable of raising capital for a number of independent companies. In Columbia and India, specialized financial entities have been created (or are in the process of being created) to serve power sector institutions.

(f) Revenue Bonds—These are bonds with a yield tied to the profitability of the entity. Such an instrument can result in the formation of a constituency that supports adequate pricing policies for the issuing company.

(g) Tax-exempt Bond Issues—In India, the National Thermal Power Corporation recently successfully issued tax-exempt bonds similar to those issued by many government-owned utilities in the United States.

(h) Sale of Electricity Futures—Large consumers interested in avoiding electricity price fluctuations may be interested in purchasing from a power company or large cogenerator the commitment to supply certain amounts of electricity in the future at an agreed price. Such consumers potentially include export-oriented industries.

(i) The Multilateral Investment Guarantee Agency (MIGA)—This is a new agency created by the World Bank, expected to be operational in 1987, to promote the flow of international investments to developing countries. It will, for a fee, provide guarantees against four categories of non-commercial risks which would otherwise be born directly by the lender or investor:

i) The transfer risk resulting from host government restrictions on conversion and transfer of foreign exchange;

ii) The risk of loss resulting from legislative action or administrative action or omission of the host government which has the effect of depriving the owner of his ownership, control, or substantial benefit from his investment;

iii) The risk resulting from the repudiation of a contract by the host government when the investor has no access to a competent forum, plus reasonable delays, or is unable to enforce a final judgment; and

iv) War and civil disturbance risk.

V. A Country Action Summary

The energy sector will continue to absorb a large share of developing country investment and to be an important arena for government policy initiatives. In addition to policies for the continued growth of the energy sector, developing country governments will need to place particular emphasis on efficient pricing, institutional and organizational ways to improve sector and energy enterprise efficiency, issues related to investment decisions for interfuel substitution under conditions of uncertainty, innovative financing options, and the development of oil and gas resources, where feasible. Decisions about power generation and heavy industry investments will depend to a large extent on questions related to efficient pricing and interfuel substitution. New investment plans will need to be analyzed in greater detail, and with a more critical eye to flexibility in primary energy sources, given the uncertainty introduced by potentially volatile oil prices over the next few years. Many developing countries will, therefore, need to introduce additional methods for risk minimization into their energy decision making process, such as blending smaller, shorter life, more flexible power plants with much larger longer-life hydro plants and in some instances nuclear power plants.

Lower oil prices have forced both major international oil companies (IOCs) and national oil companies (NOCs) to greatly restrict discretionary outlays for exploration and development, even in countries that have relatively good prospects. There will, therefore, be a trend towards more selectivity and smaller financial commitments in IOC exploration programs. If the developing countries that have exploration potential wish to avoid a collapse in their exploration programs, they will have to adjust to the new situation by (a) making more attractive areas available to IOCs, (b) negotiating more flexible exploration contracts that can provide for better returns to the IOCs during periods of low prices, but perhaps allow the country to recapture a larger share if prices rise, and (c) allowing IOCs to stretch out their work commitments and commit themselves to stepwise decision making. Relatively high cost oil producing countries might also consider postponing new oil field exploration and development on the grounds that volatile oil prices could, during the next few years, fall as well as increase.

With less of a cushion of large profits due to high prices, national oil and coal enterprises, which were previously protected from competition, will need to consider ways to restructure and to introduce increased competitive efficiency. New institutional frameworks will

be needed for expanding foreign private investment in the petroleum and coal sectors, wherever this is an economically viable alternative. In some cases IOCs may be reluctant or unable to invest in the production of resources that are economically attractive for the developing country, but are of low financial priority for the IOC. In this case NOCs may wish to consider financing such ventures through farming or through other innovative financial packaging arrangements that would secure the technical expertise of the IOC, but would reduce the drain on limited financial resources. Of course, such undertakings need to be reviewed in light of the lower obtainable profit margins and the subsequent need for greater emphasis on operating and management efficiency. Because of the large initial investment required for gas transport systems (LNG or pipelines), lower energy prices have narrowed the scope for new natural gas developments that require long distance transport systems. Gas development will require more careful study of the project's potential market, technical and financial design, and implementation. As with other capital intensive, long-lived energy projects, adequate long-term financing and guaranteed early full capacity utilization will be essential elements in obtaining an acceptable cash flow during the early years of operation.

Finally, for developing countries to maintain robust energy investment programs effectively, and with the minimum accrual of further debt, innovative financial options will have to be pursued. The institutional base for sector growth may also need to be restructured to introduce increased market forces, enhance managerial efficiency, and broaden the scope for private sector involvement, both domestic and international. The merits of the various sector organizational options would of course have to be weighed in each individual case. Nevertheless, in all cases the basis of the decision would be the extent to which possible losses in scale economies and some sector coordination are more than offset by built-in incentives for improved energy enterprise management efficiency and sector development flexibility.

While options for introducing increased market forces and sector and enterprise divestiture should be first explored, in instances in which some monopoly organizations or functions remain, the principles followed must be that: (a) energy enterprise management autonomy must be assured, (b) whatever level of government is relevant must negotiate performance principles and objectives for any primary local or regional monopoly energy enterprises (including social objectives) and agree on specific monitoring indicators with each enterprise's management, and (c) where the introduction of market

forces is not feasible, consumers must be involved in an advisory and policy role in the sector to assist in maintaining the enterprise management's focus on the ultimate goal of efficient service, to promote sufficient management concern over costs, since it is the consumers who will ultimately pay, and to build a broader public constituency which better understands the financial and tariff requirements of the enterprises.

CHAPTER 3

A STATEMENT OF THE PROBLEM

by
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Today the world is polarized between:

- Socialist/Communist governments that maintain planned economies and eschew private ownership of property and especially of industrial property, and
- Socialist/Communist, Autocratic and Democratic governments that rely primarily on market mechanisms and practice or are moving toward private ownership of industrial property.

This difference is of fundamental importance:

- Market-oriented, capitalistic systems have resulted in much more significant economic growth in those countries using such an approach. This has resulted in higher average standards of living, increasing opportunities, and broader education for the citizens, and a better-informed public.
- In turn, such economic and educational conditions are conducive to developing a more effective and durable democratic political process. In fact, market-oriented economic systems and effective democratic political systems are mutually supporting.
- Countries with workable democratic political systems and reasonable living standards (e.g., adequate GNP per capita) are much more likely to be politically stable and much less likely to foster terrorism, and either overt or covert aggression. They can also pro-

vide more effective support to other countries with less-developed economies.

Accordingly, measures which can be taken to help strengthen and broaden productive economic systems within and among nations will directly and substantially contribute toward maintaining peace and personal safety and freedoms. These goals must be the primary aspirations of all peoples.

The continuing availability of competitively-priced fuels and energy and their efficient use are requisites for economic growth. The purpose of this report is to identify or develop specific, practical policies and programs that can be used by less-developed countries to supply at reasonable cost their energy needs and to use that energy as efficiently as possible This will involve:

1. Identifying energy needs at likely future economic growth rates.
2. Identifying indigenous fuel and energy sources, their characteristics, relevant technologies, economics, and required infrastructure.
3. Identifying routes and the related economics for using fuels and energy at high levels of efficiency and for energy conservation.
4. Identifying options for fuel imports, and the related economics.
5. Identifying achievable methods of financing the above, with support from the international financial community and with special attention given to reducing investment risks. Attention should also be addressed to the parity between the local currency and the dollar, since oil is traded in dollars.

Since much of the above is site and country specific, the report is directed to three LDCs, carefully selected to cover a representative range of problems and conditions and to have reasonable likelihoods of success.

As results from the implementation of recommended programs in these LDCs are developed, this experience can be expanded to other countries through subsequent phases of the project, or by the LDCs themselves.

The product of this overall program should be:

1. Specific recommendations and implementation programs for the selected LDCs covering the above five points.*
2. Concurrence of officials in these selected LDCs with the Joint Working Group's reports and recommendations.**

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*See I., *The Policy Paper*

**See II A, *Energy Problems in Developing Countries*

3. Agreement from the international financial community and from the U.S. and participating OECD governments regarding the financing and risk abatement methods and programs proposed.

4. Programs for monitoring progress and for making available the experience gained to the combined Joint Working Group, to the involved governments, to the international financing agencies, and other interested LDCs.

At an appropriate future date, a review of all developments and results should be made and combined in a comprehensive report suitable for utilization by additional LDCs in establishing their corresponding programs.

PART III

CASE STUDIES

CHAPTER 4

ENERGY AS A DRIVING FORCE OF ECONOMIC DEVELOPMENT: THE KOREAN EXPERIENCE

by
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1. Introduction*

Since 1962, Korea has achieved rapid economic growth in scale as well as in quality through the successful implementation of Economic Development Plans. Influenced by rapid economic growth, the Korean energy sector experienced major changes in its structure.

Due to increasing demand and the lack of domestic resources, foreign dependency on energy is expected to increase continuously. And as the world energy situation is highly uncertain, a prime task of the Korean government is to establish flexibility in terms of energy matters within the growing economic structure.

*This working paper was prepared by the WEC Member Committee of the Republic of Korea, at the request of the WEC Member Committee of the United States as a contribution to the policy project "Energy Supply and Use in Developing Countries: A Fresh Look at Western (OECD) Interests and U.S. Policy Options." This paper contains the background experience, and presents the status and future prospect of the Republic of Korea's energy development program.

This paper recollects Korean experience in the energy sector and describes long term energy prospects and strategy.

2. Energy and Korean Economic Development

A. Economic Development and the Energy Trend

Before the 1960s, the major energy source of Korea was firewood. With the implementation of the Economic Development Plan, the consumption of anthracite coal rapidly increased and became a major energy source. This lasted until the mid 1960s.

As the Korean industrial structure changed, focusing on manufacturing industry, national energy demand began to increase rapidly. The domestic anthracite coal supply could not meet the demand. So oil, which was cheap and readily available in mass quantities, was gradually substituted for anthracite coal and became the major energy source in the late 1960s. With continuing economic growth and the accompanying energy demand, oil consumption also continued to rise. As economic policy placed emphasis on the development of heavy manufacturing and chemical industries in the latter half of the 1970s, oil consumption again accelerated. Oil's share of total energy consumption peaked at 63.5 percent in 1978.

After the first World Oil Crisis (1973–1975), an effort was started to substitute for oil energy in the industry sector. Substitution efforts accelerated rapidly after the second World Oil Crisis. The share of oil energy in the industry sector decreased to the level of 50 percent.

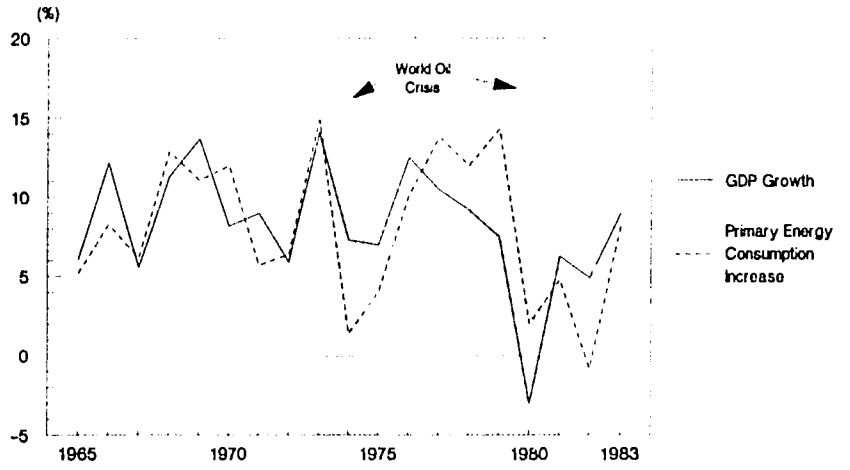
In the 1960s, because the supply of energy resources was stable, energy issues were less significant. But the 1970s was a period of crisis in terms of energy resource availability. At that time, the Korean economy became extremely vulnerable in energy because of its high foreign dependency. Energy variables such as energy supply and demand and energy price became important factors in the Korean economy.

Figure 1 shows that trends of economic growth and energy consumption move along almost the same path. When energy supply was stable, in price and quantity, the Korean economy achieved high growth. On the other hand, during the period of the World Oil Crises, when energy supply was unstable, the Korean economy stagnated.

The reasons for Korea's economic sensitivity to energy supply can be seen from two perspectives.

1. Although there is a small degree of difference between each production sector, almost all production activities require energy as

Figure 1. Trend of GDP Growth and Energy Consumption Increase



a primary input. Because of the energy intensive nature of industries (especially in material industry), the Korean economy is very sensitive to energy supply.

2. The Korean economy has long-term replacement flexibility in regard to production factors and energy sources, but on a short-term basis it cannot adapt well.

Table 1 below shows the trend of energy price and overall price levels. From 1971 to 1983, the price of oil, anthracite coal and industrial electricity escalated 23 times, 12 times and 8 times respectively. Total energy price escalated by 15 times. During the same period, the wholesale price escalated 6 times and the retail price, 5 times. These figures show how drastic the degree of energy price escalation was during that period. It is important to note that the escalation occurred mostly during the World Oil Crises.

The average annual wholesale price escalation rate was 15.8 percent during the period from 1971 to 1983. Analysis shows that the increase in energy prices contributed 49 percent to this rate. This clearly illustrates the sensitivity of the Korean price structure to fluctuations in energy price. So the key to overall price stabilization is the control of the energy price. But because of the high dependency on foreign energy supplies, capability to cope with international price fluctuation is intrinsically limited.

