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ANALYZING GLOBAL INTERDEPENDENCE

by

Hayward R. Alker, Jr.
Lincoln P. Bloomfield
Nazli Choucri

Volume II
ENERGY INTERDEPENDENCE

by
Nazli Choucri
with Vincent Ferraro

CENTER FOR INTERNATIONAL STUDIES
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASSACHUSETTTS 02139

This study is one of a number done by academic and other research institutions for the Department of State as part of its external research program. The program is planned and coordinated by the Department of State Research Council and managed by the Office of External Research in the Bureau of Intelligence and Research. It is designed to supplement the Department's own research capabilities and to provide independent, expert views to policy officers and analysts on questions with important policy implications.

On many occasions in recent years, both private citizens and government officials have talked and written about the trend toward increasing interdependence, with complex and shifting relationships, among the "actors" on the world scene. For obvious reasons, the emphasis usually is placed on economic relationships, although we are all aware that interdependence increasingly is apparent in other spheres as well--political, strategic, cultural, and so on. Indeed, one of the problems for any student of interdependence is posed by the linkages between or among such sectors.

As they thought about official and private studies and discussions of interdependence, a number of Department of State officers became convinced that at least some aspects of the phenomenon merited more serious or extensive scholarly attention. Do social scientists, they asked, have concepts and methods that can give us a more adequate understanding of the extent and nature of interdependence? Can they provide us with better means for checking assumptions that inform much of foreign policy?

The suggestion for a "conceptual and methodological" study of interdependence came from Mr. Herbert J. Spiro, of the Department's Policy Planning Staff. The detailed terms of reference for the study, designed as a guide for institutions interested in submitting research proposals on a competitive basis, were developed by Mr. Spiro and Mr. Pio D. Uliassi, of the Office of External Research, who served as the project monitor. Both drew generously from the comments of other Department officers.

We in the Department of State have already profited from the effort to define our own policy-related research interests in a more precise way from our meetings with the research team at M.I.T. and from the draft versions of this study that have been quite widely disseminated within our establishment. Our hope now, as it was when the project was first conceived, is that the published study will stimulate additional fruitful discussion and independent work on the problem of interdependence by private social scientists.

E. Raymond Platig, Director
Office of External Research
Bureau of Intelligence and Research
Washington, D.C. 20520

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Volume I — ANALYTICAL PERSPECTIVES AND POLICY IMPLICATIONS

By
Lincoln P. Bloomfield and Hayward R. Alker, Jr.
with Ann Alker

Appendices by
Ann Alker and Steve R. Pieczenik

Volume II — ENERGY INTERDEPENDENCE

By
Nazli Choucri
with Vincent Ferraro

Volume III — METHODOLOGICAL PERSPECTIVES AND RESEARCH IMPLICATIONS

By
Hayward R. Alker, Jr.
with Nazli Choucri

Volume IV — SUMMARY

Prepared by
Irirangi C. Bloomfield

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V. INTERDEPENDENCE IN THE MIDDLE EAST

A. Critical Differentials in the Middle East
B. Cleavages and Constraints
C. New Policy Directions
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FOREWORD TO STUDY

A N A L Y Z I N G G L O B A L I N T E R D E P E N D E N C E

In the summer of 1973 the U.S. Department of State awarded a contract to the M.I.T. Center for International Studies to conduct a year-long study that would, in the words of the R.F.P., "describe evolving patterns of interdependence in a multipolar world and develop new methods for projecting and appraising such patterns."

Given a projected level of effort of only nine professional man-months for the study, our governing research principle was to make maximum use of existing comparative advantages of the researchers involved, drawing to the greatest extent possible on previous or concurrent work they and their graduate students were doing. (It must however be said that all of us found ourselves entering new intellectual ground as our research proceeded.)

It was thus agreed that Professor Hayward R. Alker, Jr., would review the scholarly literature for issues, themes, approaches, and problems bearing on interdependence, and that he would also take responsibility for drawing conclusions concerning appropriate research methodologies. Professor Alker, drawing on substantial research papers on specific scholarly controversies, prepared (with Ann Alker) Chapter II of Volume I of the report. His methodological review appears as Volume III, in which Professor Nazli Choucri has coauthored the concluding chapter. Among the working papers developed in the course of that part of the project were the following, which are available on request from the M.I.T. Center for International Studies:

Lily Gardner, "Interdependence, Independence, Dependence, and Integration: Whither Western Europe?"

Fabio Basagni, "The New 'Political Economy' Controversy"

Ann Alker, "The Limits to Growth Controversy"

Richard Kugler, "Strategists and Their Critics: The United States National Security Policy Controversy"

Professor Nazli Choucri took responsibility for developing a case study on energy interdependence, with some focus on the Middle East,

that would serve the threefold purposes of: suggesting and applying an approach potentially useful in other sectors or geographic regions; illustrating some of the analytical problems, issues, and findings typical of scholarly interdependence controversies; and supplying some policy-relevant insights. Her report is bound separately as Volume II of the report. Professor Choucri also co-authored Chapter IV of Volume III. She was assisted throughout her study by Vincent Ferraro, who contributed valuable research assistance, editorial help, and substantive criticism. Chapter V of Volume II was written with the collaboration of Ijaz Gilani. Major working papers, also available on request, are:

Vincent Ferraro, "Competing Transnational Energy Regimes"

Ijaz Gilani, "Interdependence and Community-Building Among Competing Regimes of the Arab World"

The third dimension of the study was the chief preoccupation of the undersigned, who also acted as coordinator of the project. My own approach follows a generally policy-oriented perspective. In Chapter I of Volume I, I sought to parse out the meaning of interdependence so that it might be approached with more clarity; in Chapter III, I endeavored to offer the outlines of a policy analysis leading to conclusions--which are my own--regarding some desirable policy directions. In the course of this research I asked Ann Alker to prepare a brief background paper on U.S. Nonfuel Mineral Import Practices, which as a useful assembly of data is included as Appendix A to Volume I. I also asked Steve R. Pieczenik, who in addition to being a practicing psychiatrist is a doctoral candidate in the M.I.T. Department of Political Science, to see what possibly relevant insights concerning dependency situations might be drawn from the psychiatric literature. His brief but provocative response is also included as Appendix B to Volume I.

Although final responsibility remains with the cited authors, each of the principal authors read and commented on each other's contributions for this report and we are all grateful for the help so received. Dr. Choucri and I benefited from the helpful criticisms of our draft chapters by David A. Kay and Amelia C. Leiss, and I further profited from a

review of my chapters by William Diebold, Jr. Professor Alker's work was critiqued in preliminary form by Robert O. Keohane and Ramkrishna Mukherjee. His research for Chapter III of Volume III was assisted by Scott Ross. Finally, we had the opportunity to consider numerous comments from officers of the Department of State who reviewed the report in draft form.

While the contract did not call for a summary to be prepared, I increasingly felt the need for one, given the complexity of the subject matter and the fact that, despite the project's modest size, we were producing considerably more written material than we had anticipated. We therefore commissioned Irirangi C. Bloomfield, who has in the past performed numerous precis and editorial tasks for the Center, to prepare a summary volume, which we have denominated Volume IV.

My colleagues and I are grateful to Pio D. Uliassi of INR/XR for his tactful and understanding performance of the role of Project Monitor. We are very indebted to Jeanne Amnotte, and Dovianna Barrens who succeeded her, for devoted and skillful handling of the manifold tasks of Project Secretary.

Lincoln P. Bloomfield
Project Director

Cambridge, Massachusetts
November 1974

PREFACE TO VOLUME II

This volume is an analysis of the world energy system as an illustration of evolving patterns of global interdependence. It is the second in the series on Analyzing Global Interdependence undertaken at the Center for International Studies at M.I.T.

The Introduction places this study in perspective and raises some critical issues pertaining to petroleum and alternative sources of energy.

Chapter I examines the parameters of the world petroleum network, identifying patterns of production and consumption, imports and exports, and changes over time.

Chapter II focuses upon the major actors, specifically changes in the role of the multinational oil corporation and the development of the Organization of Petroleum Exporting Countries as an important international institution.

Chapter III examines the structure of the resulting economic interdependencies emerging from total commodity trade flows between producers and consumers of crude petroleum.

Chapter IV identifies the mutual sensitivities and vulnerabilities between producers and consumers resulting from large-scale revenue flows and transfer of funds across national borders.

Chapter V looks at related political and strategic interdependencies among producing countries, with a focus upon the Middle East, and illustrating the impact of regional interdependencies upon evolving patterns of global energy interdependence.

Chapter VI summarizes our conclusions regarding the world petroleum network, seeking a net assessment of attendant interdependencies.

Chapter VII identifies some political, economic, strategic, and environmental interdependencies associated with alternative sources of energy and compares nuclear fission and fusion, coal, solar power, geothermal energy, and tar sands and oil shale in each of these respects.

Finally, Chapter VIII compares potential patterns of global interdependence associated with alternative sources of energy and identifies attendant interdependencies.

It is my hope that this volume will provide both evidence and insight into evolving patterns of global energy interdependence. Our analysis of the international implications of alternative sources of energy is still partial and probing: our conclusions need further substantiation.

I am grateful to Hayward R. Alker Jr., and Lincoln Bloomfield for a careful critique of each chapter and for a remarkable generosity in sharing both ideas and insights at each stage of investigation. I am also grateful to David Kay for a review of an earlier version of this volume and to Amelia C. Leiss for insistence upon analytical clarity and organizational coherence. The suggestions and comments of Lee Otterholt have made the present version more readable than might otherwise have been the case. I must also acknowledge the research assistance of Maruja Lara in the writing of Chapter II and the collaboration of Ijaz Gilani in the writing of Chapter V. The contribution of Vincent Ferraro has been invaluable throughout this project, ranging from data collection, preliminary descriptions reported in background memoranda, and editorial assistance. Jackie Sobel is responsible for the elegant typing and for preparing tables and charts.

Nazli Choucri

INTRODUCTION

By now, the exponential growth in global energy usage is well recognized in both national and international circles. Equally prevalent is the realization that this growth results from rapid population growth and from the higher levels of consumption associated with levels of knowledge and skills. Indeed, advances in technology account in large part for the pressures placed upon the earth's natural resources. The almost perfect positive correlation between gross national product and per capita energy use (calculated on a comparison of 96 nations) attests to the criticality of energy to industrial processes.[1] Often data on patterns of energy use are employed as indicators of industrial productivity based on the empirical observation that the higher a nation's productivity is, the greater will be its energy requirements. For example, the rates of production of major industrial metals are very similar to the rates of consumption of energy.

A basic calculus of interactive effects lies at the core of the global energy system, shaping the energy demands of individual nations and conditioning the basic nature of foreign policy. Thus, while population levels and rates of growth, in combination with levels of technology, determine the energy needs of a society, its natural resource endowments shape national energy policies and alternatives.

At the global level, the world energy system is based on the available resources, patterns of production, consumption, and importation. The flow of energy across national boundaries has become an important issue of the day and has dramatically drawn our attention to the evolving patterns of interdependence which bind nations in their attempts to accommodate energy demands or to trade their own resources for other

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[1] Joseph L. Fisher and Neal Potter, "The Effects of Population Growth on Resource Adequacy and Quality," in Rapid Population Growth, ed. Study Committee of the Office of the Foreign Secretary, National Academy of Sciences (Baltimore: The Johns Hopkins University Press, 1971), p. 237.

equally valued goods, and bearing witness to established patterns of interaction. This interdependence has been molded as much by the resource requirements of the advanced industrial societies as by the desire of the resource-rich, but developing, societies to exchange their natural materials for financial benefits, scarce technology, or other valued goods and services.

In this context interdependence refers to the mutual sensitivities and vulnerabilities of asymmetrical interaction among nations and to the realization that the gains of one nation need not always be at the cost to another. These mutual sensitivities and vulnerabilities can be observed and are reflected in changing patterns of interaction among nations with respect to: (a) economic issues and their political implications, (b) national security and strategic objectives, (c) cooperation and potentials for community-building, and (d) environmental imperatives. An assessment of the ties that bind nations along each of these respects can be obtained, at first glance, from an analysis of energy flows. The actual manifestations and implications of these ties may vary according to different sources of energy and to the needs and requirements of different nations.

The growth in global energy consumption adds further insights into the nature of the present world energy system, highlighting the increasing criticality of net imports and resource accessibility and availability. The average rate of growth in global energy consumption over the past decade was 6.0% per year. The United States has averaged a 3.1% per year growth in the demand for energy throughout the past 20 years.[2] It is the world's largest producer of energy, but also its largest consumer. The fact that the country's domestic consumption exceeds its present production, contributing to a dramatic increase in net energy imports over the past few years, has become a major political issue. Forty percent of the country's energy needs are met through liquid fuels; import dependency in liquid fuels has increased steadily from 11% in 1955 to 40% in 1973.[3]

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[2]United Nations, World Energy Supplies, Series J (New York: United Nations, 1955 to 1971).

[3]Ibid.

And the demand for "clean" energy, resulting from environmental concerns, has tended to contribute further to policies of importation rather than exploitation of indigenous resources.

