CHAPTER

4

INTERNATIONAL EXCHANGES OF ALTERNATIVE ENERGY SOURCES: TECHNOLOGY, PRICE, AND MANAGEMENT

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The events of October 1973 triggered major changes in international economic and political relations, calling into question established assumptions about power politics, the use of economic power for political purposes, and the simple division of the world into rich and poor. Three trends have crystallized, each with potentially far-reaching implications. First, a growing realization by rich and poor states alike of the emerging interdependencies that bind them in a common quest for valued goods in an environment of potential scarcity; second, the development of a resource "crisis" stemming initially from impending shortages in petroleum supplies and maturing into a generalized concern over the possibilities of induced shortages, higher prices, or manipulated supplies of other resources critical to industrial processes; and third, the convergence of these two developments in an anxious concern for the international implications of investments in alternatives to petroleum and the possibility of greater reliance upon other sources of energy.

The effectiveness of the Organization of Petroleum Exporting Countries in raising petroleum prices did more than simply signal impeded access to oil resources and effective interference in the functioning of the world petroleum market. These interventions in the oil market led to the politicization of resource questions in international politics, and this politicization created a growing awareness by all states of the potential for serious malfunctioning of international economic exchanges.

The mobilization of countries of Asia, Africa, and Latin America in common opposition to the advanced industrial states placed new pressures on existing international institutions and confronted the advanced states with new constraints in the conduct of foreign policy. The very foundations of established global transactions

prior to the crisis have been challenged and international institutions are facing an unprecedented demand for effective representation of the interests of the developing world. The General Assembly of the United Nations has become a forum for debates on a new international economic order. The discussions so far have been both rhetorical and pragmatic. The rhetoric reflects the ideological concerns of both rich and poor states--the former, in preserving their preeminence in international politics, and the latter, in seeking a more favorable economic condition vis-a-vis the industrial societies. The pragmatism indicates a shared appreciation of exchange problems and an awareness of the necessity of facilitating international transactions to the joint satisfaction of both rich and poor.

This chapter describes some political consequences of a future global energy system based on alternatives to petroleum. We assume that the higher the price of crude petroleum, the more likely it will be that consumer countries will make greater investments toward the development of alternative sources of energy. Different sources of energy will invariably generate patterns of global interactions substantially different from those created by petroleum exchanges. So too, different energy sources will highlight different types of inequalities among nations, defining resource-rich and resource-poor differently, and giving rise to divergent sets of national options and priorities.

Our purpose is to delineate the characteristic features of international exchanges of alternative energy sources. We seek to identify some structural imperatives of the exchanges that might generate international political challenges for all states and contribute to the need for new organizational responses to these challenges.

CHALLENGES TO WORLD ORDER

The resolutions calling for a new international economic order provided the impetus for the Sixth and Seventh Special Sessions of the UN General Assembly.[1] Throughout the Sixth Special Session, a spirit of confrontation between rich and poor states prevailed, producing stiff reactions on all sides by the end of 1974. The amelioration of the oil crisis and plans for restructuring UN activities in social and economic affairs contributed to a perhaps only temporary lessening of tensions between advanced and less developed states.

Control over access and diffusion of advanced technology to developing countries provides advanced states with marked leverage over international transactions. Similarly, control over raw materials may provide the poorer producing countries leverage in their

relations with advanced states. The focus on international exchanges of alternative sources of energy is designed to highlight different structures of interdependencies, economic and political potential conflicts associated with alternatives to petroleum, and the role of technological advances in international energy exchanges--all with respect to their implications for the development of world order.

The global institutional arrangements governing transactions in energy have yet to be developed to any significant degree. It is clear that national governments will assume a primary role in such arrangements. Whatever agreements importers and exporters of crude petroleum might develop in the immediate future, it is unlikely that such arrangements could be readily transferable to other sources of energy. Thus, the question of competing conceptions of world order for energy transactions will emerge increasingly as an important international political problem. A fundamental aspect of this problem will be devising institutionalized means by which the costs and benefits of global exchanges of energy will be regarded as equitable to both importers and exporters. The nature of the exchange will become one of the most fundamental issues in debates between producers and consumers, importers and exporters, and rich and poor states.

PROFILES OF ENERGY EXCHANGES

The major alternatives to petroleum are coal, natural gas, nuclear fission, solar energy, geothermal energy, and tar sands and shale oil.[2] Different cost factors, time perspectives, and technological imperatives are attached to each. Although petroleum will remain the dominant energy source at least until the end of the century, its importance may recede in the economies of the major industrial states.[3] In the years to come, we are likely to be confronted with a situation in which different countries will utilize different "mixes" of alternative energy sources.

Consumption of different energy sources by the developed nations is presented in Figure 4.1. Several trends stand out:

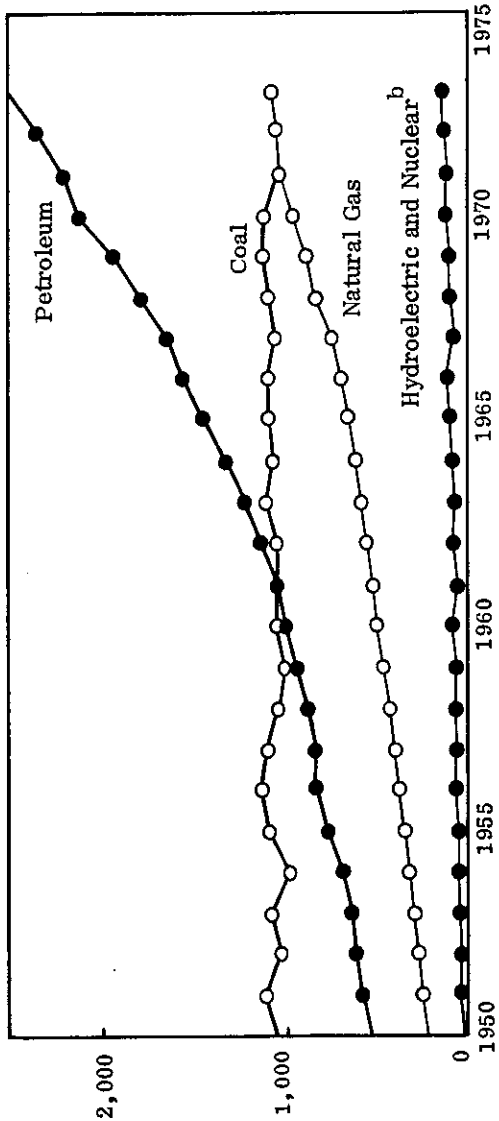
The volume of petroleum consumption increased sharply between 1949 and 1976, and the percentage of oil of total energy consumed nearly doubled during this period.

Although the total amount of coal consumed remained fairly stable, the share of coal in relation to other sources of energy declined appreciably.

The volume of natural gas consumed increased markedly over the 27 years, but its share as a percentage of total energy utilized remained fairly stable.