The world energy market has stabilized in the 1980s and price escalation has been moderated by strong government policy. Through

Table 1. Trend of Energy Prices and Overall Price
(Unit: Average Annual Growth Rate, %)

	1971–1973	1974–1975	1976–1978	1979–1981	1982–1983	1971–1983
Oil	21.8	91.6	4.1	56.5	1.2	29.7
Anthracite Coal	13.3	32.9	28.2	31.3	9.2	22.9
Individual Electricity	3.3	42.3	11.0	44.0	2.9	19.0
Energy Total	13.8	67.8	10.0	48.2	2.9	25.4
Wholesale Price	9.9	33.8	10.9	25.7	2.4	15.8
Retail Price	9.3	24.8	13.3	22.7	5.3	14.9

the diversification of energy sources, the impact from energy price fluctuation can more easily be absorbed. By further improving energy efficiency, energy cost in Korean industry can be moderated; and eventually an effective price protection system will be established.

B. The Energy Demand and Supply Pattern

With economic development, energy consumption in Korea has rapidly increased from 10.3 MTOE in 1962 to 53.9 MTOE in 1984. The structure of the energy sector changed from self-sufficiency to foreign dependency. The dependency on foreign energy increased from 12.7 percent in 1965 to 75.6 percent in 1984. The amount of energy imports in 1984 was 6.64 billion dollars, i.e. 22 percent of total imports. Energy consumption per capita increased from 0.4 TOE in 1962, to 1.3 TOE in 1984. But this figure is still lower than the levels in advanced countries.

Until the early 1970s, the trend of energy consumption was almost proportional to economic growth. In 1974 and 1975 after the first World Oil Crisis, there was a drastic slow-down in the trend of energy consumption. During an economic boom that started in 1976, the expansion of economic activities rapidly increased the consumption of energy. After the second World Oil Crisis, the increase of energy consumption slowed again due to price hikes and strong enforcement of energy conservation policy. Currently, the growth rate of energy consumption is being maintained at about 5 percent per year. A decrease in the energy elasticity to GNP to the level of 0.71 indicates the improvement of energy efficiency in the Korean economy.

The trend of the energy input ratio also indicates an improvement in energy efficiency in the Korean economy. The energy input ratio slowly decreased from 1.14 TOE/million won in 1970 to 1.09 TOE/million won in 1983, an average annual rate of −0.3 percent. In comparison with advanced countries, this ratio is still high: 1.05 times that of the U.S., 2.1 times that of Japan for the year, 1983.

This improvement in energy efficiency in the national economy results from enhancing flexibility in regard to production factors and energy sources and strong enforcement of energy conservation policy after the second World Oil Crisis.

A) Primary Energy

The change in the primary energy demand and supply structure was caused by industrial reorganization.

In 1965, the two primary sources of energy were domestic firewood and anthracite coal. They shared 42.8 percent and 43.0 percent of the total energy supply, respectively. In 1983, these shares decreased to 4.8 percent and 20.3 percent respectively.

Conversely, the share of oil in total energy increased from 12.1 percent in 1965 to 63.5 percent in 1978. Because of efforts to conserve and substitute, the oil share decreased to 52.3 percent in 1984.

Nuclear energy is a prominent energy source for the future in Korea. Starting with the commission of the first nuclear power plant in 1978, the nuclear share in total energy gradually increased, reaching 4.5 percent in 1983.

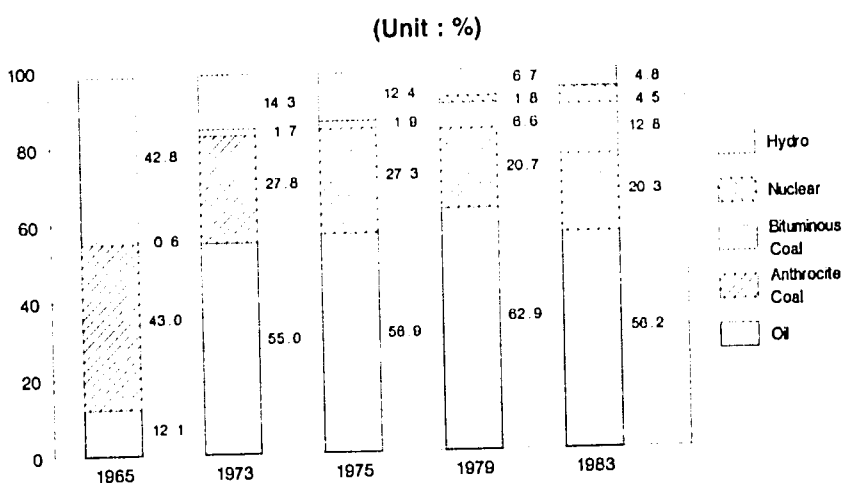
The share of bituminous coal in total energy increased remarkably to 12.8 percent in 1983 through fuel substitution in cement plants and the introduction of bituminous coal power plants since 1979.

B) Electricity Demand and Supply

Despite a hike in the electricity tariff during the two World Oil Crises, the demand for electricity continued to increase because of changes in life style. Electricity consumption per capita has increased 12.4 times, from 86 KWH in 1965 to 1067 KWH in 1983. This increase represents a disproportionate emphasis on electricity development, considering the fact that total energy consumption per capita increased only 4.1 times during the same period.

Generating capacity increased 17 times, from 769 MW in 1965 to 13,115 MW in 1983. This rapid expansion was based on an oil-oriented electricity development program. This can be explained by the fact that oil dependency, as an electricity generation fuel, rapidly increased from 14.9 percent in 1965 to a maximum 94.6 percent in

Figure 2: Trend of Primary Energy Share by Source



1974. But after the first World Oil Crisis, oil dependency for electricity generation started decreasing due to fuel substitution efforts. Oil accounted for 69.2 percent of total electricity generation in 1983.

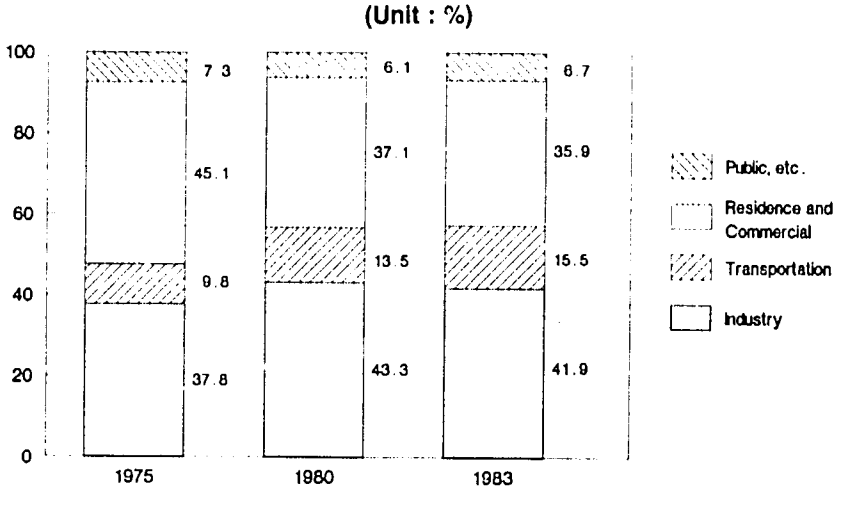
C) Energy Demand and Supply by Sector

With the industrialization outlined above, the industry sector became the major energy consuming sector, outpacing the residential and commercial sectors. In 1983, the industry sector accounted for 41.9 percent and the residential and commerce sectors shared 35.9 percent in final energy. Energy demand increase in the industry sector was greater in comparison with the increase in final energy. But after the second world oil crisis, energy conservation policy slowed this increasing trend. This indicates that energy conservation practices have been established firmly in industry.

With the rising demand for transportation and the subsequent growth of automobile use, energy consumption in the transportation sector has the highest rate of increase of all sectors. The share of the transportation sector in final energy increased from under 10 percent in 1975 to 15.5 percent in 1983.

The change in the international energy situation after the second world oil crisis had its effects on the Korean economy. Economic recovery was delayed by stagnant domestic industrial activity and export trade. In 1982, the average annual economic growth rate during the 5th Economic Development was adjusted from the original

Figure 3: Trend of Energy Demand by Sector



7.6 percent to 7.2 percent. Estimated total energy demand in 1986 was also adjusted from an originally planned 67.1 million TOE to 61.9 million TOE. With this adjustment, the planned annual average total energy demand growth rate decreased from 7.0 percent to 6.1 percent. Energy elasticity to GNP also decreased from 0.92 to 0.85.

Oil dependency in 1986 was adjusted from 52.5 percent to 46.2 percent of total energy. Average annual demand growth rate of oil was adjusted from 4.8 percent to 1.8 percent. These figures are based mainly on the reduction of oil consumption in power plants and cement plants. For anthracite coal, the demand in 1986 was adjusted from 26.1 million tons to 24.2 million tons. This corresponds to demand growth of 2.5 percent per year. The share of bituminous coal in 1986 was adjusted from 13.6 percent to 19.7 percent. The share of nuclear energy was adjusted from 9.8 percent to 10.5 percent.

Electricity demand in 1986 was also adjusted from 59.1 billion KWH to 57.1 billion KWH. This corresponds to the average annual growth rate of 10.0 percent. Assuming the import of LNG, the share of LNG in electricity generation was planned to be 11.3 percent in 1986. But because the LNG import schedule has been delayed, the electricity development plan was adjusted. Coal, hydro and nuclear shares increased to 30.7 percent, 4.5 percent and 40.0 percent respectively, according to this adjusted plan.

3. Financing the Energy Sector

Energy imports have increased continuously. In the 1970s, energy accounted for less than 10 percent of total imports. This figure jumped to 30 percent in 1980 and slowed to 25 percent in 1983. Energy has become the major import item of Korea and causes difficulty in controlling the balance of international payments.

Energy-related facilities such as power plants and oil refineries require a long construction period and huge capital investment. Because of insufficient domestic capital, Korea has relied on foreign loans for a large part of the financing. The world oil shortage further increased the import burden and foreign debt. Debts for facility investments and oil imports increased to 16 percent of the total foreign debt, reaching 6.6 billion dollars in 1983.

With a developing national economy, energy demand will continue to increase. Energy imports and investments for energy facilities will also increase and expand. Counter measures for overcoming financial difficulties are: (1) reducing the import demand and facility

investment through the improvement of energy efficiency, and (2) securing energy imports by more economical means. These measures will enhance financial self-reliance in the energy sector of Korea.

4. Long-term Energy Prospects and Strategy

A. Long-term Energy Prospects

With respect to growth in the manufacturing sector, the Korean economy is expected to expand at an annual average growth rate of 7.5 percent during the rest of the 1980s, and 6.8 percent in the 1990s. In accordance with this projection, the income per capita and the living standard of Korea will approach the current level of OECD countries late in this century.

As energy demand increases, the lack of domestic energy resources will still be a limiting factor. Foreign dependency for energy will continue to increase to 90 percent of total demand.

Energy demand for the future is evolving toward more convenient, clean, and economical forms. This growth in high quality energy demand will eventually change the current supply structure.

1. Demand Growth and Efficiency Improvement

Total primary energy demand is expected to increase to 124.2 million TOE in 2001, 2.6 times the 49.7 million TOE in 1983. The annual growth rate is expected to moderate to 5.2 percent.

This moderated growth is based on the prospect that energy efficiency will be improved as energy conservation technology is disseminated and industrial structure is reorganized. The energy input ratio will decrease continuously from 1.09 TOE/million won in 1983 to 0.79 TOE/million won in 2001. Energy elasticity to GNP will also decrease from the level of 1.0 in the 1970s to a level under 0.7 in the 1990s.

2. Prospects for Energy Demand and Supply Structure

The substitution of alternative energy sources for oil will continue, and the relative importance of oil will decline. A substitution program will be focused on two aspects: a nuclear and bituminous coal oriented electricity development program, and the use of bituminous coal by industry. Improvements in energy efficiency will occur mostly in the oil-using industry sector.

The share of anthracite coal in the energy demand and supply structure will decrease after the mid-1980s due to the increasing difficulty of mining and the increasing share of LNG as a source of residence energy.

As nuclear power generation increases, the nuclear power share of total energy will reach 17 percent by the year 2001.

As the energy demand and supply structure will be diversified and more stable, the current oil dependent structure will be reorganized into a more balanced mix of oil, coal and nuclear energy.

3. *Prospects for Energy Demand and Supply by Sector*

The transportation sector will lead growth in energy demand because of its high income elasticity. The industry sector will concentrate on energy conservation so that its share of demand will be fairly stable. The demand of the residential and commercial sectors will decrease. Current energy efficiency in these sectors is lower than other sectors, leaving much room for improvement. The savings that result through efficiency improvements will compensate for the increasing demand in this sector.

B. Long-Term Strategy

As stated earlier, the energy input ratio is expected to decrease from the level of 1.09 TOE/million won in 1983 to 0.79 million won in 2001. To realize this forecast, long-term energy strategy should emphasize the reorganization of the industry structure and maintained energy conservation.