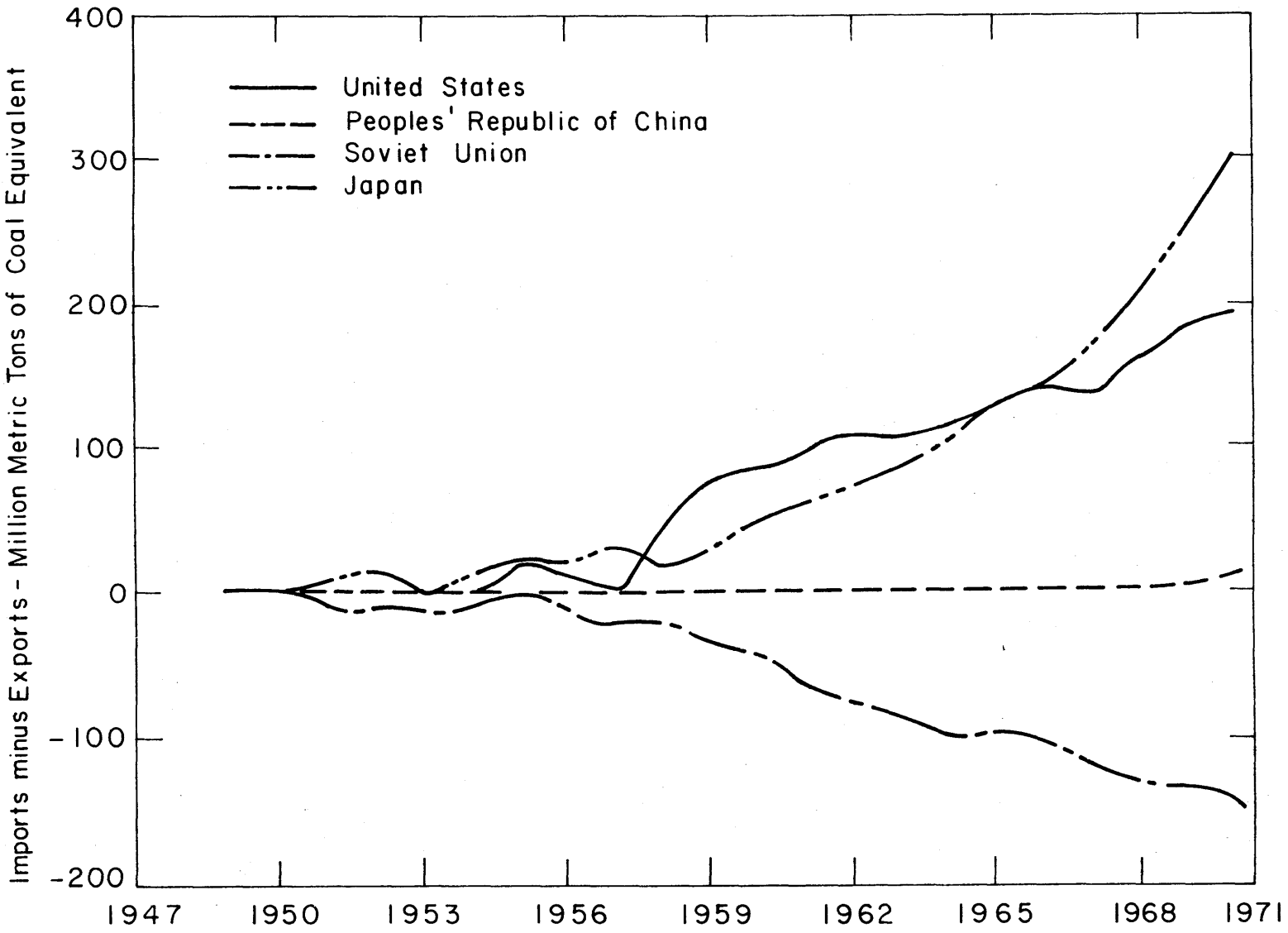
The criticality of the energy situation varies from state to state. Although the Europeans are highly dependent on external sources for their own needs, some measure of self-sufficiency in solid fuels is apparent. In Japan the situation is dramatic: the country depends entirely on foreign sources for both energy and mineral resources. By contrast, the Soviet Union is one of the world's net energy exporters, although it produces and consumes only a fraction of the energy processed by the United States. This difference accords the Soviet Union a certain flexibility in energy policy which is not shared by other states. Of the major powers, the People's Republic of China alone seems to have developed a balanced energy budget, consuming as much as is being produced domestically, thereby avoiding the necessity of reliance upon imports or of seeking a market for energy exports. Comparative trends and patterns of energy imports are noted in Figure 1.

While much of the current concern for the present energy situation centers around questions of depletion, shortages, and availability, assured access to critical resources has become an increasingly paramount national concern--one that is paralleled, with shades of variation, by all advanced industrial societies and mirrored to some extent by other states in the global energy network. Equally critical are the dual issues of cost and price--the cost of extracting domestic versus foreign energy sources, and the price to be paid in each case. The calculus is complex and recent events have illustrated the extent to which price can be manipulated with attendant implications for all nations, large and small.

The importance of the energy issue in the foreign policies of different states depends on their natural resource endowments; their level of industrialization, knowledge, and skills; and the size and rate of growth of their populations. This intricate calculus provides the broad parameters of permissible behavior for each state, defining what is most

Figure 1

NET ENERGY IMPORTS



salient, and providing some initial ordering in national preferences and priorities. These factors will condition the policies adopted and the alternative perceived. While we do not argue that a one-to-one correspondence between energy usage and foreign policy exists, some broad patterns are delineated by a country's basic structural attributes; and one state's policies become the constraints of another. In this limited sense, some basic interdependencies among national preferences, priorities, behaviors, and interactions exist with respect to energy politics and foreign policy.

We are witnessing today a gradual recognition by all nations of critical interdependencies, confronting them with a common predicament, the parameters of which differ according to one's position and posture in the global energy system, but whose bounds encompass all. The predicament is this: how to meet the growing energy requirements of all states without generating undue externalities of an economic, political, ecological, or strategic nature? More specifically: how to accommodate seemingly irreconcilable objectives of energy producers and energy consumers in ways that are consistent with national preferences and priorities and to develop viable patterns of interactions that would ensure the consumers' access to energy while respecting the producers' sovereignty?

This will be accomplished only with the development of a viable global energy regime which recognizes the interdependence generated by patterns of energy flows, and which seeks to accommodate divergent needs and demands. The actual flows and resultant interactions provide the basis of the present situation which in itself amounts to an actual regime whose parameters and rules of behavior are increasingly unsatisfactory to all actors in the global energy system. Thus, in many ways, the present malaise in the energy scene reflects a shared recognition of evolving interdependence and a common search for more viable patterns of interactions.

The immediate, short-term, political issues pertain to petroleum and to the development of a viable world petroleum system in which the

needs and requirements of all actors are minimally accommodated. In the longer range, the critical energy imperatives pertain to the development of a global system based on alternative sources of energy unconstrained by the finiteness of the underlying resource, where political and economic costs are acceptable, where safety is minimally ensured, and where technological solutions are feasible. And while it is not possible to compare different energy sources directly in these respects, some initial assessments can be made with an accompanying calculus of costs and benefits for evolving patterns of global interdependence.

Much of the foregoing pertains to some basic "realities" of the energy situation. But the importance of national perceptions and assessments in shaping responses to these "realities" must be acknowledged. Perceptions may or may not be congruent with empirical realities, but it would be a mistake to substitute one for the other, or assume that one mirrors the other, or ignore one in favor of the other. Thus, while a global energy system might be identified on the basis of flows, trends, production, and consumption, an equally important perceptual network assigns meaning and significance to such trends and determines their criticality to national security and stability: national policies are predicated as much on perceptions and preferences as they are on underlying "realities." Interjecting the perceptual dimension into any assessment of energy politics and patterns of global interdependence amounts to an important challenge that must not be ignored.

Chapter I

THE PARAMETERS OF THE WORLD PETROLEUM NETWORK

An extraordinary rise in world petroleum consumption over the past decades provides the single most important fact underlying the global energy network and flows of this critical resource. Figure 1 illustrates the magnitude of this increase. Our purpose here is less to describe the world energy network--others have documented historical developments in great detail--but to highlight some important changes over the past decades which have provided the background for present policies and postures.

Petroleum is presently the largest single source of energy and it is also a basic raw material for almost all the organic chemical products. There are, as yet, no commercially viable substitutes. And known world reserves are ample only until the turn of the century given existing economic and operating conditions. These basic factors have generated heated debates concerning the extent to which the present situation is one of "crisis" with different proponents arguing, in turn, that the crisis is manufactured in the sense that known reserves and available supplies are extensive, and, if left to market pricing mechanisms, supply and demand would reach an equilibrium. By contrast, a realization of the critical political and economic factors that have successfully impeded the functioning of a "perfect" market structure provides the basis of arguments for the criticality of the present crisis. Such arguments are predicated upon three considerations: first, reserves aside, petroleum is basically a depletable, nonrenewable resource; second, the rates of consumption cannot be sustained over the long range given known reserves; and third, the further interjection of politics into the petroleum arena impedes the free flows of this critical resource across territorial boundaries, making an otherwise geologically available resource one that is not readily accessible.

A. Changing Parameters and Evolving Crises

The parameters of the world petroleum system are shaped by the patterns of production and consumption, imports and exports. This system has undergone a marked transformation over the past two decades, both in

terms of the magnitude of flows and in terms of major actors, institutions, policies, and priorities. The situation has changed from one in which the multinational petroleum companies dominated the petroleum scene and controlled patterns of flows to one in which national governments of the producing countries have become major actors, organizing and coordinating their policies and actions, where the governments of the consumers have also become major actors, and where the multinational corporations provide intermediary services to both. There have been changes in the patterns of alignments among producers and consumers and a heightened awareness of environmental issues both in terms of the hazards of production and in terms of the virtues of conservation. This has created a structure of interaction in which the producers are able to manipulate prices. The discovery of new reserves outside this system, such as those in the North Sea and the South China Sea, may change this situation.

Finally, the impending large-scale flows of funds from the consumers to the producers in payment for petroleum imports have drawn attention to the potential alternative policies available to the producers in investing or otherwise disposing of extensive revenues. The absorptive capabilities of the producing countries have become important to producers and consumers alike, reflecting a clear realization of some basic bounds of interdependencies relating producers and consumers. Such are some of the more dramatic changes in the world petroleum network over the past decades, many of which have profound implications for evolving patterns of interdependence.

Responsibility for this present predicament has been placed in turn upon the producing countries for raising petroleum prices in a seemingly arbitrary manner, upon the consuming countries for placing extensive demands upon existing petroleum reserves, and upon the multinational corporations for allegedly encouraging the producers in their price escalation policies. The "crisis" is defined differently by different parties with different interests, goals, and objectives. What might be a problem when viewed from Washington may not be so regarded in Paris, Teheran, Cairo, Moscow, or Peking. But this much is clear: certain political and economic externalities are associated with the production and consumption of

petroleum, the nature of which define the global parameters of the present energy situation.

There are at least four distinct issues at the core of the current petroleum crisis:

First, is the issue of oil embargo, that is, the ability of the producers to successfully impede free flow of petroleum to the consumers. The question in an interdependent world is whether a nation can or should manipulate access to raw material for economic or political gains. Clearly the producers and consumers differ on this issue.

Second, is the question of shortages of supplies due largely to the explosion of demand but also to the reluctance of some producers to increase production. Clearly the consumers seek to meet their demands through imports rather than drastically reducing internal needs, while the producers, although differing on this issue, seek to maximize present gains of a resource that is obviously finite. Some have moderated their production program, others are accelerating. But the realization of the imminent depletion of this resource lies at the basis of their policies.[1]

Third, is the issue of price around which the most salient differences between producers and consumers arise. The consumers differ with respect to the criticality of petroleum and to the extent they are in fact economically dependent upon external sources. Yet the objective of defining a viable pricing system is commonly shared where present prices would be reduced markedly. By contrast, the producers, faced with a finite valued good, are seeking to maximize potential gains. Their demands, although often couched in political terms, are predicated upon some invariant economic realities.

Fourth, is the question of auxiliary support and infrastructure in terms of tanker capacity, refinery shortages, pipeline requirements, and so forth.

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[1]U.S., General Accounting Office, Issues Related to Foreign Sources of Oil for the United States, Report B-179411, January 23, 1974, p. 20.

For producers and consumers the fourfold issues of oil embargo, shortages of supplies, manipulability of prices, and shortages of auxiliary facilities are intimately related to economic and political considerations and to potential efforts toward community-building, regional as well as international. But for the multinational corporation, the policies and postures adopted are dictated mainly by the profit motive. Thus, the changing role of oil companies, from being agents of the consumers to being agents for the producers, reflects primarily economic concerns.

The institutional constraints in both consuming and producing countries add to the complexities at hand. The consumers have yet to develop viable national energy policies in which individual needs and requirements are evaluated and avenues for cooperation delineated. The sometimes contradictory energy-related policies within each country highlight the absence of a national posture regarding energy. In the United States, for example, oil import quotas have reduced incentives for domestic exploration and, in the final analysis, contributed to increased dependence upon imports. Policies toward natural gas have made this alternative to petroleum largely nonviable on economic grounds.

By contrast, the producers appear to have more concerted national policies regarding petroleum largely because of the dominant role of this resource in their respective economies. But cooperation among the producers is low at best, despite the apparent successes of the Organization of Petroleum Exporting Countries. Common postures on such issues as production and development have yet to be decided. Despite the apparent cleavages in the global petroleum system, the differences among producers and among consumers are extensive, in some cases as great as those between producers and consumers.

The projections and predictions regarding future patterns of production and consumption must be viewed with caution. The immediate outlook, however, is for an average growth rate of approximately 1.3% - 3.8% per year in the consumption of petroleum in the United States.[2] These

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[2]U.S., Congress, Senate, Committee on Interior and Insular Affairs, Survey of Energy Consumption Projections, 92nd Cong., 2nd sess., 1972, p. 20.

estimates are contingent upon the ratio of imports to domestic consumption remaining at about the 1968 level, no production of liquid fuels from coals, oil shale, or tar sands, and the continuation of the 1968 relationship of crude oil to liquified natural gas production. Of these, the first assumption is now clearly violated: imports have increased sharply since 1968. Consumption for the rest of the world is likely to increase at faster rates than in the United States, between 3.5% - 5.5% per year. These projections reflect the industrialization of large parts of the world where petroleum usage has so far been nominal, and assume continued population growth in developing areas.