FIGURE 4.1

Consumption of Major Energy Sources by the Developed Nations,[a] 1950-75
(in million metric tons of coal equivalent)



[a]The developed market economies of Australia, Canada, Israel, Japan, New Zealand, South Africa, United States, and Western Europe (including Yugoslavia).

[b]Includes imported electricity.

Source: United Nations, World Energy Supplies, 1970-1973, ST/ESA/STAT/Ser.J/18 (New York: United Nations, 1975).

While these figures do not disaggregate hydroelectric and nuclear power, we can assume that the amount of hydroelectric power consumed has remained fairly stationary over time, whereas the percentage of total energy utilized has declined somewhat. With respect to nuclear energy, however, both the amount utilized and the percentage of total energy consumed have increased dramatically over time.

There are clearly shared interests among non-oil-exporting countries in the development of any source of energy in that such activity would expand the amount of energy available, decrease pressures for the utilization of petroleum, diversify the sources of potential political and economic power associated with the control of energy, and give the advanced states in particular a more important role in energy-related transactions. Beyond these general communalities, there are specific characteristics of each alternative to petroleum that highlight possibilities for the development of shared interests among nations, but also signal potential conflicts and cleavages.

Coal

The major consumers of coal also produce the most and control the greatest volume of known reserves.[4] The United States and the USSR together make the greatest use of coal, in about equal amounts. The Soviet Union has the largest known reserves of coal, 56.5 percent of the world total in contrast to 17.5 percent for the United States. Together they control 74 percent of world reserves. The United States produced 21.49 percent of world coal in 1973 and the Soviet Union 20.03 percent; they consumed 20.45 percent and 18.94 percent, respectively. The other major producers and consumers are China, Poland, West Germany, and the United Kingdom. They have comparatively small potential in that their individual reserves are quite small, in no case greater than 5 percent of known world reserves. The People's Republic of China has been a fairly large producer in the past, providing 16.39 percent of the world's output in 1973. The other three countries produced less than 8 percent each. During the same year, China consumed 16.08 percent of recorded world consumption, the United Kingdom 5.29 percent, Poland 5.16 percent, and West Germany 4.90 percent. With few exceptions, the major consumers are self-sufficient and the major producers have extensive known reserves.

The major importers of coal are Japan (28 percent of world imports in 1973), France (7.9 percent), Canada (7.5 percent), and Italy (5.7 percent). Other West European countries also imported

coal but in relatively negligible amounts. The United States is the major exporter (about 24.5 percent of total world exports in 1973), followed by Poland (19.46 percent), the USSR (14 percent), Australia (13.9 percent), and West Germany (11.74 percent). Only Japan is clearly dependent on external sources for its coal consumption, but only to a fraction of the degree of its dependence for petroleum.

In the event that the United States becomes a major supplier of coal, it will find itself in a pivotal position in the world economy, not an implausible possibility given the magnitude of the country's reserves. Such a position would present none of the security-related problems associated with access to petroleum. Since the world's largest reserves of coal are found in the Soviet Union, potential competition between the United States and the USSR for security of access will also not be at issue. Greater utilization of U.S. coal resources may also have a positive effect upon U.S. relations with Western Europe and Japan by reducing competition for Middle Eastern oil. But such an eventuality might also broaden the gap between U.S. interests and those of its allies in terms of coordinating their energy policies and devising acceptable means of interaction with the Middle Eastern countries.

Because of the relative abundance of high-grade deposits, every nation has an interest in the development of coal. Although technological processes of liquification and gasification have been known for some time, there continues to be the need for considerable refinement in these techniques. But there are many petroleum uses for which coal would simply be an inefficient substitute.

Some difficulties pertaining to coal extraction and processing are readily identifiable. First, coal can be cheaply extracted only by large-scale surface mining. The technology of site restoration is still at a relatively primitive stage.[5] Some types of land, most notably those that are steep or arid, cannot be restored. The social costs of such activities are deemed in many cases to be too high. Second, coal production, regardless of mining method or geographical location, generates extensive wastes that may ignite and often contaminate nearby streams.[6] So far it has not been common practice to return these wastes to the mines. Third, gasification processes require large amounts of water. In areas where water is scarce, there is a built-in disincentive for investments of coal gasification projects.[7]

In short, given these considerations, in the absence of marked technological developments, it is unlikely that a substantial part of the increase in global energy requirements could be met by coal in the foreseeable future. Indeed, it is even questionable whether coal could even make a significantly larger contribution to world consumption of energy than presently made. At best, the international

incentives for expanding both the availability and utilization of coal deposits remain highly constrained.

Natural Gas

The international situation regarding natural gas is somewhat similar to that of coal. The United States and the USSR are the major producers and consumers.[8] The USSR controls the largest reserves, accounting for 31.9 percent of the world's known deposits. The second largest deposits of natural gas reserves are in the Middle East, which accounted for 20.8 percent of the world total in 1974. The United States has only 12.6 percent, an estimate which is sometimes considered rather high since proven reserves have been steadily dropping for the last four years and reserves are at their lowest since 1956.[9]

The United States consumes slightly more natural gas than it produces domestically. In 1973 the country accounted for 51.85 percent of world consumption, while producing 50.01 percent of world production. The same is generally true of the USSR, but the volume processed is considerably lower; in 1973 the USSR produced 19.20 percent of world production and consumed 19.83 percent.[10]

The other major producers are Canada (6.10 percent of total world production in 1973), the Netherlands (5.75 percent), the United Kingdom (2.34 percent), Rumania (2.24 percent), and Iran (1.5 percent). The consumption patterns for that year are somewhat different, in that all of Western Europe consumed 12.46 percent of world consumption, Canada 3.68 percent, Latin America 3.28 percent, and Eastern Europe 3.89 percent.

Natural gas is becoming a more heavily traded source of energy, a consideration not entirely appreciated in current assessments of the world energy situation. In 1969 only 4 percent of world marketed natural gas production moved across national boundaries. In 1973 this figure increased to 7.6 percent, hardly a dramatic rise, but it may well signify an emerging trend.[11] The potential strength of OPEC members in influencing the price, production, and distribution of natural gas might become an important factor in international exchanges of this source of energy. But their influence will continue to be marginal unless they coordinate their policies with those of other major producers, an eventuality that appears unlikely at the present time. However, some mutual overtures have been made between Russia and some OPEC members. For example, the USSR has agreed to allow the Iranians to build a pipeline from Iran to West Germany over Russian soil. The project should transport 13 billion cubic meters of gas annually over the 900-mile pipeline by 1981.[12]

It might be premature to anticipate a major role for the USSR in international exchanges of natural gas, but there are some indications that the USSR appreciates its international position and is seeking to expand attendant gains. It is expected, for example, that exports to France will reach an annual rate of 2.5 billion cubic meters in 1976.[13] So, too, the USSR has been exporting natural gas to Italy, Austria, West Germany, and Finland. In sum, it is generally believed that although the USSR is likely to remain a relatively small trader in oil and gas, it has considerable potential for becoming a major energy supplier in the 1980s. Present exports to Western Europe are viewed as a prelude to more extensive exchanges and as indications of potential expansion of Soviet influence.