Figure 4: Prospect of Primary Energy Share by Source

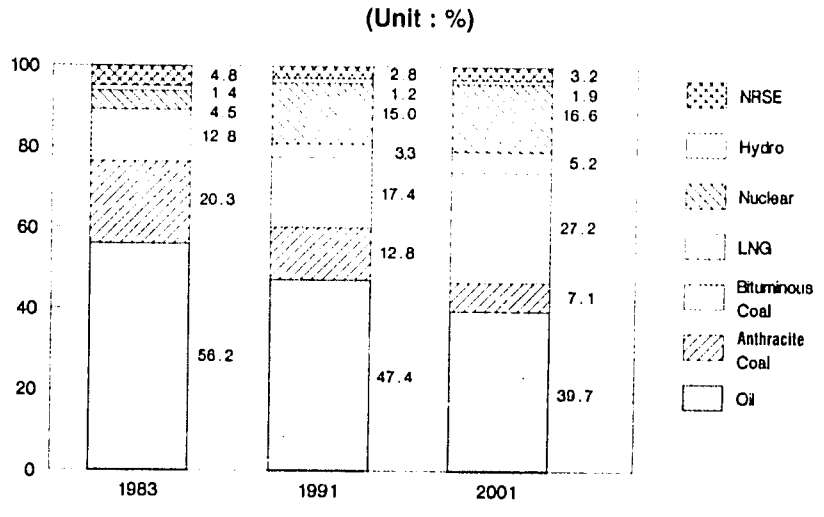
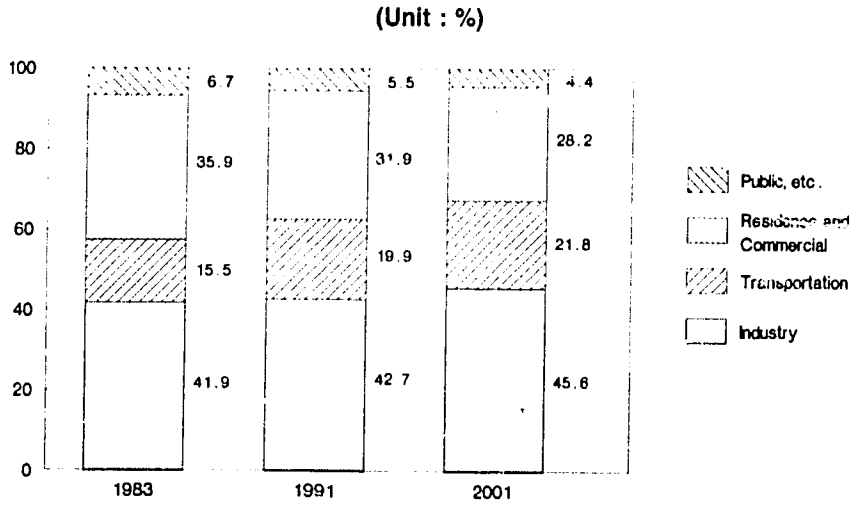


Figure 5: Prospect of Energy Demand by Sector



1. Energy Conservation

Energy conservation policy will be implemented under a systematic, cooperative arrangement between government, industry and the public.

The policy will develop from the current "simple saving" to "in-depth conservation".

In developing energy conservation technology, the prominent fields will be selected and supported intensively. Financial and tax benefits will induce energy conservation by industry and consumer. Each sector will select its own strategy and implement it step by step.

2. Stable and Economical Supply of Energy

A. Oil Supply: As a result of continuing oil substitution efforts, Korea's dependency on oil is expected to decrease. However, since oil will be the major energy source until the next century, a stable and economical supply of oil needs to be secured. This will be accomplished through improving import efficiency and the price system, increasing stockpile capacity, developing oil resources and streamlining the petrochemical industry.

B. Electricity Supply: As income increases and industrial processes become highly automated, demand for high quality energy,

like electricity, will increase faster than other energy options. For stable and economical electricity supply, the policies to be promoted are: pursuit of a non-oil based electricity development program, removal of obstacles that hamper expansion of nuclear and coal power generation, expansion of transmission and distribution systems, improvement in the electricity tariff system, rationalization of electricity use and improvement of power industry management.

3. *Development of Energy Resources*

Maximum use of domestic energy resources and overseas resources development will be intensively supported to remedy the vulnerability in the current energy supply structure and enhance self-reliance.

4. *Substitution of Oil Energy*

Korea will reduce its oil dependency from the current level of 50 percent to 40 percent of total energy consumption by the year 2001. This reduction will be achieved by increasing imports of alternative energy sources, such as bituminous coal, nuclear, and LNG. Oil substitution will enhance the diversification of energy sources and build up a stable and balanced energy supply structure.

The oil supply structure, facilities and related legal support will be established in a timely manner. The experience acquired during the first and second world oil crises will be incorporated into energy policy, which will be steadily implemented on a long-term basis.

5. *New and Renewable Sources of Energy (NRSE)*

NRSE such as solar heat, wind power and biomass are potential domestic energy resources which can contribute to energy self-reliance when existing fossil energy resources are depleted. Consequently, a basis for active use of NRSE in future generations should be established.

5. Conclusion

By successful implementation of its Economic Development Plans, Korea has achieved rapid economic growth, in scale as well as in quality. But due to the lack of domestic energy resources, foreign dependency has increased continuously. This has seriously upset the balance of international payments and has consequently led to an increase in foreign debt.

From an energy supply-side viewpoint, the ability to overcome the unstable supply of energy was limited because of the lack of

replacement flexibility in regard to production factors and energy sources. Furthermore, the industry structure became energy intensive, which created a high energy elasticity to GNP.

Future strategy should concentrate on securing energy resources, promoting energy conservation, developing technology for rational energy consumption and NRSE over a long-term basis. With these strategies and relevant investments, foreign dependency will decrease, energy technology will be secured, and replacement flexibility will be enhanced.

CHAPTER 5

THE PEOPLE'S REPUBLIC OF CHINA'S DEVELOPMENTAL EXPERIENCE AND ENERGY POLICY: TRANSFERABLE LESSONS FOR OTHER DEVELOPING COUNTRIES

by
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I

China is the largest developing country with rich energy resources. During the past 38 years—since 1949—the development of China's energy industry has gone through four basic stages. The first stage, from 1949 to 1956, was the period of recovery from the Civil War and the establishment of a central planning system. During this period, China's energy production, mainly coal production, increased rapidly. This was primarily due to the fact that the Civil War created a serious recession and, as the first priority in its economic strategy, the government decided upon the development of heavy industry. In addition, the government imported a great deal of technology and equipment from the Soviet Union and East European states.

During the second stage, 1957 to 1964, the growth of China's energy production increased smoothly. Since the end of the 1950s, when the Sino-Soviet split began, the Chinese Government adopted a pol-

icy to develop oil production based upon the strategy of "independence" and "self-sufficiency." The Soviet Union was no longer to supply China with technology and equipment for energy production. Since 1962, it cut down *substantially* its exports of oil, while China's own oil fields were not yet developed.

The third stage, from 1965 to 1978, was China's "golden age" of energy production. The production of primary commercial energy grew rapidly. The annual growth rates were approximately 10 percent during those 14 years. More importantly, China rapidly developed its oil production and supplied 100 percent of the oil it needed.

Since 1979, China's energy production has entered a new stage. The growth rate of energy production declined during the few years between 1979 and 1983. In particular, the output of crude oil declined in 1980, 1981 and 1982, while the growth rates of both coal and electricity were around 7 percent. Meanwhile, the government has undertaken a campaign of improving the efficiency of energy use and adopted a strategy of expanding energy production by introducing foreign technology and capital investment. These policies have been efficient; China's coal and crude oil production increased around 8 percent in 1984, and the efficiency of energy use has improved.

This working paper focuses on the development of China's energy industry during the last stage mentioned above. It examines the Chinese Government's energy policies, evaluates their success and problems, and then discusses China's experiences and lessons learned in the course of energy development that may be relevant to other Third World countries.

1. Energy Production

The structure of China's energy production has undergone important changes since the middle of the 1960s. In 1965, production of oil amounted to only 8 percent of total primary commercial energy production, while the percentage of coal was about 90 percent. In 1975, however, the figures become 20 percent and 69 percent, and in 1984, they were 22.5 percent and 72 percent, respectively. Oil production has thus played an increasingly important role in the development of China's energy industry.

Second, although the percentage of coal production in total energy production has been around 70 percent, annual coal production has continually increased. Its annual growth rates have been about 7.5 percent–8.0 percent since the middle 1970s.

Third, between 1974 and 1983, China's production of primary electricity increased rapidly, with annual growth rates between 13

percent and 15 percent. In 1984, however, the figure declined from 34.6 MTOE (million of tons of coal equivalent) to 34.2 MTOE.

Fourth, the output of natural gas has not been stable. It declined from some 19 MTOE in 1979 and 1980 to between 15.8 MTOE (1982) and 16.9 MTOE (1981).

Fifth, China has begun to build nuclear power plants. The Central Government has also encouraged local authorities, especially in rural areas, to develop other sources of energy for local use. Taken together, the total production of commercial energy declined between 1979 and 1981, and then increased between 1982 and 1984, with an annual growth rate of about 6.5 percent.

2. *Energy Consumption*

Since 1975, China's oil exports to the international market have remained between 15.2 MTOE (1976) and 29.9 MTOE (1982), while China's coal exports have never been over 7 MTOE. Coal has played the key role in total commercial energy, though no detailed figure is available to indicate the amount of energy that the rural population, which constitutes 80 percent of the country's total population, consumes annually.

According to the government, about 43 percent of total final energy consumption is used by industry, while 42 percent of the total is for residential and commercial use. Agricultural uses account for only about 6 percent of total final energy use; and about 5.5 percent of the total final energy is used by the transportation sector.

Fifty-two percent of the total energy that the transportation sector uses is oil, while the figure for coal is about 47 percent and electricity is only 1.5 percent. This indicates that, unlike most industrialized countries or some developing countries, China's transportation is still largely reliant upon the railway.

In industry, about 60 percent of the energy used is coal, 22 percent is electricity, 13 percent is oil, and 4.6 percent is natural gas. The high share of coal indicates that in many industrial areas, there is no advanced electricity supply system, and that heavy industry, especially metallurgy, has a high share in the total industry output. In fact, the basic metallurgy industry utilizes about 25 percent of the total energy used in industry; the chemical industry utilizes 24 percent; the figure for the building material industry is about 15 percent, and the machine building industry's share is only about 9 percent.

Coal plays an important role (88 percent) in residential and commercial energy use, while electricity's share is only about 10 percent. This proportion is primarily due to China's lower level of electricity consumption, although this is increasing now. In addition, since

1975, China exports about 5 percent of the total energy that it produces annually, 80 percent of which is oil while the remaining 20 percent is coal.

The following four points should be mentioned. In the first place, the potential increase of energy production will continue to depend on a strategy of developing various energy resources, especially oil and coal. Second, the effectiveness of the energy saving strategy will depend largely on whether the Government will be able to improve the efficiency of energy use in both industrial and residential/commercial sectors. Third, the speed of China's industrial development is constrained by its energy supply and energy using efficiency, while controlling the speed of industrial development (especially the development of both the metallurgy and chemical industries) might be the means whereby the government could temporarily moderate the shortage of energy supply. Fourth, given the fact that coal plays the key role in both the industrial and residential/commercial sectors, it will become increasingly important to formulate policies to improve the efficiency of using coal.

III

During the past several years, the Chinese government has adopted the following policies to expand energy production and improve energy use efficiency.

The government has gradually evolved a long-term strategy of energy development. According to this strategy, the government has remarkably increased its investment in the energy industry, expanded both exploration of energy resources and production, introduced new technology from overseas, and expanded R & D to improve the efficiency of energy use. This long-term strategy of energy development also includes policies to pursue institutional reform in order to increase the incentive of enterprises to improve efficiency in energy use.

At the macro level, the Chinese government has put great emphasis on the balance between economic development, especially industrial development, and the growth of energy production. During the past seven years, China's GNP and industrial output have grown faster than its energy production. Apart from four years' stagnation (1977–1981), the annual growth of energy production has been around 5.5 percent, while growth rates of China's GNP have been over 8 percent, and its industrial growth rates have been over 10 percent. In 1984, for instance, China's GNP grew 17.4 percent; its industrial output

increased 14.6 percent, within which the growth rate of heavy industry was 15.5 percent and light industry 13.6 percent. This unbalanced development has elicited the government's attention. In both 1980 and 1985, the government adopted various policies of macro-readjustment of the national economy, including reduction of investment, a tightening of the money flow, and control of the distribution of raw materials and energy, to slow down economic growth and remedy the imbalance between national economic development and the growth of energy production.

Second, the government has increased its investment in development of the energy industry. During the past seven years, the government invested a great deal in research and development of energy resources, especially oil resources. The government has rapidly increased the number of research teams, research institutes, and training programs to strengthen the country's technical capacity to discover new energy resources. It has built up many new oil fields, coal mines, natural gas fields, and power stations. In addition, with the participation of foreign corporations, China has begun to develop its offshore oil production. The government has also begun a program of building nuclear power stations, and a few nuclear power stations are already under construction.

Further, the government has implemented policies to encourage the development and popularization of new energy sources, such as solar energy for family use, and small-scale marsh gas projects in rural areas. Given the fact that the rural population comprises 80 percent of China's total population, and its demand for energy supply is increasing because of successful agricultural reform during the past eight years, these policies can be expected to improve energy supply in the rural areas.

These efforts have appeared to be effective. In 1984, China's production of coal increased 7.9 percent; the output of crude oil increased 8.0 percent, and electricity production increased 6.6 percent. The government has reported that in many rural areas, households have begun to use solar energy and marsh gas for their cooking and heating. Hundreds of small-scale hydropower stations have been built by local governments.