In rank order, the major producers in 1972, (in percentage of total world production), were the United States (18.66%), the U.S.S.R. (15.5%), Saudi Arabia (11.32%), Iran (9.92%), Venezuela (6.33%), Kuwait (5.93%), Libya (4.42%), Nigeria (3.59%), Canada (2.94%), Iraq (2.86%), the United Arab Emirates (2.38%), Indonesia (2.11%), Algeria (2.11%), China (1.0%), and Qatar (.95%). Other countries combined contributed 9.02% of total world production in 1972.[3] Members of the Organization of Petroleum Exporting Countries (OPEC) account for 85% of the world's proven crude oil reserves (other than those in the Soviet Union).

The United States, Western Europe, and Japan consume about 80% of the world's production of oil. By 1985 the same percentage is expected to be consumed out of a total base of over twice the present levels of production. Two-thirds of projected petroleum demand in the United States may have to be imported, much of this coming from the Middle East. Furthermore, competition for Middle East oil is expected to increase for all the advanced industrial states, including the Soviet Union, because of considerations of quality, cost, availability, and perhaps adequacy of domestic oil reserves. The major uncertainties are associated with the price of expected transactions.

The reserve figures are not directly comparable in that they must be

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[3]DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 1973 (Dallas: DeGolyer and MacNaughton, 1973).

TABLE 1

WORLD PETROLEUM PROFILE, 1972

(in thousand barrels)

COUNTRY	ESTIMATED RESERVES 1/1/72	PERCENT WORLD RESERVES	CRUDE PRODUCTION 1972	PERCENT WORLD PRODUCTION	RESERVES PRODUCTION RATIO	DEMAND PER DAY	PRODUCTION DEMAND RATIO	IMPORTS[1]	PERCENT WORLD IMPORTS	EXPORTS[1]	PERCENT WORLD EXPORTS
WORLD	560,119,973	100.0	18,531,872	100.00	30.22	51,640	1.02	8,122,007	100.00	8,122,007	100.00
Algeria[2]	9,839,600	1.76	390,888	2.11	25.17	53	20.15	-	-	301,292	3.70
Canada	8,333,087	1.49	544,562	2.94	15.30	1,623	1.09	282,366	3.47	313,753	3.86
China[3]	12,500,000	2.23	186,660	1.01	66.97	484	1.05	N.A.	N.A.	N.A.	N.A.
Ecuador	6,070,545	1.08	34,262	0.18	177.18	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
France	98,890	0.02	10,720	0.06	9.22	2,189	0.01	739,084	9.09	-	-
Germany, W.	560,000	0.10	51,311	0.28	10.91	2,638	0.05	764,951	9.41	-	-
Indonesia	10,673,400	1.90	390,132	2.11	27.36	153	6.97	-	-	274,237	3.37
Iran	60,450,000	10.79	1,838,451	9.92	32.88	339	14.82	-	-	1,035,692	12.75
Iraq	33,100,000	5.91	529,236	2.86	62.54	81	17.85	-	-	716,368	8.82
Japan	24,880	0.00	5,348	0.00	4.65	4,540	0.00	1,707,355	21.02	-	-
Kuwait	66,023,000	11.79	1,099,792	5.93	60.03	156	19.26	-	-	927,582	11.42
Libya[2]	28,000,000	5.00	820,000	4.42	34.15	22	101.82	-	-	819,751	10.09
Nigeria	10,000,000	1.78	665,022	3.59	15.04	39	45.49	-	-	567,840	6.99
Oman	4,750,000	0.85	103,562	0.56	45.87	N.A.	N.A.	-	-	N.A.	N.A.
Qatar	4,800,000	0.86	176,412	0.95	27.21	N.A.	N.A.	-	-	168,743	2.07
Saudi Arabia	137,040,000	24.47	2,098,423	11.32	65.31	256	22.39	-	-	1,513,814	18.63
U.A.E.[4]	15,100,000	2.69	384,300	2.38	39.29	N.A.	N.A.	-	-	589,647	7.25
U.K.	3,000,000	0.53	625	0.00	0.00	2,157	0.00	983,803	12.11	-	-
U.S.S.R.	60,000,000	10.71	2,884,080	15.56	20.80	5,977	1.32	-	-	141,359	1.74
U.S.	38,062,957	6.79	3,459,052	18.66	11.00	16,354	0.68	811,135	9.98	187	0.00
Venezuela	13,740,395	2.46	1,172,356	6.33	11.72	223	14.36	-	-	502,926	6.19

Footnotes on following page.

FOOTNOTES TO TABLE 1

[1] The figures for imports and exports are estimates from the International Petroleum Encyclopedia, 1973. As of this writing, there are no systematic figures for global petroleum trade other than estimates. These figures are converted from metric ton quantities to barrels by a factor of 7.33 barrels per metric ton. This is an average conversion factor which does not take into account the unique characteristics of each country's petroleum. For our purposes, the variation is not intolerable. This standard is based on Saudi Arabian light, 34° gravity.

[2] It should be pointed out that voluntary conservation policies in Libya and Algeria have reduced the production levels from previous years.

[3] China's position has apparently increased significantly since 1972. In 1973 China doubled her production to 366,500,000 barrels with an attendant increase in exports. (Yoshio Koide, "China's Crude Oil Production," Pacific Community 5 [April 1974].)

[4] The figures for the United Arab Emirates include only Abu Dhabi and are therefore understated.

SOURCES:

DeGolyer and MacNaughton, Twentieth Century Petroleum Statistics, 1973, (Dallas: DeGolyer and MacNaughton, 1973).

Petroleum Publishing Company, International Petroleum Encyclopedia, 1973, (Tulsa: Petroleum Publishing Company, 1973).

United Nations, World Energy Supplies, Series J, No. 16, (New York: United Nations, 1971).

viewed in terms of the quality of petroleum from each source, the indigenous needs of the producing countries, their absorptive capabilities, and their expected coverage rates. Nonetheless, they indicate some basic factors against which patterns of production, consumption, flows, and dependencies may be evaluated. Table 1 presents the data upon which the remainder of this chapter is based.

B. Patterns of Production

There are some dramatic changes in patterns of petroleum production over the past 20 years, only one of which is the exponential rise in output. In 1955 world production of crude petroleum was dominated by the United States, producing 43% of the world total. The nearest competitor was Venezuela, which accounted for 15% of the total. By 1972 the situation had changed markedly; the centers of production were no longer in the Western Hemisphere. Although the United States was still the world leader in total production, it accounted for only 18%, followed by the Soviet Union, which accounted for 15% of the total world production. The third and fourth ranks were occupied by Saudi Arabia and Iran. Venezuela had dropped to fifth place. Thus the single most critical factor in the production of petroleum since World War II has been the extensive development of Middle Eastern and North African fields. In 1972 these fields accounted for 41% of the total world production.[4] The decline in the positions of the United States and Venezuela must be viewed in relative terms: the absolute level of production is still extremely high. By early 1974 it was apparent that Saudi Arabia would replace the United States as the world's leading producer of petroleum.

This extensive production, however, has been accompanied by periodic declines, particularly in 1970-1972. The largest declines in production were in Algeria, Libya, and Egypt--each decreasing production by over 20% during this period. Venezuela, Iraq, Oman, and even the United States all

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[4] Ibid.

experienced decreases in production, much of which may be attributed alternatively to environmental concern, domestic problems in the producing countries, international conflicts, unstable prices, national security concerns, and long-range economic considerations.

Environmental concerns in the advanced industrial societies have placed a high premium on the low-sulphur crudes of Libya and Nigeria, depressing demands for high-sulphur crudes as produced in Venezuela. Internal problems such as those related to the Nigerian civil war also account for decrease in the production of some states. The international conflicts revolving around the Arab-Israeli dispute and the positions adopted by some of the more radical Arab states also enter this calculus. The price of crude oil in the United States has contributed to the depression of domestic production, based on the oil industry's arguments that the price of domestic oil was insufficient compensation for continued exploration, drilling, and development of local fields. The peak of production in the United States was in 1970. Since then the trend has been downward. Considerations of national security, particularly the conservation of reserves, contributed to the restriction of domestic production and the imposition of import quotas.

Finally, many producers, particularly in the Middle East, are restricting production for economic reasons, namely that the appreciation of revenues invested in international monetary markets is greater than the appreciation of oil in the ground. Although they are two theoretically independent factors, the increase in price and restriction of production have common implications. Cutbacks in production increase the price of the valued good for at least as long as the cutback is in effect and, more important, it preserves the reserves of the producing states over a longer period of time.

Most of these considerations are critical only in the shorter time horizon. The advent of commercially viable alternative sources of energy would make many of these arguments obsolete. For the time being, however, they assume a reality of their own. It must also be recalled that despite these cutbacks, the present world petroleum situation is one of theoretical surplus capacity and production. But the critical issues of national

self-determination, national security and military strategy, maximization of profit and economic gain, and protection of valued nonrenewable resources have impeded the free flow of petroleum across national boundaries, overshadowing the availability of this surplus. In this restricted sense the crisis is presently artificial. By the turn of the century, geological constraints may have placed absolute limits on the supply of crude petroleum. More immediately, however, constraints on the ready flow of petroleum have shaped a crisis whose reality cannot be denied and only the interpretation of which is in question.

C. Patterns of Consumption

The patterns of petroleum consumption are also truly impressive. Of the total energy consumed by the world in 1957, 30% was in the form of liquid fuel. By 1971 this percentage increased to 42% and is higher still today. This increasing reliance on oil reflects several important developments, most of which are related to cost, environmental, and technological factors. Middle Eastern and North African oil is relatively cheap in comparison with other fuels. Oil is much cleaner than coal, the technology of extraction is more developed than nuclear power, and the requirements for hydroelectricity are not present in many areas. Together, these factors have made the advanced industrial societies rely increasingly upon petroleum as a primary source of energy.

With the exception of the United States, all the other advanced industrial societies have increased the share of petroleum in total energy consumption. The growth of reliance on oil has been dramatic. In 1957 petroleum accounted for 24% of France's total energy consumption; by 1971 this figure had risen to 64%. In Germany, reliance on petroleum rose from 10% in 1957 to 52% in 1971. For the United Kingdom, the comparable figures are 15% and 43%. And Japan's reliance on petroleum increased from 26% in 1957 to 72% of total energy consumed in 1971. Today the dependence is even greater. Only the United States maintained a relatively stable consumption of oil as a percentage of total energy consumption, due to a relative abundance of coal, natural gas, and hydroelectric power.

The same general situation exists in the Soviet Union, where about 30% of total energy consumed is in the form of petroleum. Coal and natural gas are the two most viable alternatives.

Over 50% of all petroleum consumed in the United States is in the transportation sector, where as yet no alternative source of energy exists. This fact has accorded current imports of petroleum greater political salience than would be warranted on the basis of the magnitudes involved alone. The rate of growth in energy consumption in the United States serves as a reminder of the continued reliance on imports at least until the turn of the century, a consideration that is not immediately apparent given the relatively stationary role of petroleum relative to the country's total energy consumption.

The projected growth of petroleum markets in Western Europe and the Far East is substantially greater than in North America. It is anticipated that Western Europe will remain the leading market for international petroleum, mainly from the Middle East and North Africa, with increases in both absolute and relative terms from West Africa. It is also expected that oil will supply over 60% of continental energy consumption by 1980, but this projection does not take sufficient cognizance of the potentials in North Sea discoveries and their pace of development.[5] It is expected, further, that Japan's petroleum needs will be supplied primarily by the Middle East, although new offshore discoveries in Indonesia and the South China Sea are likely to modify this assessment. In any case, Japan's dependence on imported sources will remain.

These patterns of consumption have interjected new sources of tensions into the Western alliance. Japan and Western Europe have become disturbed by the rate of increase in U.S. reliance on imports. This concern is attributable to the fact that this growth is occurring at a

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[5]Sam H. Schurr and Paul T. Homan, Middle Eastern Oil and the Western World: Prospects and Problems (New York: American Elsevier Publishing Company, 1971), p. 3.

time when there is already considerable dissatisfaction with the availability of supplies to meet their own needs. They are also apprehensive of American buying power and fear that multinational corporations which dominate the international oil industry will tend to give priority to U.S. needs at the expense of the allies.

Whatever the empirical foundations for such sentiments, they do point to potential sources of tensions between the United States and her allies and the extent to which strategic and security issues become dependent upon expected patterns of petroleum consumption. The interdependencies highlighted here are of a functional nature, although no less pressing than those of a structural nature emerging from patterns of trade between the consumers and producers of crude petroleum.

D. Patterns of Crude Petroleum Exports

Two trends in the patterns of crude oil petroleum exports stand out: first, there has been a transformation from the Western Hemisphere as the focal point of petroleum exports to other areas of the world. Second, the rank ordering of exporter states in terms of magnitudes of exports has changed dramatically. Both of these factors have important strategic and economic implications for the importer countries. For example, in 1955, the world's largest exporter of crude petroleum was Venezuela, exporting 35% of the world total. The other states ranked as follows: Saudi Arabia (15%), Iraq (13%), and Iran (3%). By 1970 the situation had changed significantly. Iran had become the largest exporter of crude petroleum (14%), followed by Libya (13.6%), and Saudi Arabia (12.7%). Kuwait and Venezuela accounted for 12.3% and 11.0% respectively. These changes indicate not only a transformation of exporter rankings, but, more importantly, a decreasing concentration of exports around any one state.

These changes can be accounted for by a rapid increase in the world crude petroleum production and in exports and by the rapid development of new oil fields and new producing states. Between 1955 and 1970 total world exports of crude petroleum witnessed an increase of 361%. Today,

trade in petroleum accounts for over 10% of total world trade in all commodities.