Against this background it is important to recall that only a small fraction of total energy consumed will draw upon natural gas in the near future and there are presently few incentives for expanding the exploration of available fields in the West. The extension of OPEC and Soviet influence over natural gas exchanges may well provide potential importers with new problems and everyone with new challenges to any evolving conceptions of world order.

Nuclear Fission

The world nuclear capacity grew from an ability to generate 8,356 megawatts of nuclear-produced electricity in 1960 to 39,864 megawatts in 1972.[14] Of this capacity, 41 percent is controlled by the United States. Other major producers are the United Kingdom, the USSR, and France. Projected use of nuclear power in the world is noted in Table 4.1; Figure 4.2 presents nuclear production of electricity for five industrial states.

Reserves of uranium are estimated to pose no immediate problem. The United States has by far the largest known reserves of less costly uranium and also the world's largest reserves even under assumptions of high prices. Estimates on production of uranium indicate that the United States generated 51.57 percent of total noncommunist production of the world in 1973, Canada 18.76 percent, South Africa 13.67 percent, France 7.81 percent, and Niger 4.8 percent.[15] Despite a favored U.S. position, it is expected that after 1975 from 15 to 25 percent of U.S. uranium needs will be supplied from external sources.[16] This situation may well increase the country's concern for assuring "safe" sources of supplies and possibly for its autonomy in the nuclear area.

The breeder reactor is the next immediate phase in the development of energy technology. A reactor is a "breeder" when it creates more than one fertile atom for every fissile atom it burns.[17]

This will make the use of uranium more efficient by enabling an increase in the utilization of energy content of natural uranium from between 1-2 percent to about 60-70 percent. These estimates are speculative, yet appear increasingly plausible.[18] The Soviet nuclear program to develop large, economical, fast breeder reactors is moving more rapidly than programs in the United States or Western Europe. The emphasis and the technological base are different, however: the Soviets preferring the use of graphite, not pressurized water reactors, as cheaper and safer than conventional reactors of similar size.[19] In addition, the Soviet nuclear program is motivated by anticipated large-scale expansion of domestic demands.[20]

TABLE 4.1

Projected Use of Nuclear Power, 1970-85
(Gigawatts--10^3 megawatts)

Country	1970	1975	1980	1985
Australia	--	--	1.0	3.0
Austria	--	--	1.4	3.0
Belgium	--	1.7	3.0	5.5
Canada	0.2	2.5	6.5	15.0
Denmark	--	--	0.7	1.5
Finland	--	--	1.5	3.0
France	1.7	3.8	13.4	32.5
Great Britain	4.2	8.8	16.4	35.0
Greece	--	--	--	1.8
Italy	0.6	1.4	6.0	16.0
Japan	1.3	8.6	32.0	60.0
Netherlands	--	0.5	2.5	5.0
Norway	--	--	0.8	2.0
Portugal	--	--	0.6	2.0
Spain	0.1	1.1	8.5	12.0
Sweden	--	3.2	8.6	16.5
Switzerland	0.4	1.0	5.5	8.0
Turkey	--	--	0.4	1.0
United States	7.5	57	132.0	280.0
West Germany	0.9	5.2	21.0	45.0

Source: Commissariat a l'Energie Atomique, Rapport Annuel 1972 (Paris: Synelog, 1973), p. 14.

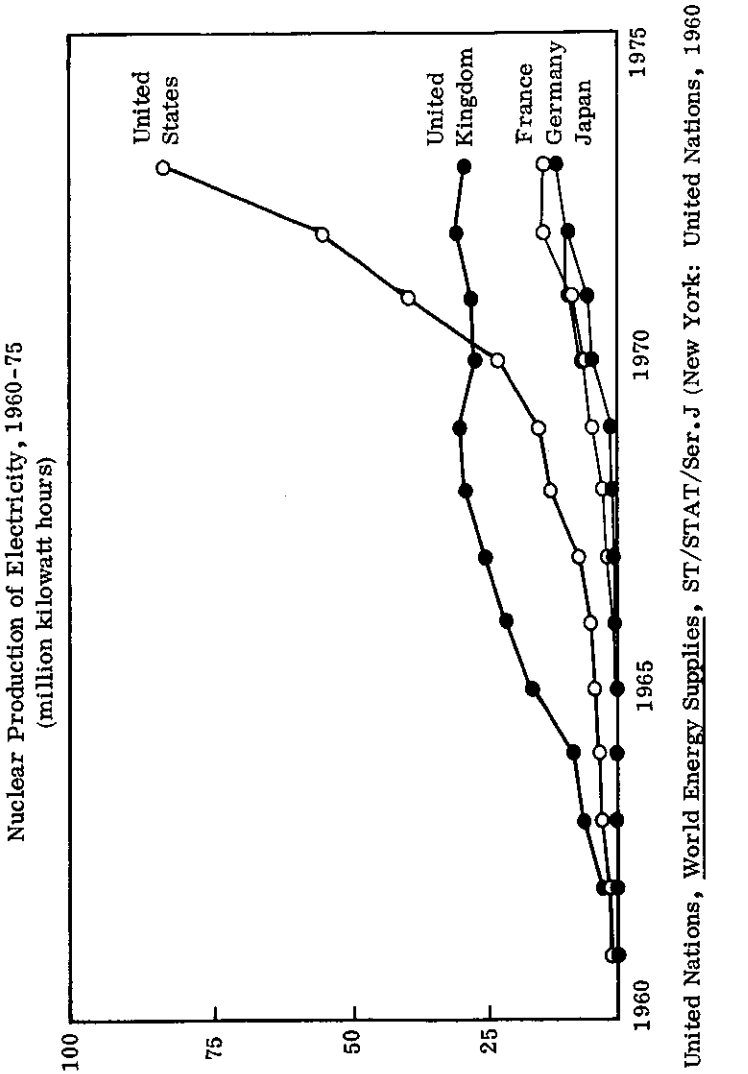


FIGURE 4.2

Source: United Nations, World Energy Supplies, ST/STAT/Ser.J (New York: United Nations, 1960 to 1973).

At this time the technology for enrichment of uranium (presently limited to gaseous diffusion) is expensive, complex, and closely guarded. Three gaseous diffusion plants owned and operated by the U.S. government have to this point supplied most of the noncommunist world's requirements for enriched uranium.[21] In addition, the United States clearly dominated international trade in the nuclear reactor industry. Only Canada with its heavy-water reactor (CANDU), has been able to break into the export market to any significant degree. This process has the decided advantage of being able to employ natural rather than enriched uranium.[22] But there are other developments. South Africa, for example, claims to have brought on-line a centrifuge method of enrichment which is 40 percent cheaper than conventional methods.[23] And the Israelis claim to have developed a laser-enrichment method which is both cheap and efficient.[24] But the full implications of these technological developments remain unclear.