Third, the ongoing economic reform included the government's energy policy. The government has decentralized the decision-making process and allowed local authorities freedom to adjust energy prices within certain limits. In addition, local authorities have been encouraged to develop energy projects. Even individual households have been allowed to open small-scale coal mine projects for local use.

Moreover, the government has set up a new bonus system to encourage enterprises to improve efficiency. Bonuses have been directly granted to both enterprises and individuals for their efforts to save energy. Enterprises have also been allowed to resell their surplus coal, oil and other energy goods that they have received from the state as part of the planning system. Further, local authorities have been granted a greater share of coal and oil that they produced locally.

Fourth, China's "open door" policy has promoted its energy industry. Since 1978, the Chinese government has signed joint venture agreements with more than 20 major western oil corporations. Under these agreements, foreign corporations putting capital investment, technology and equipment at risk have directly participated in the process of investigating and exploring both China's inshore and offshore oil resources. The government has imported a great deal of technology and equipment to strengthen its own capacity to develop its petroleum industry. Further, the government has received loans from foreign governments, international financial organizations such as the World Bank, and commercial banks to explore oil resources.

The government has as well imported technology and equipment from Western Europe to develop its nuclear power industry. It has signed an agreement with the United States for transferring nuclear technology. It has also established a joint venture project with a Hong Kong corporation, with a total investment of US$4 billion.

In the coal industry, the government has bought a great deal of equipment from the West, including Japan, to develop mines that have been exploited over decades, but which needed to be technically upgraded. The government received long-term, low-interest loans from the Japanese government to build railways and harbors for shipping coal and oil. The government has also introduced foreign capital and technology to develop its electrical industry.

Fifth, the government has made great efforts to introduce new technology to promote the efficient use of energy. During the past seven years, for instance, it has systematically replaced obsolete industrial boilers built before the 1960s. In many factories, obsolete machines whose efficiency of energy is inadequate have also been replaced. The government has stepped up public awareness to encourage engineers, scientists and technicians to save energy and introduce new technology for improving energy use.

IV

Several serious problems remain, however. In the first place, China's oil production is still unstable. This is primarily due to two basic factors: the estimates of possible oil reserves are highly spec-

ulative, particularly for the almost virgin areas offshore and for lightly explored areas (such as the western onshore basins); and further development of the oil industry would require a huge amount of capital investment and advanced technology that China lacks. According to the China National Offshore Oil Corporation (CNOOC), the offshore reserves are estimated at 2.7–10.0 billion tons of oil. China's recoverable reserves of oil onshore have been estimated at 5.5 billion tons by international experts, at 8–15 billion tons by Chinese experts. On the basis of investigators' knowledge of various Chinese fields as well as using some international yardsticks, the World Bank estimates that the minimum investment required to discover and develop the additional reserves to meet China's production targets is approximately 30 billion to 70 billion RMB (the Chinese currency) for exploration and development over the next 12–15 years. The importation of sophisticated tools, materials, and equipment, and proposed involvement of foreign contractors, might require foreign exchange in the region of US$15–20 billion. In fact, China's oil production was declining between 1979 and 1983. During these five years, the average annual investment in the petroleum industry was RMB 3 billion. In the long run, unless these two problems are solved, it will be difficult for the government to reach its production target of producing 200 million tons of oil by the year 2000.

Second, although the government has made efforts to reform its price system, and to issue bonuses to those enterprises which have improved their energy use efficiency, the big gap in energy prices between the domestic market and the international market is still one of the most important obstacles to further improvements in energy use efficiency. Energy prices are set and controlled by the central government, directly reflecting neither market supply and demand nor production costs. The central government distributes energy according to its economic plan. There is no sophisticated energy market in China. As a result, enterprises do not have a strong incentive to improve their efficiency of energy use. Further, because prices of coal are too low, compared to both the oil price in the domestic market and the coal price in the international market, and because the low prices of coal do not even fully cover production costs, the incentive to increase coal production is not strong. The lack of a sophisticated energy market makes this situation even worse, as enterprises which have a surplus of coal and oil begin to sell their surpluses in the black market or use them to trade for other goods which are in short supply.

Third, although the government has made strong efforts to control economic growth, the national economy continues to grow rapidly. This is due partly to the central government's loose macroeconomic

policies, and partly to the ongoing economic reform program. In 1984, the government adopted a loose monetary policy and investment policy. Banks were authorized greater power to make loans; local authorities and enterprises were to make their investment decisions more independently, and inflation, which was partly caused by a poorly planned price reform, further stimulated the increase of industrial production. As a result, the industrial growth rate in 1984 was two and a half times higher than the growth rate of energy production. The imbalance between industrial development and growth of energy production thus became worse.

Fourth, China lacks a good infrastructure. Only three highways are now under construction. Most trains are run on coal instead of more efficient electrical power. Similarly most trucks in China are built with old technology, without serious consideration to improving the use of energy. In factories, too, many machines are technically outmoded, and thus not energy efficient.

Moreover, China's transportation industry still depends largely on road transport, which is more energy intensive than railway transportation. The agricultural reform has encouraged millions of peasants to develop their privately owned small scale industrial enterprises and long distance trade businesses. Given the low price of coal and oil, the incentive for them to save energy is very limited. Further, in both rural and urban areas, there is no strong incentive for households to improve their energy use, nor is there a qualified heating system with a low energy cost.

As a result, China's energy consumption per unit of GDP is much higher than in most developed countries, and indeed most rapidly developing countries such as Argentina, Brazil, Mexico, etc.

V

In general, however, China has performed reasonably well during the past two decades in the development of its energy industry. It has become one of the few developing countries able to produce all of the energy that it needs. It has recently developed good cooperative relationships with major western oil corporations and benefited by the import of foreign capital, technology and equipment. Recently, the Chinese government has paid careful attention to improving the efficiency of energy use. These efforts, together with its economic reform program, will further improve China's energy supply.

For other developing countries, the following four points are important to note when trying to learn from China's experiences, especially in the area of development of an energy industry.

- The development of a long-term strategy is essential. This strategy should be based on sufficient information on a country's energy reserves and potential energy production. It should also be coordinated with the country's long-term strategy of national economic development in general, as well as its strategy for approaching the international market. In particular, a country lacking sufficient energy resources should avoid developing an energy-intensive industry.
- The expansion of investigation and exploration of energy resources should be given high priority. The government should formulate a strategy for expanding its investment in the energy industry. It is particularly important for developing countries where there is a lack of capital investment and technology to create a favorable investment environment to attract international oil corporations. In doing so, guaranteed returns to risk capital investment, favorable taxation policies, a relatively stable domestic political situation, and knowledge of international business are essential.
- Reform of the economic system, especially the raising of energy prices in response to the market situation and energy production costs, combined with the gradual establishment of a sophisticated domestic energy market, can strongly increase the incentive of enterprises and households to save energy and to improve the efficiency of energy use. It can also stimulate the energy industry to expand production.
- The introduction of new technology is also essential to the improvement of energy use efficiency. Governments in developing countries should systematically build up an infrastructure and encourage enterprises to replace old equipment with low energy use efficiency. These policies should be combined with efforts to reform economic institutions.

CHAPTER 6

TAIWAN'S DEVELOPMENTAL STRATEGY AND ENERGY POLICY

by
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Taiwan, with a scant area of 13,000 square miles, has enjoyed rapid and sustained economic growth since the 1950s. By 1984 its real GNP had increased by fifteen times compared with the 1950s, and its nominal per capita income had reached U.S.$3,000. The island is not, however, endowed with an abundance of natural resources, in fact, it can be considered quite resource deficient. It has only limited coal and gas resources, and virtually no oil reserves or other important mineral resources. At the same time it copes with a population of 19 million and the second highest population density of any nation in the world. Nevertheless, through three decades of efforts, Taiwan has built itself up from a poor resource base and in a besieged security environment into a nation noted for its rapid economic growth, stable prices, low unemployment rate and equitable income distribution—an achievement envied by many Third World countries. The Taiwan success story is now being viewed as a viable developmental model by many Caribbean nations, especially Haiti, whose people are now aspiring to turn their nation into "a Taiwan of the Caribbean."

This paper will attempt to examine Taiwan's development strategies and the role that energy plays in Taiwan's overall economic development.

I

Fostering Industry Through Agriculture in the 1950s

Having brought superinflation under control, Taiwan embarked on a series of land reform programs in the 1950s. Farmers, having acquired their own land, now had a personal stake in increasing production and furthering development. The resulting increase in the number of owner-farmers and the small-scale farming system tended to encourage a shift from the production of rice to diversification, which paved the way for rapid expansion of exports in the food processing industry. Landlords, compensated by ten-year bonds carrying a four percent rate of interest and some stock in state-owned enterprises, were urged to engage in industrial development.

At the same time, the government consistently followed a policy of taxing agriculture to finance industrial development. Land taxes, rice-fertilizer barter, and short-term production loans to farmers were paid in rice at the government's purchase prices, which were invariably kept below market prices. They amounted in practice to a kind of "hidden rice tax," thus making it possible for the government to pursue the light taxation which enabled the industrial sector to retain a large part of its profits for further investment.

The inflow of U.S. aid, which comprised 37 percent of gross investment between 1951 and 1961, made up for the inadequacy in domestic savings. By 1963, the net domestic savings ratio had reached the economic "take-off" point of 10 percent of the net national product.

Financially, the government pursued an import-substitution policy. Its key elements were a multiple exchange rate system, an overvaluation of the New Taiwan Dollar, and maintenance of higher prices for import goods vis-à-vis those for export goods. Priority was given to the development of four types of import-substitution industries: textiles, food and related industries, building materials, and industries concerned with transportation equipment.

Promoting Industry Through Agriculture in the 1960s

In the 1960s the development strategy turned toward promotion of exports. Outward-looking trade policies were initiated, including favorable interest rates for export financing, a 5-year income tax holiday for investment, reductions in taxes, duty rebates for exportation, and the establishment of three export processing zones.

Economic planners were aware that an open economy was prerequisite to the export-led policy. Between 1958 and 1960, import

controls were dismantled, quantitative restrictions on most imports removed, and the multiple exchange rate system eliminated.

In the second stage, emphasis was gradually shifted to the development of export-oriented industries, first the food processing industry, second the textile industry, and then the electrical machinery industry. Based on 1976 prices, exports grew at an annual rate of 20.3 percent and 18.5 percent in the 1960s and in the 1970s, respectively. Since the early 1960s, expansion of exports has served as the engine of Taiwan's energetic economic growth. This is evidenced by the fact that the annual growth rate of GNP averaged 8.2 percent in the 1950s and then climbed to 9.1 percent in the 1960s.

Since 1966, the export-led growth of industry has facilitated a transition in agriculture from labor-intensive to labor-saving farming methods through technical innovation. As more capital was invested in farming, land productivity rose through the application of modern innovations. In this way, technical innovation, the prime mover of agricultural development eased the shortage of labor in rural areas and fostered the slow but steady growth of agriculture.

An Oil-Based Economy

We can identify seven fundamental principles that govern the energy policy of Taiwan: adequacy, equity, growth, quality, economy, reliability and efficiency. Their respective weight in determining energy policy varies with changing perceptions and environments; some principles outweigh others at different stages of development.

Prior to the first oil crisis, the predominant principles governing energy policies were adequacy, equity, growth and economy.

Although Taiwan in the 1950s had fairly good electrical facilities, continued efforts were made to increase the capacity of electrical installations. U.S. aid was instrumental in this area. During the period from 1951 to 1963, 31 percent of U.S. aid to Taiwan (totalling U.S.$2.2 billion) went to the development of electrical installations.[1] This contributed greatly to the growth of power generation, which increased 10.3 times from 1954 to 1973.

Subsidies extended to ensure that manufacturers and low-income earners retain access to cheap energy were part of an undisputed policy, which was intended to promote overall economic growth, to enhance the competitive position of domestic products in the world market, and to upgrade the share of the poor in economic prosperity.

Before the first oil crisis, Taiwan's oil costs remained low and basically stable. Between 1965 and 1972, the price of imported Arabian light oil increased from U.S.$1.80 per barrel to U.S.$2.48 per

barrel, while domestic oil prices in this period rose annually by a mere 0.78 percent.[2] Because of low oil prices and government efforts to substitute oil for coal, the share of oil in total primary energy composition increased from 26 percent in 1961 to 72 percent in 1973 (See Table I). Dependence on oil imports accounted for only 17.6 percent of total primary energy for 1954; but their proportion increased to 70.7 percent in 1973.[3]

Cheap labor and an adequate supply of cheap energy for industry were mainly responsible for the rapid economic growth prior to 1973. Between 1954 and 1973, average real GDP growth was 9.3 percent per annum, slightly below the 9.96 percent growth for internal final energy consumption. The GDP elasticity of demand for commercial energy during this period was 1.07, and it remained constant thereafter.[4]

II

Economic Problems for the 1970s

In the 1970s, the Taiwan economy faced new challenges posed by the growing protectionism of the OECD nations and the increasing competitiveness of products from other developing nations on the world market. Domestically, a shortage of intermediate materials resulting from the export boom of the 1960s was increasingly felt. Furthermore, the quadrupling of oil prices between 1973 and 1974 directly pushed up the costs of Taiwan's export products and immediately fanned the flames of inflation, since 99 percent of Taiwan's oil consumption was imported.