By 1970 no one state could dominate the crude petroleum market: the top five exporters were separated by a margin of only 3%. Theoretically, at least, this fact should have contributed in rendering the crude petroleum system a buyer's market in that no one state could control the market by virtue of a position of preponderance, particularly in a situation of surplus capacity. The United States' position as a major oil exporter had contributed in making this theoretical situation one of reality in 1956 by successfully countering the Arab states' attempts to promote a selective embargo on Western Europe. And again in 1967 a buyer's market occasioned by a situation of surplus capacity and the United States' ability to supply Western Europe with its own oil accounted for the marked inability of producing states to exploit their position as exporters of crude oil for political gain.[6]

Today the situation is different. Although considerable ambiguity remains regarding the extent to which the producing countries might in fact draw upon their resources for political objectives, it is clear that the threat of a selective embargo carries greater weight than in 1967. The Organization of Petroleum Exporting Countries (OPEC), founded in 1960, is in large part responsible for this transformed situation. But there are many factors which have facilitated coordinated action on the part of the OPEC countries.

First, the geographical location of most of these countries and their shared cultural and religious heritage, in conjunction with a common colonial history, have tended to provide some bases for concerted international discussions. The non-Middle Eastern members of OPEC--Venezuela, Ecuador, Nigeria, and Indonesia--are not in a position to significantly counter any concerted OPEC action nor is it in their economic interest to do so.

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[6] Ibid, p. 35.

Second, cooperation among the Arab membership in OPEC has been facilitated by their common stance in opposition to perceived Israeli expansionist policies.

Third, the revenues accrued from petroleum exports have been channelled to modernizing production and market operation and have contributed to a fairly sound evaluation of the nature of the world petroleum market and the extent to which it might absorb increasing price structures.

And fourth, the growing level of sophistication in the technical and economic leadership of the oil-producing countries has improved their capacity to weigh economic gains against political objectives.[7] However, it would be a mistake to argue that the critical motivation underlying recent OPEC policies was political gain rather than economic profit. The latter is undoubtedly a more critical factor in the apparent solidarity among the members of OPEC.

Although it is customary to attribute current petroleum problems to the increasing importance of OPEC in the world petroleum market, it was the activities of individual nations that set off a series of events culminating in the selective embargo of 1973. Restrictions of petroleum production were initiated unilaterally in 1970 by Libya, based on a new policy of preserving scarce resources. An increase in price followed, shortly precipitating similar actions by other Middle Eastern and North African states. The inaction of the multinational corporations with respect to Libyan demands might be attributed in part to the fact that the Libyan move was directed toward one of the most vulnerable corporations, Occidental Petroleum, and in part to economic risks attached to resisting such unilateral actions.

It is imperative to recall that OPEC controls a product for which there are no substitutes in the short run, one that is vital to the economies of industrial societies, and one in which the members are not

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[7] U.S., Congress, Senate, Committee on Interior and Insular Affairs, Oil and Gas Import Issues, Part 1, 93rd Cong., 1st sess., 1973, pp. 218-19 (Statement by U.S. Department of Interior).

competing for greater access to consumer markets. But there are as yet some unknown parameters of permissible behavior that remain to be defined. Even the question of price around which potential coordination revolves is fraught with uncertainties. There is clearly an upward limit on the price that can be charged for petroleum without occasioning profound disruption in the world petroleum markets. This bound is set as much by the responses, policies, and priorities of the importing states as by the unilateral, although coordinated, actions of the oil-exporting countries.

E. Patterns of Crude Petroleum Imports

Against a background of escalating transactions in crude petroleum, two factors stand out: first, an increased reliance of consuming countries upon imports for meeting rising domestic consumption, and second, an increased trend toward diversification of sources of import.

The United States has traditionally attempted to maintain its imports of crude petroleum at a level between 10% to 20% of total consumption, a policy predicated on the following considerations:[8] (a) a preference for limiting dependence upon any one nation for a vital commodity, (b) a concern for maintaining a minimum level of viability for domestic petroleum industry, (c) the strategic and military implications of increased dependence on external sources, and (d) a general tendency to maintain a high degree of self-sufficiency in all critical aspects of the national economy. These factors provided the bounds for U.S. import policies, but did not further regulate the specific patterns of flows.

In 1955 the United States imported approximately 11% of total consumption. The largest source of imports was Venezuela (50% of total petroleum imports), followed by Kuwait (21%), Saudi Arabia (11%), and Canada (4%). A concern for securing "safe" imports contributed to changing this

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[8] U.S., Cabinet Task Force on Oil Import Control, The Oil Import Question, February 1970, p. 19.

pattern. By 1970 Canada had become a major supplier (48%), followed by Venezuela (20%), Indonesia (5%), and the United Arab Emirates (4%). Even greater changes were apparent in mid-1973: the United States was now importing 35% of its total supply of crude oil. Of this total, the major sources were Canada (34%), Nigeria (14%), and Saudi Arabia (13%). Today Arab oil accounts for 5% of total U.S. consumption and Eastern Hemisphere oil, 11%.[9] Some calculations foresee U.S. oil imports increasing to 54% of petroleum consumption by 1980, with the Middle East and North Africa providing 70% of this total.[10]

Several factors have contributed to a near doubling of imports over the past three years: (a) the stagnation of the domestic industry, (b) declines in the domestic production of natural gas, (c) delays in planned completion and operation of nuclear-powered plants for electric utilities, (d) technological problems encountered in the development of sulphur-control equipment for coal- and oil-burning equipment, (e) rapid rises in economic productivity, and (f) environmental and safety equipment on motor vehicles. These are all domestic considerations which do not bear directly upon the geological availability of petroleum in the United States.

Western Europe and Japan do not possess the theoretical option of reliance on domestic sources of petroleum, nor are alternative sources of energy readily available. Western Europe has always imported over 90% of its total petroleum needs. Today the figure is close to 98%. While the discoveries in the North Sea will moderate this dependence considerably, it is anticipated that 85% of Europe's future needs will be met through imports.[11] In 1955 Western Europe was the major market for oil

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[9]U.S., Department of the Interior, Bureau of Mines, Monthly Petroleum Statement, March 1974, p. 2.

[10]Oded Reinba and Anne Sinai, "The Energy Problem and the Middle East: An Introduction," Middle East Information Series 23 (May 1973), pp. 2-7.

[11]U.S., Congress, House, Committee on Foreign Affairs, Hearings before the Subcommittee on Foreign Economic Policy, Foreign Policy Implications of the Energy Crisis, 92nd Cong., 2nd sess., 1972, p. 233 (Statement by John G. Winger).

in the world, acquiring 39% of all exports. By 1970 Europe commanded 51% of total exports, thereby signaling the increased importance of West European markets to the oil producers. The West Europeans also diversified their sources of imports, a policy that is exhibited most clearly by Germany, France, and the United Kingdom.

In 1955 West Germany accounted for 2% of global petroleum transactions, primarily from Saudi Arabia (39%), Iraq (29%), Kuwait (18%), and Venezuela (6%). By 1961 Germany's main suppliers were Iran (35%), Iraq (14%), and Saudi Arabia (13%). In 1972 Libya became Germany's largest supplier (27%), followed by Saudi Arabia (18%). Between 1968 and 1972 West Germany appeared to adopt a policy of diversification (intentional or otherwise), the net effect of which was to reduce the predominance of any single supplier.

The same patterns--with different trading partners--appeared in the case of France. In 1955 France received 9% of the total world imports of crude petroleum, primarily from Iraq (42%), Kuwait (30%), Saudi Arabia (11%), and Qatar (5%). With the development of oil fields in Algeria, this situation changed dramatically. By 1962 Algeria became the major supplier (34%) of total French imports, followed by Kuwait (22%) and Iraq (19%). In 1972, following a cutback in Algerian production, the main supplier became Saudi Arabia (24%), followed by Nigeria (14%), Kuwait (12%), and the United Arab Emirates (10%). Again, the trend was for reduced concentration of import sources.

This pattern of increased diversification is equally well exhibited by British statistics. In 1955 the United Kingdom imported 10% of total world imports for that year, with the main suppliers being Kuwait (60%), followed by Iraq (14%), and Venezuela (7%). By 1972 Britain had diversified its sources of supply, relying primarily on Iraq (25%), Kuwait (16%), Saudi Arabia (16%), and Libya (11%).

The same pattern of diversification and reduced concentration is apparent in the case of Japan. In 1955 the country's main supplier was Saudi Arabia (56% of total Japanese imports), followed by Kuwait (13%), and Indonesia (9%). By 1963 Kuwait had become Japan's main supplier

(56% of all imports), followed by Saudi Arabia (18%), Iran (15%), and Indonesia (10%). In 1972 Iran was the main supplier (36%), followed by the United Arab Emirates (19%) and Saudi Arabia (16%). Kuwait ranked fourth, supplying 12% of total Japanese imports.

The apparent logic behind the policy of diversification was that any state dependent upon imported oil ought not compound this dependence by also becoming reliant upon any one single state. By expanding its sources of imports, a state could reduce the risk of impeded access to this critical resource. This posture was rendered possible by the entry of new producers into the world petroleum market, and was viable in a world where an importing state was confronted with a large number of relatively autonomous, uncoordinated exporters. But for the importer to reduce reliance on any single supplier, it would also follow that the suppliers would diversify the target of their exports. Thus, a policy of diversification which may have been predicated on the desire to reduce dependence has in fact contributed to increased interdependence between producers and consumers, linked by changing networks of petroleum transactions. These initial considerations shape the parameters of mutual vulnerability and sensitivity and provide the background conditions against which to evaluate the structure of dependencies and interdependencies in petroleum flows.

F. Interdependencies of Petroleum Flows: A Preliminary Assessment

While patterns of petroleum production and consumption provide the initial parameters of the world petroleum system, patterns of flows define the basic structure of interdependencies among producers and consumers. Imports and exports indicate unidirectional flows--who gets how much from whom--but they do not reflect the degree of structural interdependence between importers and exporters. Within the context of petroleum flows alone, the degree of mutual vulnerability and sensitivity between importer and exporter can be gleaned from an assessment of the symmetries or asymmetries in the concentration of trade. Thus, the criticality of (a) each exporter in the total imports of each importer, and (b) each

importer in the total exports of each exporter, together define mutual dependencies in petroleum flows. The higher the degree of symmetry, the greater will be the interdependencies of flows; conversely, the greater the asymmetries, the lower will be the degree of mutual vulnerability and sensitivity. A key assumption is that the value of oil is similar for both importer and exporter--an assumption that cannot be justified. However, for illustrative purposes only, some key asymmetries in trade patterns are noted below for 1970, the most recent year for which comprehensive official data on petroleum imports and exports are recorded in the United Nations Publication, World Energy Supplies. Such an assessment will pertain only to petroleum flows. Nonetheless, some unmistakable regularities emerge.

First, with respect to the United States: in 1970, Canada, Indonesia, the United Arab Emirates, and Nigeria depended more upon U.S. markets than the United States relied upon them as sources of imports. Of these, only in the case of Canada are the asymmetries highly significant: 48% of U.S. petroleum needs were supplied by Canada, but the U.S. accounted for 98% of total Canadian exports in petroleum, illustrating U.S. domination of Canadian exports. By contrast, the United States' next largest trading partner, Venezuela, accounted for a larger proportion of total U.S. imports than did the United States in terms of total Venezuelan exports. The asymmetries favored Venezuela. The percentages of imports and exports involved with respect to the United States' other trading partners are so small as to preclude any sound inference regarding asymmetries or interdependencies.

In the case of France, the same general pattern emerged in 1970, namely, that the largest asymmetries pertained with respect to the country's major trading partner. Thus, Algeria supplied 26% of total French imports, but this figure accounted for 59% of total Algerian exports. Similarly, with respect to the second largest trading partner, the reverse asymmetries pertained: Libya supplied 17% of French imports, but this figure amounted to only 11% of total Libyan petroleum exports. Once again, the consumer country dominates the export market of its prime supplier. In the case of France, it is possible to infer that the con-

sumer tends to dominate the markets of most of its suppliers, most notably Iraq, the United Arab Emirates, and Nigeria.

A different pattern of asymmetries emerged in the case of Great Britain and Germany. In each case the major exporting country supplied a larger fraction of the consumer's control of the producing country's total exports. The asymmetries favored the exporting state. Thus, 24% of Britain's total imports were supplied by Kuwait, whereas trade with Britain accounted for only 15% of Kuwait's total exports. Approximately the same proportional asymmetries pertained with respect to Britain's second-ranking trading partner, Libya. And the general pattern extended to the third-ranking exporter, Saudi Arabia. Trade asymmetries favoring the exporting country were equally salient in the case of Germany: 41% of total German imports were supplied by Libya, whereas Germany accounted for only 26% of total Libyan exports. Similar asymmetries emerged with respect to the second- and third-ranking trade partners.

Only in the case of Japan were patterns of imports and exports so highly congruent or symmetrical as to suggest a high degree of interdependence in petroleum flows: 43% of total Japanese imports were supplied by Iran, and Japan accounted for 44% of Iran's total exports of petroleum. Kuwait ranked second, providing 19% of Japan's imports, while exports to Japan accounted for 22% of total Kuwait petroleum exports. Thus, at least with regard to major trading partners, there appears to be a high degree of interdependence in petroleum flows. It is worth noting, however, some striking asymmetries in Japan's trade with the lesser partners, United Arab Emirates and Oman. Five percent of total Japanese imports came from the Emirates, whereas Japan represented 22% of this exporter's market. Similarly, Oman supplied 2% of Japan's imports, yet this figure accounted for 24% of Oman's total petroleum exports. In these two cases, the asymmetries indicate a dependence of the exporters upon Japan. But this is clearly a deviation, one that may reflect a conscious policy of transforming a situation of clear dependence into one of interdependence.

In sum, two major consumers (U.S. and France) exhibited clear trade asymmetries favoring the importing country; two consumers (Britain and

Germany) exhibited asymmetries favoring the exporting countries; and in only one case (Japan) did patterns of flows reflect a high degree of interdependence. These patterns of petroleum flows provided only initial, first-order approximations of the nature of dependencies and interdependencies underlying petroleum flows. In no way do they reflect the comprehensive constraints, mutual vulnerabilities, and sensitivities which have evolved from these factors, nor do they mirror the changing structure of the world petroleum system. Petroleum flows have given rise to a wide variety of interactions, policies, and priorities, the nature and extent of which are not readily discernible from an assessment of flows alone. Other structural factors such as those discussed in the next chapter must be taken into account.