Greater use of nuclear power could at least have two destabilizing effects from the perspective of national or global security. These are, first, increased proliferation possibilities with inadequate safeguards; and second, possibilities of terrorist potential in the use of plutonium itself, in the manufacture of nuclear weapons, or in the sabotage of nuclear plants. Clearly, the industrial countries are more vulnerable to such eventualities. For the developing states, however, there are added problems inherent in a nuclear energy system.

At least seven countries have the potential for producing nuclear explosives in the near future:[25] Argentina, Brazil, Pakistan, South Africa, Taiwan, and Israel.[26] These countries are seeking development guidelines for the transfer of nuclear technology, but so far little has been concluded.[27] Despite frequent disagreements, the development of shared nuclear interests exists among the advanced industrial states, but also the greatest differences between them and the rest of the world. In addition, there are further cleavages between those states that possess nuclear weapons and those that do not.

Against this background, five types of countries emerge, each with different interests and priorities, and with different conceptions of problems and requirements for resolution. First are the advanced states that possess nuclear weapons, namely, the United States, the Soviet Union, France, and the United Kingdom. They are concerned primarily with maintaining close control over the expansion and dissemination of this source of energy. Then there are the advanced countries with no nuclear weapons capacity, such as Japan and West Germany. These countries regard the availability of nuclear power primarily as a source of energy and so far are not willing to accept the costs of utilizing nuclear energy for military purposes. Third

are the developing states that possess nuclear technology and seek to employ it for military purposes. India and China are the major representatives. They regard the possession of nuclear technology as one indicator of power in international politics and are willing to draw upon this source of energy for military purposes. Fourth there are the countries that are less developed but growing and as of now do not possess nuclear weapons. They consider the safeguards proposed by the developed states as an attempt to deny them an opportunity to demonstrate their capability in international politics. Finally there are countries of the "fourth world." They are the poorest of the states, with no ready prospects for rapid development and no possibilities for the acquisition of advanced nuclear technology. They are essentially peripheral to global efforts to regulate exchanges in nuclear technology but will invariably be affected whatever rules and regulations are established.

There are few common interests uniting all five groups beyond those of devising safe means of transportation, controlling terrorism, and minimizing the possibilities of accident. Clearly, international cleavages with respect to the issues pertaining to the development and expansion of nuclear energy are likely to persist along these lines for some time to come.

Solar Energy

The major advantages of solar energy are derived from its virtually unlimited availability, with little of the environmental contamination associated with the alternatives. It is estimated that with present technology, its maximum contribution to total energy requirements will not be greater than 20 percent of expected consumption.[28]

Those nations controlling the technology involved would essentially control access to solar energy. Thus, the major cleavages to be expected will be along technological lines and the resulting interdependencies will be technological. As in the case of any alternative to petroleum, solar energy would free the United States from potential demands upon Middle East oil, thus making greater petroleum supplies available to its allies.

Possibilities for shaping solar technology might increase the prospects for world order, providing acceptable means of transferring, sharing, or regulating such technology are developed. Inevitably, the poorer nations will not have access to this source of energy, unless it is made available to them by the advanced industrial societies. Solar technology might well be employed as a political instrument in the years to come, by threatening to withhold access unless certain

political (or other) demands are met. Thus, the uses of control over sources of energy as a political instrument will persist. From a global perspective, the most critical problem still involves the development of regularized means of interactions and transactions related to access and transmission of solar energy.

Geothermal Heat

Geothermal heat is essentially a form of heat created by internal pressure. It is estimated that by 1985 a level of proved recoverable heat reserves could be established in the range of 29-290 quadrillion BTUs. The more important geothermal targets are deep sedimentary basins and shallow magma chambers.[29] But insufficient investments in research and development have placed strong constraints upon any rapid technological developments. Indeed, there exists no exploratory tool for locating geothermal deposits and existing methods have had limited success. Another major obstacle lies in the ability to drill holes of greater depth than is presently possible.[30]

In addition, there are major unresolved questions pertaining to air pollution resulting from the high sulfur content of steam, or other form of heat, that would be brought to the surface. Furthermore, the time required to develop environmental impact statements, assess overall environmental implications, and handle legal problems would significantly reduce the pace of geothermal exploration and development. Even under the optimistic assumption that geothermal sources of energy could be developed on a competitive economic basis in the near future, they would supply no more than 1 percent of anticipated U.S. energy requirements in 1985. On a worldwide basis the percentage would be considerably lower, rendering geothermal heat an improbable energy option.

Tar Sands and Shale Oil

Tar sands are hydrocarbon-bearing deposits distinguished from more conventional oil and gas reservoirs by the high degree of viscosity of the hydrocarbon which cannot be recovered by the same means of production. Reservoir energy is minimal, so some outside form of energy is needed to produce energy from tar sands.[31] Large tar sand deposits exist in Canada, Venezuela, and possibly Colombia as well. Deposits in the United States are much smaller and are not expected to yield considerable amounts of energy given present technology or levels of recovery. Given additional technological advances to process usable oil from such deposits, it is likely that both Canada and Venezuela will continue their policies of exportation to the United States.

Oil shale is an oil-bearing rock which may be burned directly and distilled to obtain oil products.[32] World production of shale oil is about 25 million tons per year exclusive of production in mainland China. The Soviet Union is a main producer of shale oil.[33] The United States has extensive reserves of oil shale which could be marshalled as a viable source of energy. Oil shale deposits in the U.S. western areas are estimated to yield a possible 1.8 trillion barrels of crude shale oil. But less than 6 billion barrels of recoverable reserves could be recovered given limitations imposed by construction time and environmental and legal constraints.[34] In the absence of marked technological developments, it is highly unlikely that this energy source will be utilized to any great extent in the near future.

Extensive technological developments in producing shale oil may occur as the industry develops and as national priorities are reoriented to take into account the extensive U.S. reserves. Present bottlenecks in mine and plant organization, in processing, and in the establishment of increased automation must be removed before any significant cost reductions will be possible.[35] There are also considerable ambiguities regarding the formal status of shale lands. Mining claims are yet to be accorded a clear legal position. Federal leasing policies will invariably influence the level and rate of production, largely because over 80 percent of oil shale resources are located on federal lands.[36] Again, as national energy priorities are reassessed and appropriate measures taken, such problems might be resolved to enhance the potential contribution of shale oil to U.S. energy needs. On a worldwide basis, however, this source of energy will continue to have only marginal impact (if any) toward the meeting of energy requirements.