According to estimates, about half of the inflation rate was a direct result of the changes in import prices. Oil imports alone were responsible for 77 percent of the imported inflation in 1973--74[6] which in turn generated 56.3 percent of the domestic wholesale prices index

Table I: Changes in Share of Energy Sector (Percent)

	1954	1961	1973	1977	1979	1981	1984
Coal	57	57	14	11	13	16	18
Oil	14	26	72	77	72	68	58
Gas	1	1	9	8	6	5	4
Hydro	27.5	16	5	4	4	3	3
Nuclear	0	0	0	0.1	5	8	17

Source: *Energy Supply and demand: An Analysis and Prospect* (Taipei: the Energy Committee, the Ministry of Economic Affairs, January 1985), p.8.

increase in the same period.[7] As a result, the inflation rate jumped to 40.6 percent in 1974 and the growth rate dropped to 1.1 percent.

Basic Energy Perceptions

Generally speaking, there are three basic approaches to adjusting to high energy prices. They are: (a) the price mechanism; (b) restructuring the economy through a shift away from energy-intensive industries; (c) improvement in the efficiency of energy use.

However, it was strongly argued in the early 1970s that keeping oil prices low would help reduce inflation and hence maintain price stability. Pricing policy, the easiest and as yet most effective instrument for restructuring and improving energy efficiency, gave way to adequacy, reliability, growth, equity and stability. Moreover, policy makers mistakenly believed that given the inflexibility of the business enterprises of that time and the relatively low technological level of the country, it would be very difficult for the economy to accept a long-term structural adjustment program encompassing all of the above three approaches.

Second, in a small, open economy such as that of Taiwan, increasing exports is the most effective strategy for accelerating economic development. High-volume exports mean high production, a high employment rate and abundant tax revenues. All the government has to do is to find a way to stimulate these exports. One effective short-term measure to retain the competitive edge of export products is to keep energy prices low, especially the price of fuel oil.

Third, because Taiwan is a developing country advancing rapidly to the so-called newly industrializing country (NIC) status, its energy demands will continue to increase in proportion to its future economic growth. Any decrease in energy consumption, even one occasioned by abrupt changes in oil prices, would be disadvantageous, for energy use is closely correlated to economic growth.

Fourth, some 68.5 percent of the country's total energy demand and 98.5 percent of its petroleum demand had to be imported in 1973. There is as yet no prospect of a significant increase in domestic production of petroleum or any other kind of energy in the immediate future. The heavy dependence on imported energy is likely to continue, perhaps indefinitely. Therefore, the issue of energy supply sources has become a matter of paramount concern to government and industry alike. They are more concerned with a reliable energy supply than with the efficient use of energy.

A Short-term Rescue Operation

Based on the above perceptions, the government decided to let the monopolized China Petroleum Corporation absorb most of the im-

ported oil price increases of late 1973. As a result, domestic prices were able to remain relatively stable and low; and exports grew so rapidly that a trade surplus of U.S. $569 million was accrued in 1973. This surplus served to help boost the inflation rate (in terms of the wholesale price index) to a dangerous level of 40.58 percent.

It was not until January 1974 that the government initiated a short-term rescue operation known as the "Economic Stabilization Program." The highlights of the program included (a) a substantial increase in interest rates and a corresponding tightening of credit; (b) upwardly adjusted prices for petroleum products, electricity, transportation services, and wine and tobacco; (c) a reduction in government subsidies for imported soybeans and wheat; and (d) partial liberalization of price controls through the replacement of price ceilings with negotiated prices.

The effect of this program was almost immediate. Prices jumped in February, but soon stabilized on a higher plateau thereafter. Double digit inflation was successfully arrested, but a recession soon ensued.

The Backward Integration Development Strategy

In order to offset declining investment in the private sector brought about by the stabilization, the government began to engage in heavy public spending by stepping up the "Ten Major Projects." Seven of the projects were aimed at easing infrastructure bottlenecks. The other three—the integrated steel mill, the petrochemical complex and the giant shipyard—were manufacturing facilities.

By the late 1960s, export-oriented growth had brought about a steady advance in technology and a substantial accumulation of capital. On the other hand, industry experienced a shortage of intermediate materials. It was high time for the government to start what it called "second-stage import substitution." Development of the petrochemical and steel industries was vigorously pursued with a view to achieving "backward integration."

However, the development of heavy industry perforce increased energy consumption. The GDP elasticity of demand for energy increased from 0.99 in the 1961–73 period to 1.31 during the 1974–79 period (See Table II).

A Trade-Off

By 1975, inflation was almost under control; it had dropped to a negative 5.1 percent, and the GNP growth rate had gone up to 4.2 percent. The economy was now again buoyant and back on track in the period 1976–1978, with an annual growth rate of 12.4 percent

Table II: Taiwan's Elasticity of Energy

	1961–73	1974–79	1980–83	1961–83
Annual growth rate of energy consumption (%)	10.6	10.9	3.8	9.4
Real GDP annual growth rate (%)	10.7	8.3	5.67	9.1
Elasticity of energy	0.99	1.31	0.67	1.03

Source: See Table I, p. 96.

and an inflation rate of 3 percent. The GNP growth rate was a respectable 8.43 percent from 1974 to 1979, a slight decline from the 9.32 percent of the 1955–73 period before the first oil crisis. In fact, the opposite would be true if 1974, which was a recession year, were excluded from the post-oil crisis period. The limited impact of the first oil crisis on growth may be seen as the result of a trade-off between maintaining rapid growth and reducing dependence on oil imports.

III

Changes in Energy Perceptions in the 1980s

With the outbreak of the second oil crisis (1979–1980), Taiwan suddenly found itself faced with a more challenging environment. Domestically, the economy passed the stage of labor-surplus development, with its unskilled labor virtually fully utilized. The low energy pricing policy discouraged industry from making a quick adjustment, and thus the speed of technological progress tended to decelerate. People started to demand an improved quality of life. In order to cope with these new conditions at home and abroad, a restructuring of the economy was urgently called for. Could energy policies provide a strong enough stimulus for this transition?

The reluctance and failure to take drastic measures to adjust the economy following the first oil crisis resulted in adverse effects. Economists and government officials later noted that although the low oil pricing policy would help reduce inflation and hence maintain price stability in the short run, it was inflationary in the long run. First, it would improve Taiwan's balance of trade position by discouraging imports and encouraging exports, especially energy intensive ones. In this context, export expansion would then stimulate domestic demand, which would in turn push up prices and thus erode export competitiveness. Second, expectations of rises in prices

would sooner or later undermine price stability.[8] Furthermore, as a result of the low energy pricing policy, manufacturing firms were slow to adjust to oil-induced changes as regards improvements in their equipment and production processes. In 1978 the GNP per kg. oil equivalent for Japan was U.S.$3.28, more than twice as high than Taiwan for which the corresponding figure was a mere U.S.$1.31.[9] This was a painful lesson economic policy-makers in Taiwan learned from their post-1973 experience.

In terms of energy pricing policy, a consensus was reached on implementing a timely "cost-reflecting" one. Domestic oil prices were allowed to change in a manner more reflective of import costs but only to the extent that they did not undermine export competitiveness. But when it came to changing oil prices, other factors played a role, as had happened before. Preferential prices were given to fuel oil for the sake of keeping exports competitive; to diesel oil used mainly in public transportation vehicles and trucks, for environmental and price stability concerns; and to fishing-boat oil, for equity concerns. On the whole, domestic oil price rises were able to keep pace with those of imported oil. During the period from 1979 to 1981, the domestic prices of petroleum products were upwardly adjusted at the considerable rate of 41 percent per year, while those of imported crude oil grew at an annual rate of 42.3 percent.

Besides the principle of efficiency, policy-makers after the second oil crisis laid more stress on the principles of reliability and adequacy in making energy policies than on those of equity, growth and economy.

A Sophisticated Energy Conservation Program

In actual fact, the moderate conservation measures adopted following the first oil crisis achieved few results. The outbreak of the second oil crisis prompted the government to formulate a sophisticated energy-saving program requiring wide-ranging multi-sectoral efforts.

The execution of the program was very successful. A far-reaching campaign to arouse energy conservation awareness among the public was effectively launched; thirty-three successful cases of energy-users were written up, published and distributed to consumers; energy-conservation courses were taught in vocational schools; between 1981 and 1985 over 4,000 energy management personnel from large energy user companies were trained by the Energy Committee of the Ministry of Economic Affairs; and an Energy Conservation Task Force, comprised of conservation specialists, was sent out to various factories.[10]

Furthermore, incentive measures were provided to foster energy conservation. They include time-use electricity price rates in place of progressive tariff rates; 10 percent income tax credits for enterprises that renovate or install thermal energy boilers with an efficiency level exceeding the government standard; exemptions of imported energy conservation instruments and equipment from all import duties; acceleration of depreciation; and medium-term, low-interest loans were made available for the purchase of energy-saving fishing boats and energy-saving investments.

In addition to implementing temporary measures aimed at reducing the use of oil, the government in 1980 enacted the "Energy Management Law" in an attempt to achieve long-term efficiency of energy utilization and management.

All these combined to raise national energy productivity, in terms of GDP/liter of oil equivalent, from NT$35 (in 1976 constant prices) between 1979 and 1980 to NT$39 from 1981 to 1982 (See Table III).

Upgrading of the Industrial Structure

Incorporated into Taiwan's economic policies for the 1980s are a sophisticated energy conservation program, serious efforts to upgrade the economic structure, and the diversification of energy supply sources. Since the outbreak of the second oil crisis, there has been an urgent call for the restructuring of the economy by expanding the output of energy-efficient, skill-intensive and high-value-added industries such as machinery, electrical machinery and transporta-

Table III: Effectiveness of Energy Conservation in Recent Years

Item	Year				
	1979	1980	1981	1982	1983
Energy Productivity (NT$1/Liter of Oil Equivalent)	35.1	35.2	38.6	39.2	37.7
Annual Energy Consumption (10^6KL of Oil Equivalent)		28.582	27.431	27.964	31.097
Energy Saved (10^6KL of Oil Equivalent)		0.072	2.795	3.280	2.324

Source: Chi-yuan Liang, *Energy Demand Management Technical Assistance Project: The Report of the Republic of China* (Second Draft), November 1984, p. 125.

tion equipment. According to estimates, the average usage of electricity consumed by these three industries for producing one dollar of output was only one third that of the manufacturing sector, and their average consumption of oil was only one eleventh of the manufacturing sector's average usage.[11] If these industries could be expanded, the economy could generate the same amount of added value with less energy.

Three measures have been taken to help promote this objective: (a) tax credits and low interest loans are provided to encourage greater use of energy-efficient machinery and equipment; (b) export of certain energy-intensive products is discouraged; (c) producers of energy-intensive industrial products are encouraged to enter into joint ventures with foreign firms.

Diversification of Energy Use

Efforts at diversifying energy use have been the order of the day since the 1979–80 oil crisis. A program for a switch from oil to coal in industry was swiftly effected. Price incentives are one of the more effective measures. During the period from 1979 to 1981, price increases for coal were not as great as for other major fuels—coal: 33.5 percent; petroleum products: 41 percent; and natural gas: 46.1 percent. Substitution of alternate energy sources for coal in the cement industry was completed by 1983.

Notably, a program of substituting nuclear power for oil has been vigorously pursued. The ultimate goal is to develop an electricity-based economy relying for the most part on nuclear power. Most of the additional future energy needed is expected to come from nuclear-generated electricity. The decade-long operating experience in Taiwan shows that nuclear power generation is not only safe and reliable but also economical (See Table IV). Nuclear power is now viewed as both a handmaiden to growth and an escape from dependency on imported oil; it furthermore strengthens the competitiveness of exports. Because the Taiwan economy is an export-oriented one, its products need to remain competitive with those of such key competitors as Japan, Hong Kong, Singapore and Korea. Table V demonstrates that Taipower has been able to maintain lower electricity tariff rates by maximizing the development and utilization of nuclear power. As the proportion of nuclear power increases, Taiwan's competitiveness in exports is enhanced. In 1984 the installed capacity of the three operating nuclear power plants accounted for 32.4 percent of total installed electricity capacity. The goal is 37.4 percent by the year 2000.[12]

Table IV: Unit Production Cost
(U.S. Mills/Kwh)

Year	Total Production Cost	Hydro		Oil-fired		Coal-fired		Nuclear	
		Cost	Ratio (%)	Cost	Ratio (%)	Cost	Ratio (%)	Cost	Ratio (%)
1980	35.4	14.1	129.4	43.0	394.5	30.7	281.7	10.9	100
1981	38.6	10.9	83.8	52.7	405.4	41.9	322.3	13.0	100
1982	39.6	12.2	75.8	56.3	349.7	44.0	273.3	16.1	100

Source: David S. L. Chu, "Taipower Moving Towards a New Era," *Energy Quarterly*, Vol. XIII, No. 3, (July 1983), p. 121.

Table V: Comparison of Tariff Rates of Electricity among Far Eastern Countries (US¢/Kwh)

Year	Taiwan		Japan		Korea		Hong Kong		Singapore	
	Rate	Base	Rate	Index	Rate	Index	Rate	Index	Rate	Index
1977	3.36	100	6.05	180	4.51	134	4.92	146	4.45	122
1979	3.93	100	6.13	156	6.65	169	5.73	146	5.05	128
1980	5.70	100	11.07	194	7.71	135	7.47	131	7.64	134
1981	7.61	100	N/A	—	9.81	121	9.75	128	8.89	117
1982	6.79	100	10.14	149	9.42	139	8.16	120	8.35	123

Source: David S. L. Chu, "Taipower Moving Towards a New Era," *Energy Quarterly*, Vol. XIII, No. 3, (July 1983), p. 121.