Chapter II

THE CHANGING STRUCTURE OF THE WORLD PETROLEUM SYSTEM

Patterns of petroleum production and consumption and patterns of petroleum flows across national boundaries provide an initial approximation of the changing nature of the world petroleum system. They illustrate structural regularities and establish asymmetries and concentration or diversification. They represent further the critical differentials in each nation's access to basic resources; for the consuming countries that resource is petroleum, for the producers it is the revenues accrued from the sale of petroleum. Each depends upon the other, and the net effect is an intricate network of interdependencies whose origins lie in the basic flows of petroleum across national boundaries.

The changing nature of such flows has in part been occasioned by, and in part results from, the changing role of key actors in the system. In part, they also have been brought about by the changing goals and preferences of the major actors and, more importantly, by their changing attributes and capabilities. Some of the institutional and organizational changes in the world petroleum system have been noted in Chapter I; others are yet to be delineated. But nowhere is the evolving institutional base of the world petroleum system more apparent than in the changing roles of the multinational corporations and the Organization of Petroleum Exporting Countries. While these institutions have different goals and objectives, are motivated by different preference structures, and command different levels of technical skills, their interactions with each other and with the consumer nations have shaped the petroleum system. Neither the oil companies nor OPEC alone can be given the credit, or responsibility, for engineering such profound change. It is the interactive effect between the policies of established international oil concerns and the emerging capabilities of the oil-producing states that shape the parameters of a changing world petroleum system.

A. The Changing Role of Multinational Corporations

Clearly, one of the most dramatic changes in the structure of the world petroleum system over the past decades pertains to the role of the international oil companies. From managers of the global petroleum

system, controlling flow, price, and access, the multinational corporations have gradually become intermediaries between consumers and producers. In this capacity they have provided an effective buffer, safeguarding to some extent the interests of both producers and consumers, but always seeking to maximize profit and gain. Most recently the oil companies have been accused by critics in the West of promoting and protecting the interests of the producing governments to the detriment of the consumers (and their taxpayers), a charge that has been repeatedly denied by representatives of the industry. While the precise nature of the change in the role of the oil companies remains a much debated issue, the fact that dramatic changes have taken place is not disputed.

The multinational corporations have controlled global supplies of petroleum since the time the earliest discoveries were made. At the end of the 1930s, oil supplies in the United States and the West were controlled by seven international companies--Standard Oil of New Jersey (now Exxon), Royal-Dutch Shell, Texaco, Socony (Mobil), Gulf, Standard Oil of California, and British Petroleum (then Anglo-Iranian). They were all vertically integrated, although to varying extents, and much of the transfers of products was undertaken as internal transfers of price within the same company or between affiliates.[1] The eighth major company, La Compagnie Française des Petroles, is of lesser size but shares joint operating companies in parts of the Middle East.[2] In 1971 U.S. oil companies controlled, or had acquired rights associated with more than half the world's proven petroleum reserves, a situation that still exists. Far more dramatic is the fact that 70% of all industrywide investment outside the Communist bloc is undertaken by American companies and 80% of exploration investments for oil and gas are carried out by U.S. corporations.[3]

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[1] Jack E. Hartshorn, Oil Companies and Governments: An Account of the International Oil Industry in Its Political Environment (London: Faber and Faber, 1962), p. 130.

[2] Ibid., p. 107.

[3] U.S. Congress, House, Committee on Foreign Affairs, Subcommittee on Foreign Economic Policy, Foreign Policy Implications of the Energy Crisis, 92nd Cong., 2d sess., 1972, p. 232 (Statement by John G. Winger).

By current estimates, it is expected that in the coming decade alone, around $500 billion will have to be invested in the global petroleum industry. Two-thirds of this amount is to be allocated for capital expenditures.[4]

The influence of the multinational corporation in the world petroleum system emerges from several factors: First, they have kept tight control of downstream operation in the producing countries, thus effectively reducing the role of producing governments in policies affecting exploration of indigenous fields. Second, their monopoly of technology and knowledge and skills pertaining to the petroleum industry in terms of exploration, development, transportation, refining, and marketing oil has afforded them with an unparalleled advantage in perpetuating their management and control of the global petroleum system. Third, they have supplied the capital necessary for undertaking necessary explorations and exploitations to a degree that could not, until very recently, have been undertaken by the producing countries. And fourth, they have acted as managers, as well as intermediaries or buffers, between producer and consumers, a dual role that has long reinforced their control over the global industry. The recent reaction of the producers to this situation has taken the form of strategies toward each of these four factors, predicated on an appreciation of the power base of the multinational corporations. Indeed, it is the changing relation between the producer countries and the multinational corporation that has presented the consumers with problems of price and supplies. By the same token, it is the energy policies of the consumers--or lack thereof--that has afforded the producers with the possibility of manipulating prices to their own gain.

The interdependencies between the producers and the multinational corporations are extensive: First, the producing nations cannot manipulate prices without employing the multinational companies. Once taxes are set by government-company agreement, the price floor is established,

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[4]U.S., Congress, Senate, Committee on Interior and Insular Affairs, Oil and Gas Imports Issues, Part 3, 93rd Cong., 1st sess, 1973, p. 922 (Report by the U.S., Congress, House, Committees on Foreign Affairs).

but it can be modified at the initiative of the producing governments through a variety of institutionalized means, of which "participation" is only one illustration. Second, the oil companies in effect transfer revenues from consumers to producers and have often been charged with acting as tax collectors for the producers,[5] but they provide a service for which there is no institutionalized organizational substitute. Third, the maneuverability of both producers and intermediaries is effectively increased by the notable shortages of petroleum supplies for the consumers. In the case of the United States, the supply problem is a function of the inefficient use of energy, the absence of a comprehensive energy policy, and the concern for protecting the domestic petroleum industry. In the case of other consuming countries, the shortage is predicated upon physical and geological limitations. In each case, however, the parameters of shortage are not totally controlled by producers and intermediaries; neither possess sufficient maneuverability to propel the consuming countries toward one set of energy policy alternatives rather than another. The bounds of permissible behavior for each actor in the world petroleum network, although seemingly set by exogenous considerations, are in fact highly permeable, and subject to control and modification by each of the actors.

So, too, the criticality of access to overseas reserves has always been a factor in the strategic calculations of the consumer countries, most notably the United States. In 1943 the Arabian-American Oil Company (at the time a consortium of major U.S. companies) extended to the government of the United States an option to purchase at a discount extensive quantities of Saudi Arabian oil. It would be arranged that the oil remained underground, and it would be the company's responsibility to ensure that sufficient reserves would always be available to meet a government requisition.[6] This arrangement would be made in exchange for U.S.

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[5] Ibid., p. 1067 (Statement by M.A. Adelman).

[6] U.S., General Accounting Office, Issues Related to Foreign Sources of Oil for the United States, Report B-179411, January 23, 1974, p. 27.

government protection, thus indicating the importance that the United States placed upon Saudi oil to the extent of viewing it as part of its military reserves.[7] In this respect, the United States was willing to tie its security needs to the security of the corporations' control over the reserves and production schedules. This offer, however, was withdrawn before formal completion because of corporate fears of government domination.

The operating companies in the producing countries are, in fact, non-profit-making: they undertake extraction operations and transfer the oil at a fraction more than actual costs to the shareholder companies or affiliates. This oil, transferred at posted prices to other affiliates, represents profit, an extensive portion of which is paid as tax to the host government. In noting changes in the price structure of petroleum over the past decades, and most dramatically during the recent months, it is important to stress that increases in host government revenues are not accompanied by a reduction of profit to the oil companies.

A good illustration of the change in the role of the oil companies in the world petroleum network can be gleaned by comparing early charges that the multinational operations control led the behavior of the producing countries and sought to shape national decisions that favored corporation profits, with more recent charges that the corporations have become the tax collectors of the host government, in effect aligning their own interests with those of the producers. Nationalization of the Iraq Petroleum Company was prompted by a drastic loss of revenue to the national government. The companies argued that the Kirkuk oil was no longer competitive. The government argued the companies had deliberately sought to punish the Iraqis for their independent national oil programs and, in fact, applied pressures to hinder the implementation of its development programs in Iraq.[8] It has been argued that when the first Libyan cutbacks

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[7] Ibid.

[8] Middle East Monitor: (June 15, 1972), pp. 1-2.

in production were declared, a strong posture by the multinational corporations and the consumer countries would have resulted in a reversal of the decision, and that it was the companies' unwillingness to adopt a strong stance that prompted the Libyan position.[9] The charges and countercharges need not be substantiated to illustrate the extent to which the major actors in the world petroleum network have assumed new roles and adopted new postures, but one fact remains: the change in role and behavior has tended to increase, rather than decrease, the extent of interdependence among the major actors.

Despite the producing countries' willingness to make demands upon the multinational corporations, they are aware of their dependence on the oil companies, and recent events have passed with little direct hostility between these two groups. But there are some underlying conflicts of interest that cannot be ignored. Most critical among these is the emerging difference in priorities: the multinational corporations seek to realize maximum profit before the expiration of their leases, and some producers have voiced concern for spacing production and preserving some reserves for future exploitation. Yet despite such fundamental differences, the common goal is the maximization of profit. This commonality of interests, and the change in the companies' global position, has raised the possibilities of direct foreign intervention in the policies of the oil-producing countries.[10] While this possibility is remote, the changing role of the multinationals has, for the first time, placed the producers and the consumers in direct confrontation.

Throughout the past several years, there have been numerous cases of nationalization, expropriation, or negotiated sale of petroleum assets,

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[9]U.S., Congress, Senate, Committee on Interior and Insular Affairs, Oil and Gas Import Issues, Part 3, 93rd Cong., 1st sess., 1973, p. 1086 (Statement by M.A. Adelman).

[10]Oded Remba and Anne Sinai, "The Energy Problem and the Middle East: An Introduction," Middle East Information Series 23 (May 1973), pp. 2-7.

Table 2

OIL COMPANY PROFITS

1973

COMPANY	1973 PROFITS (in $ millions)	% INCREASE OVER 1972
EXXON	2,440	59.5
TEXACO	1,292	45.1
STANDARD OF CALIFORNIA (CHEVRON)	843	54.2
MOBIL	843	46.8
GULF	800	79.0
STANDARD OIL (INDIANA) (AMOCO)	511	36.4
SHELL	333	27.7
ATLANTIC RICHFIELD (ARCO)	270	38.4
CONTINENTAL (CONOCO)	243	42.6
PHILLIPS	230	55.3
SUNOCO	230	48.0
CITIES SERVICE	136	37.0

SOURCES: New York Times, Feb. 1, 1974, Feb. 10, 1974, and Feb. 13, 1974; Boston Globe, Feb. 15, 1974.

Note: This table may not indicate that the multinational oil corporations earned "exorbitant" profits in 1972. It may simply reflect the fact that profits for 1972 were not extensive. However, it is undeniable that 1973 profits were very significant.

generally in direct conflict to U.S. interests. In response, the United States has threatened to prohibit all assistance to states which confiscate U.S. holdings.[11] This posture, combined with the United States' commitment to the protection of nationals resident overseas and their property abroad, assumes extensive proportions in the case of petroleum, where U.S. overseas investments amount, in 1974, to about $24 billion. At the same time, however, the United States is not accorded any formal commitment by the multinational corporations for ensured access to petroleum supplies.

The entry of the Soviet Union as an active participant in the world petroleum system has placed added pressure on both the multinational corporations and the consuming nations. Although the U.S.S.R. is a net energy exporter, it trades actively in petroleum and petroleum products; if current trends persist, it might become a net energy importer, placing added demands upon existing reserves and emerging as a potential competitor for Middle East oil.[12] The Soviet Union's threefold role--as supplier, consumer, and potential middleman--may be a source of additional friction in a system where the scarcities of the basic commodity are aggravated by the goals and policies of individual actors, and may increasingly constrain the behavior of the multinational corporations by adding an element of volatility to an already rapidly changing environment.

In the final analysis, the multinational corporations are faced with certain imponderables: First, there are no viable alternatives to Middle East oil in the present decade--with projected increases in the petroleum needs of the United States and other consuming countries, the pressures placed upon Middle East sources will become increasingly acute. Second, by the end of the present decade, the revenues accrued to the oil-producing countries will greatly increase the latters' maneuverability in the world petroleum system and their ability to manipulate the

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[11] U.S., GAO, Issues, p. 20.

[12] Remba and Sinai, "The Energy Problem," p. 6.

structure of flows. And, third, as a result of the changing structure of the global petroleum system, the multinationals are finding themselves in a situation where their own maneuverability is becoming increasingly constrained, where they are becoming the targets of both producer and consumer dissatisfaction, and where the benefits derived from their extra-territorial status may be lost. Now that the consuming countries are becoming active members of the global petroleum system, with their governments assuming the role of direct agents, the multinationals might find themselves being forced by both producers and consumers into a global petroleum regime premised on agreed needs of producers and consumers.

Alternative futures for the multinational corporations are still a matter of speculation. But their own policies have, to a large extent, triggered critical changes in the structure of the world petroleum system, notably the development of the Organization of Petroleum Exporting States and its entry in the global petroleum network as a challenger of established patterns and an active opponent of the prevailing principles of interaction. The emergence of OPEC can be attributed even more to changes in the capabilities of the producing countries and the objectives of their governments. Assigning credit or responsibility to the multinationals for the advent of OPEC can only be undertaken following a close look at the factors leading to the emergence of this novel institution--those related to the international environment and those emerging from within their national borders.