DIMENSIONS OF CONTROL

The control of alternative sources of energy will undoubtedly pose the greatest global challenges in the decades to come. There are three aspects to the problem, each reflecting a different perspective on the predicament of control. First is the question of price: Who sets the price of energy; who are the major participants in debates regarding price; and what are the determinants of the pricing algorithm? Second is the question of distribution: Who controls, manages, and manipulates flows of energy across national boundaries; who sets the conditions of exchange; and who determines the codes to be employed? Finally is the question of regulation: What aspects of

energy transactions are to be regulated; who determines the nature of the regulatory mechanisms; what policing methods are applied; and what authoritative or legal basis is devised?

Control of price, distribution, and regulation of alternative sources of energy are thus the most important legacies of the petroleum crisis of October 1973. That crisis has politicized the issue of control, drawing worldwide attention to the political implications of economic exchanges and to the leverage that producers of energy may exert over the international system. This leverage might well involve imposing the producers' own conception of world order upon the global community. Indeed, the aftermaths of the 1973 events can best be described as a struggle around control, reflecting differing conceptions of world order and of the appropriate rules and regulations for the management of this order. Conflict over the control of price, distribution, and regulation of energy thus represents the generic predicament of world order posed by the events of October 1973.

Price

The petroleum crisis initially involved the issue of embargo, but, increasingly, difficulties over price and the unilateral increase imposed by the oil-producing countries made it clear that the more durable aspects of this crisis will invariably revolve around price. At the present time the major international debates pertain to a definition of equitable price--a price that both producers and consumers regard as acceptable to them. The definition of what is equitable is itself dependent upon three related factors: the varying relationship between cost and price; the extent to which the gap between cost and price differs in relation to the costs of different sources of energy; and the realization that price reflects a variety of preferences, both private and public, that are aggregated and manifested in a statement of economic value.

In the case of petroleum, the cost of extracting one barrel of oil constitutes only a marginal component of the price per barrel. The government tax of the oil-producing countries and the markup factor of the international oil companies determine price. That the cost of production is minimal in no way influences the final determination of price. Prior to October 1973 the preferences of the multinational companies determined price. Following the embargo and the subsequent price increases, the national objectives of the oil-producing countries assumed a greater impact upon price. The shift from a price dominated by the oil companies to one dominated by the governments of oil-producing states indicates most sharply the recent

outcome of a conflict over the control of the price of petroleum. The disagreements within OPEC reflect further this struggle for control. Any resolution will invariably reflect the preferences of all oil-producing states, some degree of compromise by everyone, and some willingness to bear marginal social, economic, or political costs for the compromise.

Both producers and consumers of petroleum agree that the higher the price of oil, the greater will be the incentives for investments in alternative sources of energy and, by extension, for reducing the cost of production. These incentives are, however, partly determined by the present price of alternatives to petroleum.

The price of coal has been steadily increasing because of rises in the price of oil. In addition, safety regulations in U.S. mines, environmental regulations, and transportation costs all influence the price of coal. The cost component of price differs according to the grade of ore. On balance, however, most of the variables influencing price in the United States are tractable and potentially amenable to government regulation or, alternatively, to being shaped by market forces. Other than the power exerted by the coal lobby, there are no clear systematic influences that might distort market mechanisms to the degree exhibited in the case of petroleum.

Price calculations with respect to nuclear energy are considerably more complex. Price is most generally determined by the high capital costs. "Cumulative capital expenditures in the non-Communist world for nuclear power plants and equipment could exceed $250 billion by 1985, with approximately 50 percent of that sum expended in the United States, 30 percent in Western Europe, 12 percent in Japan, and the remainder in various other countries."[37] The price of uranium is a small fraction of the cost of nuclear energy. Thus, any distortions imposed upon the price of uranium by joint action on the part of the major uranium producers would affect the overall price of nuclear energy only marginally.

The difficulties inherent in economic calculations of the costs of alternatives to petroleum are overshadowed by far by those involved in calculating environmental, political, and social costs. To date we have only the most rudimentary understanding of the composite cost calculus associated with alternative sources of energy. We have only begun to appreciate the overall costs of reliance on petroleum. Only the vaguest glimpse of the overall costs of alternative energies is available, and almost no visions of the costs of different "mixes" of energy alternatives have yet been made. Even the most sketchy observations may not be warranted given the state of knowledge of overall cost assessments. It is clear, however, that for any alternative to petroleum, cost will be the major determinant of price. It is trite, but important, to stress that the gap between

cost and price, so large in the case of petroleum, will not be replicated for any other alternative for the foreseeable future. This is a fundamental reality that shapes all decisions regarding investments in alternatives to petroleum and provides the basic parameters of the potential price structure.

The debates between producers and consumers of petroleum over the past several years have reflected varying assumptions of equitable price and different conceptions of what each ought to accept from the other. But it is the debates among the oil-producing countries themselves that highlighted most dramatically the fact that a price preference reflects national priorities and represents an aggregated index of government demands for resources. Development plans, national objectives, and political priorities together shape and translate into a set of economic preferences for a specific price or a range of prices. We do not yet fully know how national preferences are expressed into a preferred price, nor the type of mapping function that states one in terms of the other. So, too, there is little understanding in both policy-making and academic circles of the appropriate algorithm for this mapping. Yet everyone agrees that the price of petroleum as stipulated by the oil-exporting governments represents a social welfare function and not simply that of profit maximization. Equally important is the realization that the objectives that are pursued may not even be conceived in terms of a maximization algorithm (however implicit, vague, or inarticulate it might be), but that some form of satisfying occurs, whereby at times minimalist rather than maximalist strategies dominate.

How national preferences are shaped, who is instrumental in defining these preferences, and how national goals are reflected in a price preference thus remain a mystery. Some clues are available in comparing the price preferences of countries with high petroleum reserves and those with low known reserves, particularly when their respective population sizes and level of economic development are also taken into account. But once these comparisons are made, there are few ready means of attributing (or predicting) a particular price preference to particular national attributes and characteristics. Therein lies one of the major uncertainties regarding national preferences for price structures. The few efforts currently undertaken to clarify this relationship are tentative at best.[38]

At the international level, the most critical debates over price now pertain to the criteria of equity: By what measuring rod ought nations determine the appropriate price for an international exchange of resources? The Seventh Special Session of the UN General Assembly reflected the range of arguments and preferences. The various proposals by the producing as well as consuming countries indicate the differences in priorities. Despite the ambiguities, this much is clear: Any evolving conception of world order will inevitably take into account the conflicting criteria for the determination of equitable price.

Distribution

Economic and political factors tend to determine the flow and distribution patterns of energy as a basic resource. The petroleum "crisis" of 1973 indicated changes in the distribution of petroleum. The multinational corporations have exercised control over the flows of petroleum and the ways by which the product is distributed. Increasingly, the producing countries are seeking to obtain greater control over the process, although it is not yet clear precisely what form this control will take. Political considerations are coming to the fore in the distribution of petroleum, and the ability to evoke the oil "weapon" as a policy instrument is testimony to this development. These changes signal analogous possibilities for alternative sources of energy.