IV

Intractable Problems

Taiwan's scarcity of domestic energy resources and its three-decade commitment to an adequate, reliable supply of energy without due regard for efficiency and diversification have produced some unique features in Taiwan's energy picture.

Over the past twenty years, Taiwan, like her resource-poor neighbors, has become increasingly dependent on foreign energy supplies to meet her economic requirements. In 1965 Taiwan's commercial primary energy supply amounted to 6,061 thousand metric tons of oil equivalent, of which 66 percent was of domestic origin. By 1969 foreign energy supplies exceeded indigenous supplies. By 1984 the total commercial energy supply increased to 38 million kiloliters of oil equivalent, of which 89 percent was imported (See Table VI). Table VII also shows that Taiwan had a higher rate of dependency on energy imports than Korea and Japan in 1982.

Table VI: Taiwan's Energy Import Dependence

	Total Energy Supply (million kiloliters of oil equivalent)	Domestic (%)	Imports (%)
1961	5.15	73	27
1973	17.15	28	72
1979	29.85	17	83
1983	35.54	12	88
1984	38.02	11	89

Source: *Energy Supply and Demand: An Analysis and Prospect* (Taipei: The Energy Committee, the Ministry of Economic Affairs, January 1985), p. 7.

Table VII: Energy Import Dependency of Major Nations, 1982

	Domestic (%)	Imports (%)
Taiwan	14	86
Japan	15	85
Italy	16	84
Korea	23	77
France	31	69
West Germany	45	55

Source: See Table VI.

The composition of the primary energy supply has undergone a great deal of change in recent years. Coal, which contributed 57 percent of the commercial primary energy in 1960, dropped to 13 percent in 1979, but then rose again to 17.76 percent in 1984. The share of oil rose from 14 percent in 1954 to 72 percent in 1979 (See Table I). Although the share of oil fell to 58 percent in 1984, the oil import bill still amounted to U.S.$4.1 billion, accounting for 19 percent of total imports and 7.37 percent of GDP. Furthermore, in that year, dependence on Middle East oil was as high as 83.21 percent of total oil consumption.[13]

From 1954 to 1984, primary energy consumption increased at an average rate of 9.2 percent to meet the soaring demand impelled by rapid economic growth, increases in the standard of living and changes in the economic structure. In the same period real GDP grew at an annual rate of 8.66 percent. The GDP elasticity of demand for total energy was 1.06 for the entire period, indicating relatively low energy productivity.[14]

These problems will remain a major concern to the industry and government officials shaping Taiwan's energy policies. In recent years, economic planners have been searching for a way out. Their strategy, much like the one adopted by their Japanese counterparts, is to shift to less energy-intensive industries and to build up a nuclear-based economy.

V

Conclusion

In recent years, many economists have shown great interest in exploring the factors behind the Taiwan success story. Some attribute Taiwan's success more to subjective or qualitative factors such as devotion to a work ethic, a high educational level, thriftiness, restraint of population growth, acceptance of equalizing tendencies, and successful economic planning; others give greater weight to more tangible, quantitative factors, such as agricultural land reform, high savings and investment rates, strong export-led growth, and anti-inflationary discipline. But another necessary condition for rapid, sustained growth is an adequate and reliable supply of energy resources to all consumers at the lowest feasible cost. All these have combined to generate a real GDP annual growth rate in Taiwan of 8.66 percent in the period from 1954 to 1984.

Easy access to cheap energy is also vital to improving the people's standard of living. The electrification of the countryside has contributed greatly to the decentralization of industry and to rapid labor

absorption. Electricity is now available to people living even in the most remote mountainous areas. As early as 1977, 99.7 percent of all households in Taiwan had access to electricity[15] and thus also to the conveniences and luxuries made possible through this source of energy. As a consequence, the ratio between the incomes of households in the top 20 percent and those in the bottom 20 percent decreased from 5.33 to 1 in 1964 to 4.29 to 1 in 1983.

There is still a long way to go before Taiwan can join the ranks of the "affluent" nations, but the people of Taiwan now enjoy considerable equality of income distribution, in addition to economic prosperity. Taiwan is now determined to attain the status of a developed country by the turn of the 21st century. To reach that goal, efforts are now being made to renovate economic institutions that will enable the government to adopt a more dynamic and flexible developmental and energy policy in the coming decade.

Notes

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2. Chi-yun Liang, *Energy Demand Management Technical Assistance Project: The Report of the Republic of China* (Second Draft, November 1984), p. 11.
3. *Taiwan Energy Statistics 1984* (Taipei: The Energy Committee, Ministry of Economic Affairs of the Republic of China, 1985), p. 11.
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6. Chi-yuan Liang, *Energy Demand Management Technical Assistance Project*, p. 29.
7. W. A. Yeh and W. C. Hwang, "An Analysis on the Patterns of Price Fluctuations in Taiwan During the 1970s," (Taipei: Council of Economic Planning and Development, Executive Yuan, R.O.C., May 1981).
8. Chen Sun and Chi-yuan Liang, "Energy Policies of the ROC, ROK, and Japan: A Comparison," *Industry of Free China*, September 1980, p. 13.
9. See "Conference on Energy Conservation," in *World Economic Press* (Taipei), August 18, 1980.
10. Chi-yuan Liang, *Energy Demand Management*, pp. 80–90.
11. Shirley W.Y. Kuo, *The Taiwan Economy in Transition*, p. 313.
12. *Energy Supply and Demand: An Analysis and Prospect* (Taipei: The Energy Committee, Ministry of Economic Affairs, January 1985), p. 76.
13. *Taiwan Energy Statistics 1984*, p. 11.
14. *Ibid.*
15. *Social Indicators of the Republic of China 1981* (Taipei: Directorate-General of Budget, Accounting and Statistics, Executive Yuan, R.O.C., June 1982), p. 107.

PART IV

GOVERNMENT AND PRIVATE SECTOR ROLES

CHAPTER 7

DEVELOPMENT OF OIL RESOURCES IN OIL-IMPORTING DEVELOPING COUNTRIES

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Introduction

In the past several years there has been continuing interest in the development of oil resources in developing countries, in particular oil importing developing countries (OIDCs). Development of such resources could decrease petroleum imports into OIDCs and depending on the resource base present might lead to petroleum exports. In addition, the development of such resources could: 1) increase government revenues; 2) provide business opportunities for local business; 3) foster the development of infrastructure; and 4) provide opportunities for nationals to develop knowledge and skill in the petroleum sector.

Throughout this period, concerns have been expressed by some that the private sector would not actively seek to explore for and develop the petroleum resources of the OIDCs. In response to this concern intergovernmental institutions have undertaken a number of activities to foster these developments. Several years ago the World Bank, for example, undertook a one billion dollar a year program, which placed particular emphasis on fostering petroleum resource development in developing countries. As was to be expected, some

governments and private sector companies stated their reservations regarding some of these programs, their major concern being that capital available from intergovernmental organizations was substituting for private capital rather than filling a void. Implicit in this private sector view is a strongly held belief that as long as the petroleum resources have economic value and necessary incentives are present, funds will be invested by the private sector for aid to governments for the development of oil policies, training, and infrastructure development.

In the past few years there has been some rethinking of the roles of intergovernmental institutions in this area with significant indications that these institutions wish to place greater emphasis on activities which foster private sector initiatives. The World Bank is now placing particular emphasis on this approach in its current programs.

This paper has been prepared to provide background on some of the issues relating to the development of the oil resources of developing countries with emphasis on OIDCs. The paper:

1. Describes the factors considered by investors in deciding whether or not to explore for and develop petroleum resources.
2. Provides information on the nature of contracts between private sector investors and governments.
3. Includes data to demonstrate that there has been significant exploration in developing countries. The extent of drilling has in fact increased in the most recent years for which data are available.
4. Highlights intergovernmental efforts to promote oil and gas development in developing countries. Many of these efforts concentrate on such developments in OIDCs.
5. Discusses the heightened interest in the World Bank in supporting programs for OIDCs, which would foster private sector investment.

The paper concludes that the issue of oil and gas development in OIDCs is being successfully addressed at this time as:

1. The private sector is interested in developing economically viable petroleum resources throughout the OIDCs. Such development would be undertaken to meet either domestic or international market needs.
2. Governments of developing countries have increased their capabilities in negotiating with private sector investors.

3. Extensive exploratory drilling has occurred in OIDCs. About 200 companies were engaged in efforts in the period between 1979–1983 in developing countries despite rapidly changing contract terms with governments.

4. It is not possible at this time to determine the overall impact on oil development of intergovernmental activities of the past few years.

5. World Bank current efforts focused on overcoming impediments to invest, whether they may be government policies, lack of key infrastructure or policies of private sector investors are timely and should contribute constructively to exploration and development of oil resources in OIDCs.

I. Factors Considered By Investors in Decisions to Explore for Oil

The decision to invest is heavily dependent on the geological potential of an area; exploration must precede the decision to invest. Exploration activity will occur when:

1. The area is perceived to have geology favorable for oil accumulation.
2. There is access to acreage.
3. The contract terms governing exploration and subsequent development and production are satisfactory to all interested parties.

An adequate amount of exploration is not measured by the number of wildcat wells per unit of area based on exploration efforts in large oil producing countries such as the United States. "Adequate" exploration is a more qualitative concept since it involves an assessment of whether exploration has been pursued to the extent it has been felt economically justified. For example, the remote location of some resources and their overall geologic attractiveness play important roles in determining the economic justification for undertaking exploration activity.

From the results of 100 years of exploration and discovery, it is known that hydrocarbons are not evenly distributed within sedimentary provinces, but are rather concentrated in a limited number of areas. Much of the world's oil is found concentrated within giant fields within these areas where the geologic conditions exist for generation, accumulation, and entrapment. Oil is often not found where it is wanted or needed. Therefore, saying that exploration activity must be increased in countries because they need the oil to

satisfy local needs or reduce reliance on imports ignores the technical aspects of oil exploration. In other words, many areas are unlikely to have economically viable oil reserves.

The most attractive drilling spots are those regions where the presence of hydrocarbons has already been established. This helps to explain the unique distribution of exploration drilling activity in various geographic areas of the world. Analysis by a major oil company showed that during the period 1966–1976 the success ratio was only one well in forty-four (1:44) in those non-OPEC countries (primarily OIDCs) that had no previously discovered reserves.[1] The data base for this analysis was over 1,000 wells.

It does not take saturation drilling of an area to establish that it does not have economic accumulations of oil. Generally, oil or gas is found in the early stage of exploration when only a few wells have been drilled. In most cases it is possible to identify the most promising spots for exploratory drilling. It is therefore not valid to state that because the "density" of wells drilled in a number of non-oil producing LCDs where no oil has been found is low, an increase in the number of wells drilled will result in a proportionate rise in discoveries.

The decision to develop a discovery is judged on its economic merits after the discovery is made—if one company does not choose to do so, a government or another company may feel that the discovery is economically viable and proceed with development.

Information on the extent of exploratory drilling in developing countries is presented in section III of this chapter.

Some believe that transnational corporations (TNCs) are not interested in a project to supply a purely local market. If prices are not controlled and profits can be remitted, local market size projects can be as attractive as export size projects. Export size projects serve to eliminate several possible risks. Oil in the export market is generally sold at world market prices so there is no risk of reduced revenues due to internal price controls. Oil sold on the world market generates hard currency which is not subject to possible local foreign exchange difficulties which may range from governmental restrictions to the simple absence of enough hard currency.

Where oil is economic, oil companies are interested in it primarily as a saleable commodity rather than as a particular supply for their refineries. There are independent explorer/producers who have no refineries at all and the typical integrated major looks for oil any place it expects economic accumulations may be found, not just near its refineries. Integrated crude supplies are useful, but it is not normally an overriding consideration in exploration or development decisions.

There is no doubt that considerable oil remains to be found, but where and how much is a matter of speculation. Experts disagree. The fact that different operators in a highly competitive industry have different views on this subject leads to a dispersion of activity and improves the odds that "adequate" exploration is taking place.

The perception that exploration may not take place because of the prospect of discovery of small fields, or the prospect of discovering only sufficient reserves to supply the local market, appears to assume that it is possible to know in advance what will be discovered. This is not the case. Naturally investors would prefer to find the largest fields they can. Target field size is dictated by minimum economic feasibility where the potential size of the discovery must be large enough to recover costs and provide a return on investment, and to offset the high probability that there will be no discovery at all.

There is no single ideal petroleum agreement or contract. Each contract should be tailored to the specific situation and conditions at hand recognizing the desires and needs of all parties. Oil companies have accepted many new contractual forms, and have developed ways of operating under production-sharing and service contracts to earn a reasonable return on investment. Some desirable features (but not a detailed comprehensive list) of contracts include:

- Provisions that prevent double taxation in the host and home country (requires coordination between legislative and tax authorities).
- Designation of one government entity to deal with regarding all areas of petroleum operation.
- Careful spelling out of each party's rights and obligations, disposition and pricing of production, arbitration and other mechanisms for resolution of disagreements.
- Adequate cost recovery provisions.
- Reasonable work programs/commitments.

A contract should be carefully structured in order to be applicable to discovery results other than "the most likely outcome." This will allow the economic development of even the small, high cost fields. In addition, a contract that is structured to handle the "high side case," as well, will be more likely to be judged fair in the eyes of the country and therefore less likely to be subject to abrogation.