B. Evolving Institutional Response: The Organization of Petroleum-Exporting Countries

The development of OPEC can be traced to three factors: First, apprehensiveness among the petroleum-exporting states regarding the ability of multinational corporations to cut petroleum prices without consultation with producing countries. Second, a realization among the more established exporters that the entry of new producers into the world petroleum market at lower costs might detract from established

markets. And third, an increase in the technical knowledge and skills of the producing countries and their resulting ability to make demands upon the consumers and the multinational corporations regarding the structure of prices and the taxing system.

The genesis of OPEC lies in early attempts at cooperation between Venezuela and Iran at the time of Iran's negotiations with its concessionaire, the Anglo-Iranian Oil Company, in 1949. The information on its own tax arrangements given by Venezuela to Iran, Saudi Arabia, and other producing governments was in part responsible for changing the method of payments from the multinational corporations. The first formal agreement of cooperation among producing countries signed in 1953, between Iraq and Saudi Arabia, prescribed the exchange of information and frequent consultation regarding oil prices and policies.

Attempts by oil-exporting countries to improve their financial terms were, at several points, successful, encouraging attempts at international collaboration. The formation of the Arab League in 1945 provided the Arab oil-producing states with a formal institutional structure within which to develop further collaborative arrangements. A security pact termed the Joint Defense and Economic Co-Operation Treaty, of 1950, provided an important position for oil in the policies of the organization. The Department of Oil Affairs in the Arab League has been largely responsible for the diffusion of information regarding the petroleum industry and increasing the technical skills of the individual members. However, the decision to seek collaborative postures regarding oil policies had, so far, been primarily a political one. The unilateral price cuts by the multinational corporations provided the necessary economic incentive for more effective cooperation and a greater degree of coordination than could have been established on political grounds alone.

Venezuela had taken the lead in protesting price cuts in 1959. During that year posted prices were reduced by about 8%, averaging 18 cents per barrel of oil. The cut was initiated by British Petroleum. Venezuela protested to the British government, but the latter could not (or would not) intervene in company policies. During the same year the

Shell Oil Company of Venezuela reduced posted prices ranging from 5 to 15 cents per barrel, according to type of oil. These price reductions, accepted by Venezuela, were kept within the limits provided by the market situation in the United States, an illustration of the importance of exogenous constraints in determining the revenues of the producing country.

More drastic price reductions were announced by the British Petroleum Company during the same year for their operations in Kuwait, Iran, and Qatar. Similar reductions were posted in Venezuela to meet the Middle East cuts in posted prices. The First Arab Oil Congress met during that same year, and, while the participants voiced dissatisfaction and apprehension, no effective action was envisaged.

Once more Venezuela took the lead in organizing the producing countries in the form of an Oil Consultation Commission, the purpose of which was to establish international agreements to prevent waste of an important source of energy, to stabilize posted or reference prices in crude oil, and to increase the tax revenues of the host countries. Disagreements among the oil-producing countries contributed to the short life of this Commission. But a clear precedent had been established and it remained for the producing countries to develop viable and institutional means of voicing their dissatisfactions with the policies and postures of the multinational corporations.

During the next year, Venezuela tried once again to organize the producers, this time with the collaboration of Saudi Arabia. In August of 1960 the international oil companies reduced posted prices again by about 6%, amounting to 10 cents a barrel. This cut meant a substantial loss of revenue to the host governments on the order of $93 million. Following this price reduction, representatives from Iraq, Iran, Kuwait, Saudi Arabia, and Venezuela met in Baghdad. The Organization of Petroleum Exporting Countries was created in September of 1960 to coordinate and

unify the policies of its members.[13]

The creation of OPEC was supported by the politicized public in member countries and, in each case, coincided with the national leaders' own grievances against the international oil companies and the consumer countries. The unwillingness or inability of the governments of consuming countries to counter price reductions added further fuel to an already volatile situation. While collusion between the oil companies and consumer governments cannot be established, from the perspective of the producing countries, this possibility was very much a fact. And the political disputes between the producers and the consumers, many of which revolved around the decolonization of the Middle East, contributed to the grievances and dissatisfaction generated by the reduction in posted prices.

To attribute too great a role to the multinational corporation in the creation of OPEC would be misleading. In a very real sense, OPEC emerged as an institutionalized response to a changing global petroleum system and to greater technical capabilities in the host countries. The highly concentrated structure of the industry, its vertical integration, and the nature of the concession system itself all proved ready targets for the dissatisfaction of the producing countries with their role in the world petroleum system and their share of the profits accorded to them by the international oil companies. With the growth of independent petroleum companies the flexibility of the multinational corporations in pricing their goods and services within an integrated system was becoming

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[13]There is an alternative explanation for the creation of OPEC. In 1959 Venezuela increased the taxes on the petroleum corporations working in Venezuela. These corporations, in an attempt to forestall further tax increases and to demonstrate to other oil producers their displeasure with such moves, reduced the prices of Venezuelan crude and increased production in the Middle East. Venezuela responded by meeting with the other oil producers and, with the support of Sheik Tariki of Saudi Arabia, OPEC was created. See Fuad Rouhani, A History of OPEC (New York: Praeger, 1971), pp. 76-77.

increasingly limited. Vertical integration had become a target for host as well as consuming governments. The latter even require vertically integrated oil companies to base their transfers of goods and services upon open market prices.[14]

The creation of OPEC also coincided with increasing political sophistication among the oil-producing countries. The producing countries not only controlled a critical resource, but were in a position to amass large sources of funds, the magnitude of which might occasion large-scale dislocation in the international economic system. The needs of the consuming nations provided the producing countries with financial resources that far exceeded their capabilities to absorb these resources or to make use of them for purposes of national development--an unprecedented situation in the world economy.

The member countries of the Organization of Petroleum Exporting Countries are Abu Dhabi, Algeria, Ecuador, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, and Venezuela. Gabon is an associate member. Among them, they control 85% of the oil available for export to the nonsocialist world. To date, OPEC's major achievements have been to deter price competition among its members, to increase profits, to gain participation arrangements with the international oil companies, and to conserve oil reserves for future exploitation.[15] The vast differences in political orientation, economic development, national objectives, size of population, and so forth, have provided considerable obstacles to the development of joint petroleum policies, but the recent display of coordination among them is impressive.

The interdependence among the major actors in the world petroleum system is further illustrated by the near total dependence of the producing countries upon the revenues accrued from the sale of petroleum. By

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[14]Zuhayr Mikdashi, The Community of Oil Exporting Countries (Ithaca: Cornell University Press, 1972), p. 42.

[15]U.S., GAO, Issues, p. 18.

the same token, however, their control over global monetary resources are, and will continue to be, extensive. In 1974 the annual oil revenues transferred to OPEC may increase to $65 billion--approximately a 300% increase over a five-year period. At present prices, by 1985 total OPEC revenues will reach half-a-trillion dollars, about half of the present gross national product of the United States.[16] While scholars and policy-makers alike debate the potential consequences of such large-scale transfers of funds, there is common agreement that at the very least these transfers would increase the maneuverability of the OPEC countries and enhance their ability to achieve their political or economic goals.

The oil-exporting countries have negotiated a series of agreements with the multinational corporations, the most important of which was the provision for an exporting country's participation or part ownership in the international company's operations. And, for the first time, the producers were compensated for economic problems and devaluations in the economies of the consuming countries. The Teheran Agreement of February 1971 raised the basic posted price of oil 35 cents a barrel, an increase which followed a 9-cents-per-barrel raise in 1970.[17] Additional increases for inflation and the rising demand for oil were also established. And, finally, it was agreed to increase the host countries' taxes from 50% to 55% of net taxable income, and a system for adjusting posted price with a further increase for low-sulphur oil, as well as additional temporary increases to reflect high freight rates for oil tankers and their advantage while the Suez Canal was still closed. The Geneva Agreements of January 1972 increased the posted price of petroleum to restore to the producing countries the effective purchasing power which had been reduced by the 1971 devaluation of the U.S. dollar.[18] In sum, these developments highlight the interdependence among producers, intermediaries, and con-

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[16] Financial Times, May 10, 1974.

[17] U.S., GAO, Issues, p. 31.

[18] Ibid.

sumers in the world petroleum system, their realization of their mutual vulnerabilities and sensitivities, and the extent to which the policies of one actor become the constraints of another, generating a set of binds which constitute the essence of interdependence.

The Organization of Petroleum Exporting States has been under the leadership of individuals whose knowledge of the petroleum industry and of international trade has enhanced their position vis-à-vis other actors in the world petroleum system. They are aware of the effects of their price increases upon global price trends and of their competitive position in relation to other sources of energy. They also appear to realize the implications of their posture and the extent to which they might contribute to propelling the consuming nations to increase their investments in alternative energy sources. And, they are aware of the extent of their dependence upon petroleum revenues. Yet there are fundamental differences among the producing nations regarding their policies toward continued exploitation of petroleum reserves. These and other differences are examined in Chapter V.

OPEC has succeeded in developing an apparently viable organization to meet some basic needs of producing countries. It has succeeded in manipulating prices and in raising them beyond any previous level; and it has been recognized as an international group, with the status, rights, and privileges of an international organization. But OPEC has failed in its attempt to identify the priorities of its members and to reach an agreement regarding the structure of these priorities; it has failed to unify their petroleum policies; and it has failed to devise ways of stabilizing petroleum prices.

The development of a cartel depends upon the ability of small numbers of producers to dominate a market and regulate it on the basis of their oligopolistic power rather than on the basis of supply and demand. Its maintenance depends upon close coordination of producers to allocate markets and establish noncompetitive prices; and, historically, a cartel is generally subject to internal price-cutting and attempts to undermine the oligopoly. The development of OPEC in 1960 can be attributed more

to exogenous factors than to considerations internal to the group. The criticality of the energy "crisis" in the Western World must be attributed more to the policies and demands of the consumer countries than to those of the producers; and the establishment of an oil embargo in 1973 was a response to events of a political nature, not events that bore directly upon the existing petroleum supplies. In all these respects at least the circumstances leading to OPEC being regarded as a cartel were in fact exogenous to the group.

In short, OPEC is different from other producer cartels in four important respects: (a) it controls a product which is irreplaceable in the short run; (b) the producers are not now competing for larger shares of the consumer market; (c) they vary extensively regarding their requirements for added revenue; and (d) manipulating prices is not dependent upon coordination among the producers, nor are the incentives for price-cutting uniformly extensive; the producing countries with the larger reserves are those least susceptible to becoming engaged in unilateral reductions in price.

Even more important is the fact that coordination among policies of the producing countries has been at a minimum. The producers differ considerably regarding approach to exploitation versus preservation of their reserves. They differ regarding their participation in the oil embargo of late 1973, and they differ in their needs for petroleum revenue and the criticality of such revenues for national development. High petroleum prices could be maintained without any coercion by OPEC. Each member, pursuing individual policies guided by its respective national interests, might quite conceivably choose not to unilaterally reduce petroleum prices. Thus, traditional price-cutting policies, so characteristic of cartels, do not appear so far to be a necessary corollary of the development of OPEC. The members do control a crucial source of energy for which there is no immediate substitute; but they cannot be accorded responsibility for the unprecedented rise in petroleum consumption in the West, nor can they be blamed for the near absence of energy policies in the West. The most they can be charged with is exploiting a changing

global petroleum system, manipulating prices in an environment of uncertainty, and, as a result, placing great pressures upon the international monetary system. The large-scale transfer of funds to the oil-producing states, the attendant balance of payments problems in the West, and the potential economic dislocations all result directly from increasing petroleum prices, but they cannot be attributed to the cartel-like behavior of OPEC. Such developments appear logically independent of coordination among the producers. Individually motivated price increases would have produced the same reactions.

The importance of OPEC, therefore, lies not so much in cohesion of its members, but in their realization that even individually they can shape the nature of the world petroleum system and influence prices in a manner that is not dependent upon obtaining organizational cohesion among the member states. This simple fact accords OPEC considerably greater influence than if its effectiveness were contingent upon securing the cohesion of its members and developing coordinated policies. Such coordination would undoubtedly be to their own benefit, but their influence on an evolving global petroleum system is predicated upon their individual attributes and capabilities as well. From the perspective of the consumer nations, therefore, a frequently advocated policy of "breaking up the cartel" may not necessarily reduce the effectiveness of OPEC members in their efforts to attain some control over evolving institutional arrangements among producers, consumers, and multinational oil companies.

Chapter III

ECONOMIC INTERDEPENDENCE: TRADE ASYMMETRIES AND OPTIONS

The parameters of the world petroleum system--as defined by patterns of petroleum production, consumption, imports and exports, and by changes in the roles of the multinational corporations and the Organization of Petroleum Exporting Countries--provide initial insights into emerging interdependencies. Total commodity trade between producers and consumers yields further evidence of the linkages established by flows of crude petroleum across national boundaries.

Total trade in all commodities between producers and consumers highlights three important facts: First, there are pronounced asymmetries in patterns of total trade, largely revealing the degree of penetration of the producing countries by the advanced industrial societies. Second, there is an extensive diversification in trade concentration of the consuming countries reflecting an effective division of control of trading partners by the advanced industrial societies; and third, by the same token, the producers too exhibit a high degree of concentration in their trade pattern with the consumers, a pattern that illustrates both concentration as well as diversification. And, to a very large extent, patterns of trade are remarkably similar to those of petroleum flows. Clearly some routinized modes of interactions have evolved over the recent decades which become manifested in commodity transactions. (Tables 3 and 4 present illustrative data for 1964 and 1971.)