A combination of economic and political factors will serve to shape the distribution of nuclear energy in the years to come. The availability of uranium is geographically determined. Moreover, technological developments, notably in the form of breeder reactors, will play an increasing role in the distribution and diffusion of nuclear energy. So, too, control over the transfer of technology can be exercised as a political "weapon" to be accorded to nations whose policies are consistent with those of major donors.

The distribution of nuclear reactors on a worldwide basis is still subject to political constraints, as most of the nonnuclear powers are ready to argue. But the full potential for employing such transactions as instruments of foreign policy is yet to be explored. So far, there have been only discrete cases, too few to draw broader generalizations. Even more severe ambiguities persist with respect to needs for and trends in regulation of alternative sources of energy.

The distribution (and diffusion) of the technology for solar power, energy from oil shale and tar sands, and geothermal energy is likely to be shaped primarily by economic factors. The extent to which technological developments enable the advanced industrial societies to make use of these alternative sources of energy will determine their ability to make them available to other nations. The possibilities appear more remote than for nuclear energy. Yet they are plausible enough to warrant assessment as to the international implications of their development.

Regulation

Control over the regulation of energy exchanges is perhaps most central to the question of world order.[39] At the present time the regulation of petroleum exchanges is undertaken largely through the conjunction of the policies of the oil-producing countries, the services of the international oil companies, and the legacies of a world petroleum market that has produced a situation of considerable stability of exchanges over the past 25 years. The oil-consuming nations have attempted, and continue to attempt, to influence existing patterns of regulation. But, so far, control remains with the producers.

There are no formal mechanisms for the regulation of coal, nationally or internationally, nor are there any institutions for the worldwide regulation of natural gas transactions. In the United States, government control of price is an important regulatory factor with potential international implications insofar as low domestic prices create high demand which may then affect the international market. The International Energy Agency may itself become involved in the regulation of natural gas in the event of another oil embargo. OPEC is also trying to develop mechanisms for regulating transactions among its natural gas exporters. Algeria and Iran are likely to take a major role in the event of an official OPEC posture on this issue.

By contrast, there are a number of ways in which the dissemination of nuclear technology is regulated and, by extension, the availability of nuclear energy. First, there are bilateral controls. When Canada made nuclear technology available to India, it insisted on fairly stringent controls.[40] U.S. sales to Egypt, Iran, and Israel are also predicated on strong bilateral controls. Such constraints are not necessarily effective in limiting the expansion of nuclear technology. The Indian nuclear explosion, for example, indicates that diversion of fissionable materials is entirely possible under a system of bilateral controls.[41] Adequate safeguards cannot be developed unless both nations are in agreement about the content, processes, outcome, and intents of the safeguards. Clearly, there are fundamental differences among the nuclear and nonnuclear powers on this issue, just as there are between the developed and developing states.

Two perplexing problems continue to confront the international community in this regard. First, the question of the "rights" nations have to develop nuclear weapons capabilities; second, the question of equal rights to access and distribution of such capabilities. The dual problem has been posed as follows: "No matter what the rhetoric, a world in which five or six nations control the weapons technology is by definition discriminatory; a system which leaves all the decision making in their hands is by definition paternalistic. Clearly there is an unfilled need for a more attractive option than either accepting the monopolistic position of the 'nuclear OPEC,' or going it alone."[42] Clearly, too, the need for such options is viewed differently by different nations.

The prospect for development of an active uranium cartel of national governments appears increasingly implausible. The major producer countries--the United States, South Africa, Canada, Australia, and Niger--seem too diffuse in their political orientations or economic objectives as to preclude any ready agreement among them. More important, however, is the fact that the uranium market is controlled by private interests. The Uranium Producer's Forum, a group comprised of Britain's Rio Tinto Zinc, Canada's Rio Algom and Denison Mines, Australia's Western Mining, France's Uranex, and an organization of South African Mines called Nuclear Fuel Corporation control most of the world's production. But within this group the strength of the individual members is unequal. The Rothschilds of France and England have an interest in nearly every major uranium mine in the world, with controlling interests in the Rio Algom Mines of Canada, which owns the largest uranium reserves in North America, as well as major interests in Rio Tinto Zinc, Anglo-American Corporation, Mohta and Pennarya Companies.[43] However, demand is predicted to be sufficiently high to preclude any disagreements about market shares. Risks and costs are ambiguous but do not seem to be very different for different producers. In addition, the market will probably bear prices above cost because of the projected structure of demand. Available estimates for demand are calculated prior to the oil embargo of 1973, thus probably underestimating what actual demand will be. In sum, while the prospects of a national cartel of uranium producers might be unlikely in the foreseeable future, one of private producers appears increasingly possible.

The symbolic importance of the International Atomic Energy Agency (IAEA) as an international regulatory mechanism should not overshadow two important facts: It performs basically a bookkeeping function; and it has no effective control over the producers' policies. The IAEA determines how much nuclear fuel is processed within a country and expects to be informed by individual nations exactly where nuclear fuels are being utilized. In the event that some nuclear fuel is unaccounted for, the IAEA "operates on the principle that if there is an international system which will give the proper alarm whenever a state is suspected on reasonable grounds of intentional diversion, this in itself should provide sufficient deterrence."[44]

The weakness of the IAEA is perhaps best revealed by the fact that the most severe sanction it can impose is to expel a member and call its violations to the attention of the international community and to the UN Security Council. In the final analysis there are no international arrangements that can prevent nations from demonstrating their ability to build their own nuclear weapons.[45] The raw materials and the technology both exist and the intent to develop nuclear weapons can always be justified in the name of national sovereignty, punctuated by arguments of national defense.

TECHNOLOGICAL IMPERATIVES IN ENERGY EXCHANGES

Undoubtedly the most critical considerations in international exchanges of alternative sources of energy are technological. The costs of alternatives to petroleum--and the attendant price of imports and exports--will continue to be determined by technological constraints. Therein lies the major difference in energy exchanges: For petroleum, physical control over the underlying resource has come to dominate control over extractive and processing technologies in shaping prices and influencing availability. For alternatives to petroleum, control over technology will continue to be the major determinant of price and, by extension, of distribution and regulation.

Since the advanced industrial states control the development and diffusion of advanced technology, they are both the producers and the consumers for any source of energy other than petroleum. They will inevitably become the rule makers as well as the managers of international exchanges of alternative sources of energy. The advantages enjoyed by the oil-producing countries in this regard will not extend to coal, natural gas, nuclear power, or other energy sources. It is partly in recognition of their unfavorable position in international exchanges that the poor countries have sought to tie debates regarding equitable prices of petroleum and other raw material to exchanges in, and availability of, advanced technology. Indeed, the transfer of technology from richer to poorer states has dominated international debates leading to the Sixth and Seventh Sessions of the UN General Assembly in 1974 and 1975. These arguments revolved around the question of a global reorientation of international exchanges in resources, technology, financial flows and trade relations.