For terms to be attractive to an investor, they must relate to the actual hydrocarbon situation in the country. A country that has limited production or reserves cannot expect terms patterned on an Indonesian model for example, to be competitive. In order to attract

that initial bit of exploration work, very competitive terms must be offered. Subsequently terms may be tightened up somewhat in new areas to be offered as a certain amount of geologic risk has been eliminated. As stated before, nothing attracts further exploration work better than a good success. Additional comments on contracts are presented in Section II below.

II. Nature of Contracts Between Investors and Governments

The private sector operating under the laws and regulations of individual countries and in accord with bilateral and other intergovernmental agreements has played a key role in developing commercial energy resources in developing countries including oil importing developing countries.

A number of studies provide information on the growth of national oil companies in the 1960s and 1970s as well as the nature of laws, regulations and contracts (UN studies and Resources for the Future). The growth of national oil companies in the 1960s and 1970s is presented in the 1983 UN publication "Main Features and Trends in Petroleum in Mining Agreements."[2]

Another UN report ("Transitional Corporations in World Development") states that as a result of developments in the period between 1970 and 1979, the overall share of petroleum transnational corporations (TNCs) in worldwide production has decreased from 94 percent in 1970 to 45 percent in 1979.[3] The same UN report provides extensive information on trends in policies and the overall relations between private petroleum TNCs and national governments, with particular emphasis on developing countries. The report on the basis of a study of petroleum laws and agreements notes the following policy trends in the sector:

1. Regimes have been established to accelerate exploration and production (E&P) at minimum cost to the host countries, TNCs providing risk capital.
2. Mechanisms have been introduced "to ensure more effective host country participation in and control of the petroleum operations."
3. Increased emphasis has been placed on training of nationals.
4. Significantly new methods have been introduced to maximize host country revenues.
5. Economic linkages to ensure broader development have been introduced.

The UN paper noted that in some instances host countries have relaxed terms to induce investments by TNCs.

The UN report, "Main Features and Trends in Petroleum and Mining Agreements," referred to earlier provides more extensive information on the changing conditions for foreign investors in the petroleum sector. Terms for agreement between private foreign investors and their governments are compared in one table of this report. The information on financing and fiscal matters in the UN Report clearly demonstrates the role of foreign direct investment in providing risk capital and governmental approaches to maximizing governmental revenues from these agreements.

Raymond F. Mikesell in a 1984 publication provides additional information on this subject.[4] The paper includes extensive discussions of petroleum production sharing agreements used by Indonesia, Peru, Guatemala and other countries, as well as discussions of service contracts, joint ventures and concession agreements.

Mikesell concludes that:

- "Most contracts provide for lower output or revenue shares for the contractor from higher incremental production thereby reducing the expected NPV* from an exploration investment and also discouraging the development of additional production from higher cost fields."
- "the case studies provide a number of examples of increased interest on the part of international petroleum companies following a liberalization of contract terms."
- "the efficiency of a GOC (government oil company) should be judged on the basis of its success in mobilizing external resources rather than simply on the basis of its own performance in exploration and development."

III. Oil Industry Exploration Activities in Developing Countries

A 1983 publication by the American Petroleum Institute[5] provides extensive information on the extent of private oil company exploration activities in developing countries, most of them oil importing developing countries. Such activity is a clear indication of the interest of such companies in developing economically viable petro-

*Not Present Value.

leum resources in oil importing developing countries. The API publication lists about 200 companies that have been active in LDCs in the five-year period ending in 1983. These companies range in size from the major U.S. and European oil companies to a great many independent oil companies from the United States, Europe, Canada, Japan, and the Philippines.

The API survey also shows that private oil companies were active in 97 developing countries during this period. As stated in the API paper "private oil companies have been active in many LDCs, even those which are very poor and where there are no obvious indications of oil deposits large enough to permit major exports. In most of these countries, wells have been drilled, and in about two-thirds more than one private company has been involved."

The API paper further provides information supporting a statement that "In general, countries with no reported activity are small island nations and countries with exceptionally poor geological prospects." Examples of these countries taken from the API paper are noted below:

Continent	*Country*
Africa	Cape Verde Islands
	Rwanda
	Upper Volta
Asia	Cambodia
	Mongolia
	Singapore
Middle East	Cyprus
	Lebanon
Oceania	Samoa
	Solomon Islands
Western Hemisphere	El Salvador
	Grenada

Another perspective on the extent of exploratory drilling in developing countries by all companies (private and government) for the period of 1967 to 1984 is presented in Figure I.[6] These data show that about 50 percent of exploratory drilling outside the United States, Canada, and communist areas for this period has been in developing countries. Data shows that by 1984 the number of exploratory wells drilled in developing countries has increased significantly, 894 rel-

ative to 615 in 1976. See Annex A for a discussion of why drilling statistics in the United States and Canada should be excluded in looking at worldwide exploration statistics.

Figure I: Exploratory Drilling (Ex. United States, Canada and Communist Areas)

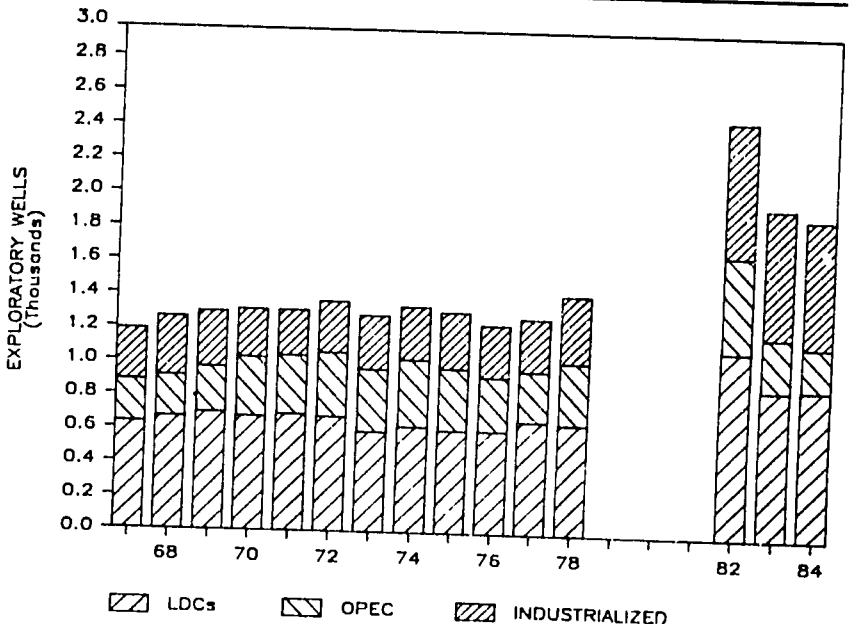

Table I: LDC Exploratory Drilling 1984

Compared to 1976	1976	1984
Number of exploratory wells	615	894
Number of countries in which wells drilled	35	41
Countries drilled in 1984 which had no exploratory drilling in 1976		14
Countries drilled in 1976 which had no exploratory wells in 1984		(8)

Distribution of 1984 Drilling	Number of Countries	Number of Countries
Countries with no prior discoveries	9	21
Countries with prior discoveries	32	873

IV. Intergovernmental Activities Aimed at Developing Petroleum Resources of OIDCs

Many national governments have taken action in the past 15 years to restrict the activities of petroleum TNCs. In part of this period a number of developing countries were also placing increased restrictions on TNCs in a number of other sectors. The actions of national governments in the petroleum sector have in many instances created policy frameworks in which it did not appear to petroleum TNCs that it would be economically viable to develop petroleum resources in some countries. Recent developments (in particular, decreased petroleum demand, prices and worldwide excess production capacity) have also had impact on decisions regarding exploration and production activities.

In addition different perceptions exist on the potential petroleum resources of some countries and in particular the extent to which exploration activities are now being pursued in some developing countries, in particular oil importing developing countries. This subject has been discussed in Section III of this paper, but it is appropriate to state again that there is extensive evidence that exploration activities have been pursued at an appropriate rate taking into account geological potential, access to acreage, the mechanics of conducting exploration, governmental policies regarding foreign direct investment, and current market conditions.

Because of concerns about the pace of petroleum resource exploration and development, intergovernmental organizations have undertaken a number of new programs in recent years. The World Bank and the UN Development Program (UNDP) have undertaken individual national reviews of energy policies in OIDCs (29 completed by 1984 out of a total of 70 planned by the end of 1985). These reviews are widely viewed as making significant contributions to this important area of concern.

The World Bank has also expanded its activities in energy, moving from placing essentially all energy effort on electric power generation in the 1970s to including oil and gas exploration and development, as shown in Table II below. (Energy lending is about 25 percent of overall lending).

World Bank efforts have included: assistance in estimating energy resources; sponsoring seismic surveys; exploratory drilling; development; training; and co-financing to a limited extent (World Bank, government, private investors). Some concerns have been voiced in the past, in particular in the United States, regarding this World Bank program and the extent World Bank funding may have substi-

Table II: Energy Lending by World Bank (By Fiscal Year)

	$B				
	1978	1980	1982	1984	1985
Electric Power	$1.1	$2.4	$2.1	$2.7	$2.3
Oil & Gas	—	0.4	0.5	0.6	0.8
Other	—	—	0.8*	0.2	0.4
Total	$1.1	$2.8	$3.4	$3.5	$3.5

Source: *World Bank (includes $0.4B refineries)

tuted for funds otherwise available from private foreign investors. The World Bank has recently reviewed utilization of its funds to determine the best way to foster energy development and has developed guidelines for energy investment which are intended to foster increased private investment. These guidelines are discussed in Section V below.

The World Bank also agreed to a Convention which would establish a Multilateral Investment Guarantee Agency (MIGA) designed to foster foreign direct investment at the World Bank-International Monetary Fund Meeting in Seoul in 1985.[7]

MIGA is charged with (1) insuring investments "serving a development purpose," in a developing country against risks such as currency transfers, expropriation and similar measures, breach of legal commitment and war and civil disturbance; and (2) promoting investment in developing countries.

The agency will not be a part of the World Bank, but the President of the Bank will serve as Chairman of the Board of MIGA.

Authorized capital will be $1 billion and minimum subscription $250,000. The Convention will enter into force when five capital exporting and ten capital importing countries have ratified the convention. By year end 1986, 50 countries signed the convention and seven developing countries ratified the convention. In addition the Preparatory Commission agreed on operating and financial policies for MIGA at a September 1986 meeting.

The International Finance Corporation has undertaken an energy program which is increasing expenditures from about $20 million a year to about $100 million a year over the five year period beginning in 1984.[8] About 20 percent of this $500 million will be used to make equity investments in oil and gas exploration projects. The IFC is considering taking 10 percent shares in projects which the IFC be-

lieves would be of interest to independent oil companies rather than majors.

According to an August 1984 UN report[9], over the preceding six year period, in conjunction with other groups in the UN system, UNDP had committed about $230 million to projects in 90 LDCs. About half of the 487 projects have been in the area of new and renewable energy.

Regional development banks have also developed financing programs for oil and gas development. In 1982, for example, total commitments for energy projects equalled $1.4 billion. Other intergovernmental activities on energy have included: an IEA Seminar on oil and gas development in OIDCs; a UN Conference an Alternate Energy Resource; and creation of a UN office to exchange information on the energy activities of various UN agencies. In addition, OECD Ministers have agreed to take steps to foster more positive policies in LDCs regarding FDI in general (not energy specifically).

V. The World Bank's Role in Fostering Private Sector Investment

A January 1985 article in *Bank's World*,[10] a publication of the World Bank, reports that the Bank had at that time issued guidelines to its operational staff for oil and gas lending, which calls for private capital as a prime mover in developing oil and gas resources. These guidelines were developed to clarify the Bank's role in this area.

In this article, Jean-Loup Dherse, Vice President, Energy and Industry, said that the Bank's support for exploration promotion will be based on a "precise inquiry as to what is holding up investments—why oil companies are staying away from the country." The Bank would then propose programs aimed at helping overcome specific obstacles.

Mr. Dherse noted that exploration and appraisal drilling is a "high-risk area that is best undertaken by people willing and able to take a chance on losing their entire investment." He then noted that ample risk capital is available from investors if countries provide satisfactory conditions. This means, according to Mr. Dherse, that the Bank "will not be very active in financing exploration." The Bank can, however, "help countries attract foreign investors in exploration" by helping governments finance developments which may result from the exploration program.

Commenting more widely on petroleum development, the article states that the Bank can be helpful in putting together financing for

development, which might involve public funds, foreign equity and various types of co-financing. Under the guidelines, loans for oil development would not be made if no effort were "really made to attract other equity investors."

The article also reported that two major criteria are to be used to determine whether or not oil and gas projects need any Bank financing. "The first is whether or not the project could take place without Bank involvement. The second is whether by providing some funds the Bank can help a country improve its policies and the local companies strengthen their management capability."

VI. Conclusion

A review of the material in this chapter shows that the issue of oil and gas development in OIDCs is being successfully addressed at this time:

1. The private sector has demonstrated an interest in developing economically viable petroleum resources throughout the OIDCs. Such development has been undertaken to meet either domestic or international market needs.
2. Governments of developing countries have increased their capabilities in negotiating with private sector investors.
3. Extensive exploratory drilling has occurred in developing countries, most of which are OIDCs, and about 200 companies have been engaged in such efforts, despite rapidly changing contract terms with governments.
4. It is not possible at this time to determine the overall impact on oil development of intergovernmental activities of the past few years.
5. World Bank efforts currently are increasingly focused on overcoming impediments to investment, whether they be government policies, lack of key infrastructure or policies of private sector investors. The Bank's efforts are timely and should reinforce private sector efforts in exploration and development of oil resources in OIDCs.