First, with respect to asymmetries in trade flows: Although the volume of mutually directed trade represents a much larger fraction of the producer's trade than that of the consumer, discrepancies are formidable. For example, in 1971 (the most recent year for which cross-national trade data are systematically available in U.N. documents) [1] total trade with the producing countries accounted for a small fraction of the consuming countries' imports: United States (4%), United Kingdom (10%), France (9%), and Germany (7%). For Japan, this figure amounted

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[1] All data in this chapter on trade come from the United Nations, World Trade Annual: 1964 and World Trade Annual: 1971 (New York: United Nations, 1964 and 1971), and the International Monetary Fund, International Financial Statistics, 1964 and International Financial Statistics, 1971 (Washington: International Monetary Fund).

to 17% of all imports. At the same time, however, the magnitude of trade represented a dramatically larger fraction of the producing countries' total imports. Thus, the United States accounted for 40% of Venezuela's imports for the year, 25% of Iran's, 22% for Indonesia, and 20% in the case of Saudi Arabia's total imports. While the other consumer countries exhibit similar patterns of trade with the producers, the concentration is no less, and in some cases the discrepancies are sometimes greater. For example, 26% of Nigerian imports came from Great Britain, but Nigeria accounted for only 1.0% of British imports during the same year. These figures certainly represent patterns of interactions established as a result of the colonial experience, but are no less significant in highlighting the apparent reliance of Nigeria upon Britain.

Similarly, in the case of France, 41% of all Algerian imports came from the metropolitan power and yet Algeria accounted for only 1.0% of that power's total imports. The figures for West Germany and Japan are less dramatic, illustrating a lower degree of concentration; and the discrepancies though equally extensive are based on smaller volumes of trade. Again, as with petroleum flows, Japan may be following a strategy of concerted interdependence. Although the same discrepancies are present, there is evidence of attempts to allocate to the producing countries a fraction of its own domestic market that might be regarded as somewhat commensurate with the extent of Japan's penetration of the producing countries' markets. This inference is based on a reduced discrepancy between mutually allocated market shares, and in an apparent congruence of allocations. Thus, Japan's trade with the producing countries concentrates on Iran (6% of Japan's imports), Indonesia (4%), Saudi Arabia (3%), and Kuwait (2%). The other producers are allocated less than .05% each. The four main trading partners have accorded Japan considerably larger proportions of their own trade--Indonesia (38%), Saudi Arabia (16%), Iran (12%), and Kuwait (12%)--which represents a more extensive commitment than is given by Japan to other producing countries. Thus, while the discrepancies are indeed extensive, they may reflect a concerted strategy of promoting interdependencies in trade patterns.

Second, this high concentration of trade and discrepancies between

Table 3

PERCENT OF IMPORTS OF THE MAJOR OIL-CONSUMING COUNTRIES FROM THE MAJOR OIL PRODUCERS (INCLUDING OIL IMPORTS)
(in percent of total imports)
1964

EXPORTER → / IMPORTER ↓	Algeria	Indonesia	Iran	Iraq	Kuwait	Libya	Nigeria	Saudi Arabia	Venezuela	Total oil producers
United States	.02	.9	.4	.03	.3	.2	.2	.5	5.1	9.92
United Kingdom	.01	.13	.71	1.45	2.24	1.15	1.59	.02	1.29	9.36
France	6.0	.09	.8	1.5	1.7	.44	.33	.41	.55	12.2
Germany	.45	.31	1.19	.64	.27	1.69	.61	.88	.85	7.07
Japan	—	1.61	2.54	.61	5.20	—	.09	2.49	.35	13.21

Source: United Nations, World Trade Annual: 1964 (New York: United Nations, 1964).

Table 4

PERCENT OF IMPORTS OF THE MAJOR OIL-CONSUMING COUNTRIES
FROM THE MAJOR OIL PRODUCERS (INCLUDING OIL IMPORTS)
(in percent of total imports)
1971

EXPORTER → / IMPORTER ↓	Algeria	Indonesia	Iran	Iraq	Kuwait	Libya	Nigeria	Saudi Arabia	Venezuela	Total oil producers
United States	.04	.40	.20	.01	.07	.10	.20	.20	2.0	4.0
United Kingdom	.10	.07	1.0	.30	2.0	1.0	1.0	1.0	.7	10.0
France	1.0	.09	.70	1.0	2.0	1.0	1.0	1.0	.20	9.0
Germany	.8	.2	.9	.2	.2	1.0	.7	1.0	.2	7.0
Japan	.002	4.0	6.0	.01	2.0	.04	.1	3.0	.08	17.0

Source: United Nations, World Trade Annual: 1971 (New York: United Nations, 1971).

Table 5

PERCENT OF IMPORTS OF THE MAJOR OIL-PRODUCING COUNTRIES

FROM THE U.S., U.K., FRANCE, GERMANY, AND JAPAN

(in percent of total imports)

1964

EXPORTER → / IMPORTER ↓	United States	United Kingdom	France	Germany	Japan	Rest of world
Algeria	8	3	70	2	1	16
Indonesia	10	3	3	8	18	59
Iran	19	11	6	17	7	40
Iraq	14	14	1	7	4	60
Kuwait	17	17	2	8	11	45
Libya	20	17	6	10	3	45
Nigeria	9	28	4	8	11	40
Saudi Arabia	23	10	2	7	9	49
Venezuela	47	5	2	7	5	34

Sources: International Monetary Fund, International Financial Statistics: 1964 (Washington: International Monetary Fund, 1964); United Nations, World Trade Annual: 1964 (New York: United Nations, 1964).

Table 6

PERCENT OF IMPORTS OF THE MAJOR OIL-PRODUCING COUNTRIES

FROM THE U.S., U.K., FRANCE, GERMANY AND JAPAN

(in percent of total imports)

1971

EXPORTER → / IMPORTER ↓	United States	United Kingdom	France	Germany	Japan	Rest of world
Algeria	6	5	41	10	3	34
Indonesia	22	3	1	9	38	26
Iran	25	9	4	19	12	28
Iraq	4	8	6	4	3	73
Kuwait	12	10	5	6	12	52
Libya	11	9	13	8	6	51
Nigeria	11	26	3	9	6	44
Saudi Arabia	20	11	4	6	16	41
Venezuela	40	4	4	9	7	34

Sources: International Monetary Fund, International Financial Statistics: 1971 (Washington: International Monetary Fund, 1971); United Nations, World Trade Annual: 1971 (New York: United Nations, 1971).

Table 7

IMPORTS OF OIL PRODUCERS:

CHANGES IN TRADE RELATIONSHIPS

(1964-1971)

A) Reduced Relationship (> 10% decreases)

Algeria	(18% decline)
Iraq	(13% decline)

B) Maintained Relationship (within ± 10%)

Kuwait	(7% decline)
Libya	(6% decline)
Nigeria	(4% decline)
Saudi Arabia	(8% increase)
Venezuela	(no change)

C) Increased Relationship (> 10% increase)

Indonesia	(33% increase)
Iran	(12% increase)

mutually directed market shares is accompanied by a great degree of diversification in the trading patterns of the consuming countries with the producers. Thus, of the 4% of total U.S. imports emanating from the oil-producing countries in 1971, 2% came from Venezuela and the remainder is almost evenly divided among the remaining nine producers. A similar pattern appears in the cases of the United Kingdom, France, and West Germany. With few exceptions (and in most cases they are quite minor), the consumer countries appear to engage in effective strategies of diversification. It might well be that, aside from critical raw materials, the commodities exchanged are readily replaceable, making a strategy of diversification more apparent than intentional. Only in the case of Japan, where the underlying policy appears to be less diversification than concerted interdependence, are shares of imports proportionately allocated according to shares of exports to the producers.

Third, the diversification of trading partners evident in the case of the consumers is not paralleled by the producers. (Tables 5 and 6 present illustrative data for 1964 and 1971; Table 7 compares figures for both years.) Indeed, the latter demonstrate a high degree of concentration in their patterns of imports from the advanced industrial societies, and this pattern reflects some underlying spheres of interests probably determined more by the consumers than by the producers. Thus, again employing 1971 as an illustrative year, Algeria's trade is concentrated primarily with France (41%) and Germany (10%); Venezuela focuses imports upon the United States primarily (40%), with no other consuming country accounting for more than 9% of its total imports; Indonesia's imports come largely from Japan (38%) and the United States (22%); and similarly for Saudi Arabia, although the proportions are different, 20% from the United States and 16% from Japan; Iran's trade concentrates largely on the United States (25%), Germany (19%), and Japan (12%); Kuwait focuses on Japan and the United States, allocating each 12% of her total imports; Libya imports commodities mainly from France (13%) and the United States (11%); and Nigeria's trade is concentrated largely upon the United Kingdom(26%) and, to a lesser extent, the United States (11%). Of the oil-producing states, only Iraq appeared to follow the Japanese strategy

of diversification, drawing trade almost equally from the United Kingdom (8%), France (6%), the United States (4%), Germany (4%), and Japan (3%). In this case, a strategy of diversification appears more probable as a choice imposed by the producing country, one that is consistent with recent historical experience and dissatisfaction with interactions of the advanced industrial societies. Iraq's near-revolutionary posture in the Arab world is consistent with her patterns of trade: there is no evidence of latent spheres of interest or patterns of preferential trade.

Although these inferences concerning asymmetries, concentration, and diversification of trade are based on 1964 and 1971 as illustrative years, they indicate patterns of interaction that seem fairly well established. In those limited terms, again, it appears that the dependence of the producing countries upon the consumers far exceeds the reliance of the consumers on the producers. These trade flows highlight more dependencies than interdependencies, although both diversification and concentration of trade are suggestive of established networks of interdependencies in commercial flows.

In highlighting the asymmetries that appear to emerge from trade and petroleum flows, it is necessary to examine the alternatives available to the producing countries should either they or the consumers choose to redirect their trade in new directions.

Against a background of asymmetries, high concentration, and considerable diversification in trade patterns, as illustrated with data for 1971, the resulting interdependencies can be demonstrated with reference to the options available to the producing countries should critical commodities be denied them by the consumers. The rationale of embargo strategy is the ability to deny the opponent access to critical goods or services. This ability is a function of the alternatives available to the opponent, and the alternatives are in large part set by existing patterns of production and consumption.

The patterns highlighted above with reference to 1971 appear to persist in 1972, the most recent year for which detailed data on U.S. trade are available. Total exports to the oil-producing countries for that year

amounted to 5.49% of all U.S. exports, while 18% of all goods imported by the oil-producing countries came from the United States. This asymmetry indicates, once more, that imports from the United States are more important to the oil producers than the exports are to the United States. Such an inference emerges from examining asymmetries in total value of trade flows and does not take into account the commodities transacted.

Detailed statistics confirm that several of the petroleum-exporting states relied quite heavily upon U.S. imports. Thus, Saudi Arabia received 39% of its total imports from the United States, followed by Venezuela (38%), Iran (23%), and Indonesia (21%). The other exporters of oil--Libya, Algeria, and Iraq--obtained a much smaller fraction of their total imports from the United States. The highly skewed nature of U.S. trading patterns with oil-producing countries, concentrating primarily on four of the major producers, is further revealed by inter-country comparison among the producing countries. Within the group itself, Venezuela accounts for 34% of all imports from the U.S., followed by Iran (20%), Saudi Arabia (11%), and Indonesia (11%). These figures are revealing in that they suggest that if the United States were to undertake a trade embargo against OPEC or against a group within OPEC, to be effective such an action need be enforced against at least these four states. Although these are the major U.S. trading partners within OPEC, to exclude them from such a hypothetical embargo would mean that 76% of U.S. imports to the oil-producing countries would not be affected. The reliance of four major petroleum exporters upon U.S. imports provides the United States with a potential policy leverage for manipulating the behavior of important members of OPEC. But any such policy adopted by the United States must be undertaken vis-à-vis at least these four countries to be effective, an important constraint on U.S. policy alternatives.

Of the total trade of the U.S., the U.K., France, Germany, and Japan in the following commodities, the U.S. accounts for these percentages: electric machinery (25%), nonelectric machinery (31%), transport equipment (30%), and cereals and flours (63%). These are the four major commodities imported by the oil-producing countries.

The United States sends 5% of its exports in electric machinery to the oil-producing countries, and primarily to Venezuela, Iran, and Saudi Arabia. Such commodities include electric appliances, television and radio equipment, and general electronic equipment. About 7.5% of U.S. exports in nonelectric machinery go to oil-producing countries; again, the main recipients are Venezuela, Iran, Saudi Arabia, and Indonesia. The oil-producing countries receive about 5% of all U.S. exports in transport equipment, primarily in terms of railroad equipment, cars, trucks, aircraft, boats, and ships. Again, the same countries are major recipients of U.S. exports in transport equipment.

These three commodities are also major exports by the other advanced industrial societies. Total exports of electric machinery for the four other consuming countries are as follows: Germany (27%), Japan (23%), United Kingdom (13%), and France (10%). For nonelectric machinery, their total exports amounted to the following percentages of their total trade: Germany (32%), United Kingdom (17%), France (10%), and Japan (9%). And their total exports of transport equipment amounted to the following: Germany (25%), Japan (20%), United Kingdom (12%), and France (11%). Thus, the other advanced industrial societies are also major exporters of three of the major commodities imported by the oil-producing countries. In those terms, the possibilities of redirecting trade available to the producing countries are extensive. But this is an option available only with respect to these capital intensive manufactured goods. The situation with cereals and flours is markedly different. (See Table 8 .)

There are no alternatives to the United States as a major exporter of cereals and flours to the oil-producing countries. These countries accounted for 8.7% of all exports of cereal and flour by the United States in 1972. Once again, the largest markets are Indonesia (30%), Venezuela (24%), Iran (18%), and Algeria (10%). This commodity represents a potential leverage in the United States' interactions with the oil-producing countries, but it is one that cannot be readily employed. First, such a course of action is likely to arouse domestic and international opposition. Second, and more critical, the United States' capability for increasing

Table 8

COMMODITY TRADE OF THE UNITED STATES, THE UNITED KINGDOM, FRANCE, WEST GERMANY, AND JAPAN AS A PERCENTAGE OF THE FIVE-NATION GROUP AND OF TOTAL WORLD TRADE, 1971*

(in percent of group and world totals)

EXPORTER	NONELECTRIC MACHINERY		TRANSPORT EQUIPMENT		ELECTRIC MACHINERY		CEREALS AND GRAINS	
	Group %	World %	Group %	World %	Group %	World %	Group %	World %
World	72.37	100.00	70.89	100.00	75.21	100.00	60.56	100.00
U.S.	31	22.61	30	21.86	25	19.07	63	38.08
U.K.	17	12.61	12	8.58	13	9.01	3	1.45
France	10	7.34	11	8.08	10	7.74	26	16.29
Germany	32	23.28	25	17.78	27	20.69	4	2.49
Japan	9	6.51	20	14.58	23	17.88	4	2.25

Source: United Nations, World Trade Annual: 1971 (New York: United Nations, 1972).