Specifically, the Seventh Special Session centered around eight issues: (1) establishment of a new international economic order, (2) problems of international trade, (3) transfer of real resources for financing the development of poorer countries and international monetary reforms, (4) problems of science and technology, (5) industrialization problems, (6) food and agriculture, (7) problems and

prospects of cooperation among developed and developing countries, and (8) the restructuring of the economic and social sectors of the UN system.

Different positions crystallized around each of these issues, with the major cleavages between the less developed countries and the United States, Western Europe, and Japan, and sometimes major differences arose among the less developed countries themselves. Generally the Western world took positions at variance with those adopted by poor states, but there were notable exceptions and it was not uncommon for the United States to find itself in disagreement with the European Community or its allies in general. The final U.S. position on many of these issues differed markedly from its initial stiff reaction and a modicum of reconciliation appeared to emerge. The positions and preferences of the developing countries are still being clarified and there is, as yet, no commonly agreed upon stance and no single perspective that represents poorer states.

Undoubtedly the most pervasive corollary of the Seventh Special Session was the increased awareness in both national and international circles of the growing interdependence among states and of the international constraints on national behavior. Concern of the advanced states over the possibility of impeded access to supplies of raw material from poorer states has been accompanied by a growing concern by the producers of raw materials for greater access to advanced technology.

In sum, the events following the petroleum crisis of October 1973 leading to a greater concern for the development of alternative sources of energy have contributed to a deeper appreciation of the role of technology in international energy exchanges and to the criticality of control over access and diffusion of advanced technology. By seeking to press their advantage in this regard, the industrial states have contributed to the mobilization and politicization of technological transfers to developing countries. Exchanges in alternative sources of energy are now closely coupled to debates on technological exchanges. More important, the issue of access to advanced energy technology is now closely related to debates over the access of poorer countries to advanced technologies for development. In each case the transfer of technology across national borders raises important questions of management and of the appropriate criteria of exchange.

INTERNATIONAL TRANSFER OF ENERGY TECHNOLOGY

The importance of technological change in rendering alternative sources of energy commercially viable is well recognized in

both national and international circles. Less clear, however, are the magnitudes of investments required for effective technological development, the precise technical requirements for each source of energy, and the appropriate criteria for technological decisions. Despite these uncertainties everyone recognizes the importance of technological exchanges among nations and the fact that such exchanges are becoming an important medium for exerting political influence. Indeed, the transfer of technology has become a clear form of political leverage.

Technology transfer is a diplomatic term that fails to convey the fact that technology is bought and sold in international markets, and that commercial considerations dominate such exchanges. Even more compelling is the fact that such transfers are largely in the hands of multinational corporations rather than national governments. Although nation-states are assuming an increasingly important role in global exchanges, the transnational firm is still the major conveyor for the movement of technology between states. Private firms seek to maximize profits and national governments seek to maximize social objectives. The conflict between the two types of goals is often manifested in the attempt of governments to control and the multinational corporations' activities in their own countries, and in the efforts of the international organizations to develop viable codes of conduct both for the multinationals and for national governments. These efforts have to a large extent been unsuccessful. Yet a momentum has set in, and the international community is seeking greater authority and responsibility for the management of technology transfers.

The view from the developing countries is that the technological decisions need to be made within a developmental context, that energy-related decisions need to be evaluated on their social and political merits rather than on their economic merits exclusively, and that poorer countries should share in the global management of technology transfers. Although everyone agrees that the "right" technical decisions for the development of energy resources in an advanced country need not necessarily be "right" for a developing state, fundamental disagreements persist regarding what might be viewed as "right" in each context. The debates are over appropriate criteria for investment in energy-related technology and for the transfer of technology across national boundaries. For example, what might be considered an appropriate technical decision on the grounds of productive efficiency may not be desirable or acceptable in terms of potential for generating employment, contributing to political stability, or enhancing the international position of a nation.

These differences become all the more compelling in the nuclear energy field where the five types of countries described earlier are

likely to have diverse technical priorities and differing conceptions of appropriate criteria for technical investments or technology transfers. Advanced states with nuclear capacity will seek to control the diffusion of technology and to dominate the decisions for technical investments. Advanced states with no nuclear capacity are likely to value technological investments on scientific grounds rather than in terms of their immediate power or military potential and to view technological investments in this light. Less developed states that possess nuclear capacity will be concerned with the foreign policy implications and the military value of their capabilities and will employ criteria of national power and prestige as major determinants of technological investments and technical exchanges. Less developed countries that do not possess nuclear technology may seek to influence the evolution of international codes for the management of energy exchanges in a way that might preserve for them open options for the future such that they might be able to influence the nature of technological exchanges in the years to come. Finally, the "fourth world" countries that have minimal influence, if any, on such debates, will attempt to align energy-related decisions to development decisions in such a way as to assure there be participation in international debates pertaining to the transfer of technology for development. In sum, states with differing nuclear status employ different criteria for what is "appropriate" for technical investments and technological transfers. These differences constitute the essence of alternative views of world order as they pertain to different conceptions of the management of energy exchanges.

MANAGEMENT OF INTERNATIONAL EXCHANGES

The problem of establishing international patterns of collaborative behavior in the energy field is undoubtedly one of the most critical of our times.[46] The absence of agreements among nations regarding control of the price, distribution, and regulation of energy exchanges accentuates the need for the development of collaborative behavior. Four alternative modes of regulating international energy transactions illustrate some differences among alternative conceptions of world order: market mechanisms, joint exchanges, multilateral coordination, and international agreements; they all differ in their accommodation to the requirements of collaborative behavior.

International energy exchanges based on market principles would also predicate control of energy products upon resource, capital, and technological considerations and the distribution of energy upon market structures. But specific national interests would be taken into account, allowing national governments to exercise direct

control over the structure of emerging arrangements. A joint exchange (in terms of bilateral agreement, for instance) would take the national interests of the participants into account while basically relying on the price mechanism to regulate energy transactions. Thus, the role of government would be more direct than in a free market situation.

By contrast, multilateral and international energy exchanges would differ substantially in their underlying premises and in their approach to the issues of price, distribution, and regulation of energy forms. A multilateral exchange involving government-to-government regulative mechanisms would predicate the control of energy products upon community values and upon the maximization of benefits to the group as a whole. An international system of energy exchange would develop institutionalized means of assessing the energy needs of its members and develop means of apportioning available resources accordingly. In such a situation, conventional principles would be superseded by institutionalized means of regulating energy flows based on procedures agreed upon by the participant states.