Notes

1. Hart, M., Fitzgerald, T., and Zieman, W.E., *Exploration and Economics of the Petroleum Industry*. South Western Legal Foundation, Matthew Bender, Inc., 1979.
2. UN Centre on Transnational Corporations, *Main Features and Trends in Petroleum and Mining Agreements*. New York, New York, 1983.

3. UN Centre on Transnational Corporations, *Transnational Corporations in World Development*. New York, New York, 1983.

4. Mikesell, Raymond F., *Petroleum Company Operations and Agreements in the Developing Countries*. Resources for the Future, Washington, D.C., 1984.

5. Wollstadt, Roger D., *Oil Exploration in Less Developed Countries: The Activities of Private Oil Companies*. American Petroleum Institute, Discussion Paper No. 028, August, 1983.

6. Data used in preparing this figure are taken from: The Oil and Gas Journal; Basic Petroleum Data Book; Petroleum Industry Statistics, Volume V, Number 3, September 1985, American Petroleum Institute; American Association of Petroleum Geologists, AAPG Bulletin.

7. Report on MIGA: Multilateral Investment Guarantee Agency, The World Bank, Information and Public Affairs Department, September/October 1985.

8. *Petroleum Intelligence Weekly*, page 7, July 16, 1984.

9. United Nations General Assembly, Development and International Cooperation: Development of the Energy Resources of Developing Countries, Report of the Secretary General, A/39/420, August 24, 1984.

10. Tillier, Ellen, *Banks' World*, January 1985.

ANNEX A

Exploration in the United States & Canada

U.S. and Canadian petroleum operations are very different from the rest of the world in a number of ways:

1. Their petroleum infrastructure is much better developed. Equipment, skilled operators, and services are readily available at low cost.
2. Leasing is largely unregulated. An explorer identifying a potential drilling site has simply to reach agreement with the landowner (the landowner owns the mineral rights).
3. Rule of capture exists whereby adjacent landowners may also tap a discovery after it is made. This stimulates additional drilling.
4. There is a very well developed pipeline network to offtake crude to a refinery or shipping point. Delivery costs to market are very low.
5. There is no governmental control of production or pricing in the United States and to a large extent in Canada.

The result of these conditions is that a great number of wells are drilled in the United States and Canada. Some can be drilled for as little as $100,000. They can also be economically produced, even if the yield is very small (3-4 B/D—the overall average in the United States is 14 B/D). In the developing countries and other parts of the world, a new pipeline would likely be needed, requiring appreciable throughputs, whereas in the United States pipeline systems already are in place.

CHAPTER 8

THE ROLE OF THE PRIVATE SECTOR IN PROVIDING TECHNICAL ASSISTANCE FOR ENERGY DEVELOPMENT

by
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Introduction

The shift to higher oil prices has been an abrupt shock from which nost developing countries have yet to recover. Although oil prices n dollars have declined over the past two years, costs in European nd other currencies have continued to increase. As indicated in the receding chapters of this book, adequate energy availability is crit- :al to a modern economy, and even more critical to developing ountries attempting to modernize their economies. It is expected iat non-oil developing countries will spend $75 billion to import iel in 1985, up 50 percent from $50 billion in 1980.[1] Moreover, on-commercial fuels, comprising firewood, charcoal, and animal id plant wastes, currently represent 50 percent of all energy use in any developing countries. These more traditional fuels cannot pos- oly meet the future energy demands of the developing countries, pecially when the countries regain a more robust economic growth th.

Technical assistance from the OECD private sector can play an important role in helping the developing countries meet their energy needs. The costs of meeting these requirements will be very high, but so too will be the benefits. According to World Bank estimates, approximately $1.5 trillion will be needed over the next ten years to develop potential energy resources in the developing countries.[2] Several of the more important forms of assistance that the private sector can provide are:

- Serving as an entrepreneurial stimulus in creating new energy projects.
- Arranging urgently needed financing.
- Participating directly in energy management activities ranging from energy planning and development to ownership interests in development projects, operation and maintenance of energy resources and marketing assistance.

This paper examines the role that the private sector can play in providing these forms of technical assistance—entrepreneurial, financing assistance, and energy development, operations, and planning.

The Entrepreneurial Role of the Private Sector

For many years, the private sector of the major OECD countries has played an important entrepreneurial role in developing energy projects in Third World countries. However, in the last decade, direct foreign investments in the Third World have slowed significantly, primarily as a result of the lack of economic incentives to the OECD private sector and increasing protectionism and nationalism. If the Third World is to solve its pressing energy problems, it is important that they take better advantage of the entrepreneurial skills of the OECD private sector in creating energy projects within their countries—including project conceptualization, development and implementation as well as arranging financing—all provided within a commercial market framework that enforces efficiency.

A key issue then is the economic incentives needed to increase the role of the OECD private sector in Third World energy projects. The potential for the private sector to offer its developmental, technical, operational, and marketing expertise and financing assistance will depend, to some extent, on the willingness of the developing countries to allow more private enterprise participation in the de-

velopment of their energy sectors. It is important that the Third World provide a more stable business environment within their countries that will encourage foreign participation. Risk capital, which is particularly important for projects in the exploratory and developmental phases, is unlikely to be provided by the OECD private sector unless the proposed energy projects are developed consistent with commercial practices. Furthermore, as debt financing becomes more limited, equity funding will become increasingly important in providing the capital and credit support necessary for commercial financing of projects. In order to attract this risk capital, developing countries must provide assurances that investors will earn a return commensurate with the risk. Whether investors can earn this return will depend on a country's policies toward such issues as equitable treatment of foreign ownership, foreign participation in management and decision-making, fairly allocating project revenues, assuring repatriation of earnings, consistently applied taxation policies, and currency convertibility, among others.

Technical Assistance in Financing

In today's environment, financing is often a prerequisite to the implementation of projects in developing countries. However, in view of the liquidity problems that have dampened economic activity in many developing countries, attracting financing from international financial markets has become exceedingly difficult. Even if current financial instability diminishes, commercial banks are expected to continue to be reluctant to commit funds in many developing countries without assurances concerning the financial viability of proposed projects. Increased private sector involvement would contribute significantly to the proposed project's viability and acceptability by commercial banks.

However, OECD governments can play a more important role in assisting their private sectors to take the developmental lead in creating projects and providing financing and technical expertise to developing countries. For its part, the U.S. government should consider expanding its finance programs currently available to foreign countries. Financing is critical in supporting the feasibility and planning studies required in the entrepreneurial stage of large energy projects. It is important that developing countries be able to secure grants and other soft-loan funds for these feasibility studies. For this reason, perhaps programs such as the U.S. Trade and Development Program, and the U.S. Agency for International Development should

be re-evaluated and strengthened to assist in the entrepreneurial stages of these projects.

Strengthening the export finance programs in the U.S. Eximbank and other agencies to focus more on financing technical assistance, rather than manufactured exports, can play an important role in facilitating the development of energy projects in Third World countries, e.g., expanding these programs to fund soft currency transactions, to provide export credits in conjunction with aid funds, and perhaps provide import funding to help secure markets for the output of new projects.

The World Bank and other multilateral agencies can also play an expanded role in promoting private sector technical assistance in energy project development. The International Finance Corporation, the private sector arm of the World Bank, and other similar agencies can assist the private sector in the formation of government/private partnerships and increase the role of co-financing with private funding sources. Co-financing can help leverage limited amounts of funding as well as attract the participation of commercial lenders and other funding agencies, including export credit agencies, to energy projects.

Although international financial institutions can partially assist in providing financing, the financial resources of these agencies are limited and can only supplement the role that private financing will need to play in future energy developments. As a consequence, assistance in arranging the financing perhaps has become as important as the other forms of assistance that can be provided to the developing countries. The types of financing assistance that the private sector can arrange for energy sector projects in the developing countries include:

- Project financing, including commercial loans, export credits, soft loans and multilateral institution loans.
- International joint ventures/consortia.
- Barter/countertrade.

Project Financing

Limited recourse project financing, where the financing is based primarily on an evaluation of the project's capacity to meet debt service, operating expenses, and other financial requirements from anticipated revenues, rather than the creditworthiness of the project's sponsor, have been utilized for many years in financing energy projects in the United States and other OECD countries. Recently,

these techniques have begun to be applied to energy projects in developing countries.

In these arrangements, lenders usually require additional backing in the form of guarantees and other assurances from sponsors and other related parties in the event of unexpected difficulties in project completion or operation. The ability to finance an economically attractive project, therefore, depends upon the willingness of sponsors, equipment suppliers, contractors, offtakers, and others involved to provide adequate credit support—and perhaps most important, depends on the sponsor's ability to pull all of the potential participants together into a viable project; i.e., the marshalling of capital, and managerial, technical and marketing forces. Accordingly, the thoroughness of the preliminary resource assessment and energy planning feasibility studies assumes great importance in demonstrating the overall economic viability of proposed projects.

International Joint Ventures/Consortia

Developing countries can do much more to attract private equity capital to development projects by forming joint ventures with the multinational and other private firms. These cooperative efforts could take new forms through joint ventures among energy producers, equipment suppliers, and contractors, as well as other interested private firms—both domestic and international. Some energy projects are so massive that joint development through a jointly owned company is required to spread the capital requirements and risks. Such ventures lend themselves to project financing as well.

To make this technique more attractive to potential private sector partners, it is increasingly important that more developing countries consider privatization policies for energy projects, rather than the more traditional approach of development by governmental agencies and state enterprises—especially until the sovereign risk borrowing problems of developing countries are resolved. With increased privatization, international consortia can be formed to bid, develop, own, and operate the project. In so doing, governments of developing countries can preserve foreign exchange earnings for other uses while drawing upon the expertise of the private sector to develop projects urgently needed for energy development.

Barter/Countertrade

Barter and countertrade are increasingly being used to attract funding by countries where shortages in foreign exchange earnings are acute and traditional sources of funding are not available. Approximately 90 countries are now using these techniques in some form.

Fuels, especially oil, have been particularly amenable to these transactions in recent years. To finance a project in this way, either the output of the project or other goods or services produced by the country may be tendered to offset the costs of construction and procurement. The expertise of commodity traders and general trading companies is very important in appropriately structuring large-scale trades.

Technical Assistance in Energy Planning

Energy development generally requires large, complicated, capital-intensive projects. As a result of the capital-intensive nature of these projects, and the serious financial constraints facing developing countries, very experienced project management is necessary to develop such projects on schedule, within budget, and within standards of high quality engineering design and construction. It may be necessary to develop innovative approaches, including smaller-scale modular plants which offer the flexibility of adding increments of additional production capacity at a later date. Technical assistance from the OECD countries is vital in these areas.

Each step of the energy planning process has a technical aspect for which the OECD private sector can provide substantial assistance. This can range from assessing the domestic requirements for energy to determining the quantity and quality of energy resources that can be developed for the domestic market and for export. Technical assistance from the OECD private sector has the advantage that the expertise provided is based on extensive experience in national and international resource development under a broad range of conditions. Additionally, the technical expertise can be transferred to developing country nationals in the course of the energy project development, e.g., in the case of electric power development, technology transfer can be useful in determining which fuels are best to use, in sizing power plants, and in timing construction to meet demand. OECD electric utility system planners can provide developing countries with this type of technical assistance and technical transfer.

Conclusion

In order for developing countries to meet their future energy needs, it is imperative that they provide appropriate economic incentives to OECD private sector entrepreneurs and financing institutions. In the future, as a result of the developing countries' financing con-

straints, it will be increasingly difficult to develop many energy projects without some form of private sector participation. Constrained by the limitations of current government assistance programs, the cooperative efforts of the industrialized countries' private sectors would go a long way toward reviving important development programs and projects.

It is very important that the commercial market discipline of the private sector be the basis for these energy projects. Oil, for example, is an internationally traded commodity whose price is increasingly determined by demand and supply conditions. Without the market discipline of the private sector, oil pricing and production levels become unrelated to market needs, causing severe economic distortions and social adjustments throughout the world, but especially within the non-oil developing countries. With the appropriate economic incentives, the OECD private sector will provide a broad spectrum of urgently needed technical services in the development of economically attractive energy projects. The benefits of this approach, which would accrue to both developed and developing countries, include expanded world trade, increased economic growth and employment, as well as the availability of reasonably priced energy.

Notes

1. Wharton Econometrics, August 1984.
2. World Bank, 1984.

THE ATLANTIC COUNCIL OF THE UNITED STATES

Founded in 1961, The Atlantic Council of the United States is a national center for education and for the formulation of policy recommendations on the problems and opportunities shared by the developed democracies. The Council is national in scope, rigorously bipartisan in orientation, and actively centrist and consensus-building in nature.

For over a quarter century, the Atlantic Council has focused on:

- strengthening Western cohesion through our Atlantic and Pacific alliances;
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- exploring the interrelationships of previously segregated "Atlantic" and "Pacific" issues;
- integrating the traditionally fragmented aspects of our international economic and national security policies; and
- serving as a catalyst for better understanding and communication by bringing together the younger "successor generation" leaders from the public and private sectors of Western Europe, North America, East Asia and the Pacific.

It is the combination of these special characteristics which confers on the Atlantic Council its effective role in the formulation and conduct of US foreign policy.

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