The distribution of energy in a multilateral coordination system would differ from that in an international arrangement. In the first case, community interests as well as the market mechanism would shape the nature of energy transactions; in the other, social welfare considerations would predominate. So, too, the price system in a multilateral energy exchange is likely to be predicated upon principles of community equity as well as supply and demand factors; but in an international arrangement a broader view of price would predominate, based on equity and encompassing the interests of all participant states. Similarly, the underlying regulatory mechanisms would also differ. Thus, a multilateral arrangement would develop means of regulating energy transactions according to community-oriented rules and regulations, whereas an international exchange will be public-regarding in that the organizational framework would be based on explicit rules and regulations, to be applied to all participants on rational-legal principles. Regulatory mechanisms for international or multilateral energy systems exchanges would be fundamentally different from those in competitive market or joint systems.

These observations are summarized in Table 4.2, which illustrates the differences among these four alternative managements with respect to the control of energy resources, the distribution of the products, the price of energy, and the underlying regulatory mechanism. Finally, it must be recognized that autarky represents still another option. But such a posture would, in effect, negate the possibility of developing a viable global exchange. A policy of

TABLE 4.2

The Management of System Requisites for Energy Exchanges

System Requisites	Alternative Exchange System			
	Competitive Market Mechanisms	Joint Exchanges	Multilateral Coordination	International Agreements
Control of energy resources	Profit maximization based on resource capital, and technology considerations	Based on resource availability and technological endowments	Based on agreed upon community principles	Institutionalized control of global management
Distribution of product	Competitive market principles	Market principles and accommodated national interests	Community interests and market principles	Social welfare function
Price	Supply and demand functions	Supply and demand functions	Community interests and supply and demand functions	International equity
Regulatory mechanism	Market price	Price and national interest	Community organization	International public organization

Source: Compiled by the author.

autarky amounts to a nonexchange and denies the necessity of developing viable means of interaction with other nations. Such a posture would be extremely costly and does not represent a viable option for the United States or any other nation. Energy needs can be accommodated only through a recognition of the linkages and interdependencies among nations, and through the development of some institutionalized means of regulating such transactions. The choice of such means is basically a question of alternative conceptions of world order.

NOTES

1. This section draws upon research notes for an ongoing Project on Access, Security, and Availability of Mineral Resources supported by the Rockefeller Foundation Fellowship Program in International Conflict.

2. This section draws upon Chapters 1 and 9 of Nazli Choucri with Vincent Ferraro, International Politics of Energy Interdependence: The Case of Petroleum (Lexington, Mass.: Lexington Books, 1975).

3. The following data are from United Nations, World Energy Supplies, ST/ESA/STAT/SER.J (New York: United Nations, 1960-73).

4. Ibid.

5. Amory D. Lovins, "World Energy Strategies," Bulletin of the Atomic Scientist 30, no. 5 (May 1974): 23.

6. Joel Darmstadter, "Energy," in Population, Resource, and the Environment, ed. Ronald G. Ridker (Washington, D.C.: U.S. Government Printing Office, 1972), p. 140.

7. James Ridgeway, The Last Play (New York: Mentor, 1973), p. 171.

8. United Nations, World Energy Supplies, ST/ESA/STAT/SER.J/No. 18 (New York: United Nations, 1975).

9. Wall Street Journal, June 12, 1975.

10. United Nations, World Energy Supplies, 1970-73, op. cit.

11. U.S. Department of the Interior, Bureau of Mines, World Natural Gas, 1973 (Washington, D.C.: U.S. Government Printing Office, 1974).

12. New York Times, April 11, 1975.

13. New York Times, August 20, 1974.

14. Commissariat a l'Energie Atomique, Rapport Annual 1972 (Paris: Synelog, 1973).

15. United Nations, World Energy Supplies, 1970-73, op. cit.

16. U.S. Department of the Interior, Bureau of Mines, Mineral Facts and Problems, 1970 (Washington, D.C.: U.S. Government Printing Office, 1971), p. 239.

17. Irvin C. Bupp and Jean-Claude Derian, "The Breeder Reactor in the U.S.: A New Economic Analysis," Technology Review, July/August 1974, p. 27.

18. Allen Hammond, "Breeder Reactors: Power for the Future," Science 174 (November 19, 1974): 808.

19. Robert Gillette, "Nuclear Power in the U.S.S.R.: American Visitors Find Surprises," Science 173 (September 10, 1970): 1003.

20. Ibid., p. 1006.

21. Joseph A. Yager and Eleanor Steinberg, Energy and U.S. Foreign Policy (Cambridge, Mass.: Ballinger, 1974), p. 350.

22. Wall Street Journal, June 24, 1975.

23. New York Times, November 23, 1975.

24. Robert Gillette, "Uranium Enrichment: Rumors of Israeli Progress with Lasers," Science 183, no. 4130 (March 22, 1974): 1172.

25. Boston Globe, June 8, 1975.

26. New York Times, June 13, 1975.

27. New York Times, June 18, 26, 29 and July 20, 1975.

28. Dietrich E. Thomson, "Farming the Sun's Energy," Science News 101 (April 8, 1972): 238.

29. Allen Hammond, "Geothermal Energy: An Emergency Major Resource," Science 177 (September 15, 1972): 978.

30. National Petroleum Council, U.S. Energy Outlook (Washington, D.C.: the Council, 1972), p. 230.

31. Ibid., p. 225.

32. Nathaniel B. Guyol, Energy in the Perspective of Geography (Englewood Cliffs, N.J.: Prentice-Hall, 1971), p. 49.

33. Ibid.

34. National Petroleum Council, op. cit., p. 4.

35. Ibid., p. 219.

36. Ibid., p. 206.

37. Yager and Steinberg, op. cit., p. 335.

38. See, for example, Esteban Hnyilicza and Robert S. Pindyck, "Pricing Policies for a Two-Part Exhaustible Resource Cartel: The Case of OPEC," MIT Energy Laboratory, World Oil Project Working Paper, MITEL76-008WP, April 1976.

39. This section expands on themes presented in Chapter 9 in Choucri with Ferraro, op. cit.

40. New York Times, May 21 and 23, 1974.

41. New York Times, May 21, 1974.

42. Lincoln P. Bloomfield, "Nuclear Spread and World Order," Foreign Affairs 53, no. 4 (July 1975): 747.

43. "It Worked for the Arabs . . .," Forbes 115, no. 2 (January 15, 1975): 19-20.

44. Ryukichi Imai, "Nuclear Safeguards," Adelphi Papers, no. 86 (London: The International Institute for Strategic Studies, March 1972), p. 1.

45. William O. Doub and Joseph M. Duckert, "Making Nuclear Energy Safe and Secure," Foreign Affairs 53, no. 4 (July 1975): 756.

46. An earlier version of the following arguments has been presented in Analyzing Global Interdependence, Vol. II, Energy Interdependence, Nazli Choucri with Vincent Ferraro (Cambridge, Mass.: MIT Center for International Studies, 1974).

PART II

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