*"World" refers to the 24-nation Organization for Economic Coordination and Development, not including Turkey and with the additions of Israel, Yugoslavia, Australia, and New Zealand. Those countries include all listed in the United Nations' World Trade Annual.

its supplies of cereals and flour in the immediate future is seriously in doubt. This country's own food requirements are likely to be an increasingly important factor in any calculations regarding the use of cereals and flour as potential policy instruments. And, third, the potential role of the Soviet Union as an exporter of cereals and flour cannot be discounted.

While the producing countries are highly dependent upon the consuming states for the imports of capital-intensive goods, there are options available with respect to trading partners. Since the advanced industrial societies all export the same commodities to these less developed countries, the latter might have greater options and alternatives with respect to the sources of imports. This fact might reduce the ability of the consumer countries to employ trade as a leverage for manipulating, or inducing, change in the behavior of the oil-producing countries. Only with respect to cereal and flour do the producing countries have no alternative to obtaining these commodities from the United States. In those terms, the interdependencies in commodity trade are extensive. Withholding cereal and flour by the consumers cannot be compared directly to the withholding of petroleum by the producers, but the criticality of each commodity to the recipient nation is undeniably great, and the absence of viable alternatives highlights the starkness of the resulting economic interdependencies.

Chapter IV

ECONOMIC INTERDEPENDENCE: REVENUE FLOWS AND THE TRANSFER OF FUNDS

The economic vulnerabilities and mutual sensitivities that have been generated by the processes described in chapters I-III are characterized by considerable volatility resulting from each nation's attempts to manipulate the situation to attain some control over seemingly increasing vulnerabilities. The purpose of chapter IV is to trace the economic reverberations of increasing petroleum flows and rising prices in order to highlight the new ways in which nations have become increasingly bound by economic consequences of the flows described earlier. Our focus is the implications of rising prices in terms of the balance of payments issue for the consuming nations and revenue surpluses for the producing countries. We seek to trace the second-and-higher-order consequences that have been given rise to by the successful attempts of the oil producing countries to manipulate petroleum prices. The exact magnitude and nature of the recent price increases, along with the concomitant effects on flows of capital and investment cannot be stated with definite certainty. The figures cited below, while necessarily inexact, can be legitimately treated as indicating the range of economic transactions likely to occur under present circumstances, and in all probability understate the real financial consequences of the price increases.

A. First-Order Effects: Increases in Petroleum Prices

The recent increases in petroleum prices initiated by the oil-producing states precipitated a series of impending "crises" hitherto latent in the patterns of petroleum flows. The large-scale transfer of funds from the consuming to the producer countries is giving rise to a situation characterized by, first, a wide range of economic linkages between producers and consumers, and second, a high degree of mutual interpenetration in the economies of both producers and consumers. The interactive effect of both of these factors has had an extensive impact upon the global economy and is increasingly calling into question the basic viability of several major currencies. It is not at all clear where the focus of control lies: both producers and consumers are vulnerable

to the actions and policies of each other.

This situation is also characterized by a variety of actions and reactions by producers and consumers alike to the consequences of the large-scale transfer of funds. The consequences of these transfers lie beyond the control of any single nation and reflect mirror-image dynamics in that what might amount to a balance of payments problem for the consuming countries also involves a problem of absorbtive capacity for the producing countries. This network of effects has one underlying characteristic: no nation can "opt out" of these global interdependencies; all are affected by the flows of funds across national accounts.

The recent increases in the price of Middle East petroleum are undoubtedly the clearest indication of the changing structure of the world petroleum system. The ability of the oil-producing countries to manipulate prices stands in sharp contrast to their inability or unwillingness to respond effectively to the series of price reductions initiated by the multinational oil corporations in 1949, 1950, 1959, and 1969. Middle East prices were not formally posted until 1950 when, for the first time in many of the oil-producing countries, the government acquired a direct interest in the price of petroleum.[1] The official rationale for the initial price cuts was the need to standardize prices in different production centers. By 1960, however, unilateral reductions could not be accounted for by the objective of aligning prices across production areas. Maximation of profit was the main objective.

Although observers often attribute the success of the producing countries in raising prices to the cohesion of OPEC, it is instructive to note that both posted prices and tax rates were increased to higher levels in 1970 outside the framework of OPEC. Libya had taken the initiative, capitalizing on the fact that it was the leading oil supplier to Western Europe and possessed financial reserves that would cover at least two years' requirements of imports, while the Western European

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[1] Jack E. Hartshorn, Oil Companies and Governments: An Account of the International Oil Industry in Its Political Environment (London: Faber and Faber, 1962), pp. 137-38.

countries had only a two-month supply of petroleum stocks.[2] The Libyan leadership selected the more vulnerable oil companies as the target of its new policy. The timing was perfect, in that the Suez Canal was closed, the Tapline had been cut off, and the consuming countries were clearly vulnerable.

The precise degree of coordination among the oil-producing countries in setting new prices is a subject of much debate. Yet the fact remains that each producer, by acting in his own self-interest, could contribute to group objectives, and thus while continuing to pursue national policies, would enhance the position of the group as a whole. Although unilateral price-cutting by one single member would seriously damage the cohesion of the group, skyrocketing prices may, in the long run, be equally unproductive for them.

During the last three months of 1973 the posted (or tax reference) price of Middle East crude petroleum increased from $3.01 to $11.65 per barrel, a rise unilaterally imposed on the global petroleum system by the producing countries. These new prices provided the base for commensurate increases in government revenues, which expanded from $1.76 to $7.00 per barrel.[3] The effect on actual prices--taking into account costs, taxes, royalties, oil company profits, and return to the host government--has also been extensive, with the f.o.b. price of petroleum in the Gulf area increasing to about $5.50/$6.00 per barrel.[4] (See Table 9.)

The revenues (in terms of economic rent) accrued to the petroleum-exporting countries amounted to $25 billion annually, based on 1973 production and prices. The price rises increased this flow of funds almost fourfold, amounting to an additional transfer of $50 to $60 billion

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[2]Mikdashi, The Community of Oil-Exporting Countries, p. 146.

[3]Thomas R. Stauffer, "Oil Money and World Money: Conflict or Confluence?," Science 184 (April 19, 1974) p. 321.

[4]Ibid.

Table 9

POSTED OR TAX REFERENCE PRICES

(Dollars per Barrel)

Source of Oil	20th Jan 1972	1st Jan 1973	16 Oct 1973	1st Jan 1974
Persian Gulf				
Arabian light (34°)	2.479	2.591	5.119	11.651
Abu Dhabi Murban (39°)	2.540	2.654	6.045	12.630
Mediterranean and Africa				
Arabian light (34°)	3.370	3.451	7.149	13.647
Libyan (40°)	3.673	3.777	8.925	15.768
Nigerian (34°)	3.446	3.561	8.310	14.691
Venezuela				
Oficina (35°)	3.261	3.447	7.802	14.247

Source: Table 1, "Prices in Transition," The Petroleum Economist (February 1974), p. 43.

dollars annually. These increases amount to about 10% of the value of total world trade.[5] It is estimated that these transfers will place an additional burden on the world economy in 1974 to the amount of $55 billion plus the increased profit of the oil companies.[6]

Scholars and policy-makers alike differ widely regarding both assessments and predictions regarding this changed economic situation, yet most agree that the present situation is tenuous in that it represents a transition to a preferred alternative based on procedures yet to be worked out between producers and consumers. So, too, attribution of blame or responsibility for this changing global economic environment varies widely. The spectrum of opinions range from those, such as Professor Morris Adelman, who argue that the present crisis is basically artificial in that the petroleum market is characterized by excess capacity, that supply and demand relationships have been overriden, and that the cohesion of OPEC has allowed its members to capitalize on this situation;[7] to those, such as Ambassador James Akins, who see in the exponential rise in petroleum consumption in the West and Japan the potentials for price manipulation by the oil producing countries.[8]

But all agree that the "rules of the game" are changing, and that viable modes of interaction are yet to be established. Critical to the potentially emerging consensus is the dual consideration that (a) the cost of petroleum production lies far below the price, thus the margin for potential accommodation is broad, and (b) supply and demand do not govern world petroleum prices. To some extent, there is no precedent for such a situation.

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[5] Ibid., p. 322.

[6] Ibid.

[7] Morris Adelman, "Is the Oil Shortage Real?," Middle East Information Series 23 (May 1973).

[8] James Akins, "The Oil Crisis: This Time the Wolf Is Here," Foreign Affairs 51 (April 1973), pp. 462-90.

The inelasticity of petroleum prices is an obstacle in bringing supply and demand into balance. The inelasticity of supply is largely a function of the high capital intensity of the production and supply of oil, and of the ability of producers to override supply and demand relationships. The host government's revenues are directly proportional to posted prices, thus their interests lie in high prices. Indeed, the price of crude petroleum can still be increased before reaching the monopoly point or the point of largest profit. There is, as yet, still a wide margin for further possible price increases, whose effects upon consumption may not be extensive.[9]

The threshold above which prices would not profitably be further increased is likely to be set by the commercial availability of alternative sources of energy. If prices were equal, the advantage of petroleum lies in its ease of handling and transportation. In those terms, at least, there is some explicit threshold which, in the longer run, will shape the parameters of permissible prices set by the producing countries. Yet the economic interdependencies that have emerged from recent price increases transcend by far the issue of price. The economies and economic plans of both producers and consumers are being affected in often substantial ways.

B. Second-Order Effects: The Balance of Payments Problems for the Consumers

The key to evaluating the monetary impact of the present energy situation is the rapid increase in the import bill for petroleum. For the major consuming nations, oil imports are likely to cost about $50 billion more in 1974 than in 1973. If petroleum consumption does not decrease appreciably, and if prices increase, the petroleum bill might

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[9] U.S., Congress, House, Committee on Foreign Affairs, Subcommittee on Foreign Economic Policy, Foreign Policy Implications of the Energy Crisis, 92nd Cong., 2nd sess., 1972, pp. 414-15, (Statement by M.A. Adelman).

well rise to $500 billion by 1985. While the precise magnitudes involved are subject to debate, it is certain that they are large enough to unsettle the present world monetary system.[10] Indeed, the question of financial instability might be the biggest problem resulting from the energy crises, and in the absence of institutionalized means for coping with such problems, and handling international transactions of such magnitude, it is not difficult to anticipate serious global dislocations.

World energy trade is expected to double by 1985, amounting to 20% of all international trade. In the absence of any drastic changes in consumption patterns, the United States is expected to account for about one-third of the world's energy market supplies. One-half of that amount will be obtained from abroad. This fraction could result in an additional U.S. balance of payments deficit estimated at $20 billion or more.[11] It is also highly likely that by 1985 the United States will be importing a large amount of refined products with possibly a higher value than crude petroleum. In such eventuality, the balance of payments deficit would be about $15 billion greater, even approaching a total of $40 billion.[12] Even under the most optimistic conditions, it is extremely unlikely that U.S. exports of goods and services could offset a flow of such magnitude. These figures are all speculative yet cautious. The Chase Manhattan Bank places such deficits at higher figures.[13] Even if exports are projected to increase by an additional $1 billion or $1.1 billion by 1980, such an increase would not have an appreciable impact on the negative balance of payments.[14] (Table 10 illustrates the impact of increased

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[10]Gerald A. Pollack, "The Economic Consequences of the Energy Crisis," Foreign Affairs 52 (April 1974), p. 453.

[11]U.S., Congress, House, Subcommittee on Foreign Economic Policy, Foreign Policy Implications (1972), p. 215.

[12]Ibid., p. 234.

[13]Ibid., p. 5.

[14]U.S., Congress, Senate, Committee on Interior and Insular Affairs, Oil and Gas Imports Issues," 93rd Cong., 1st sess., 1973, p. 529 (Statement by William Letson).

Table 10

BALANCE OF PAYMENTS IMPACT OF INCREASED OIL PRICES

(millions of U.S. dollars).

Country	Balance of Payments for 1973	Expected Increase in Oil Costs, 1974
U.S.	4,904	9,300
France	686 (1972)	5,100
Germany	2,489	6,000
Japan	-159	9,300
U.K.	-1,186	4,200
India	163	1,241

Sources: International Monetary Fund, International Financial Statistics, Volume XXVII, No. 7, July 1974; Thomas R. Stauffer, "Oil Money and World Money: Conflict or Confluence?," Science, Vol. 184, No. 4134, 19 April, 1974; "Shock for the Third World," The Petroleum Economist, February 1974.

petroleum prices upon the balance of payments.)

The implications of the oil import bill for Western Europe and Japan cannot be estimated with great precision, but it appears that Britain faces a deficit for the current year of up to $10 billion, Italy at least $6 billion, France about $4 billion, and Japan at least $7 billion. Despite the uncertainties regarding such numbers the general magnitude is not questioned and at least this much is clear: the key deficit countries could reach the limits of their credit in international markets, and the longer the deficit remains of such magnitude and concentration, the greater is such danger likely to be.[15]

Another aspect of the energy balance of payments problem is that Western Europe and Japan are also heavily reliant upon imported energy supplies. By 1980 Western Europe will be a net energy importer by about $23 billion to $31 billion, and Japan some $12 billion to $16 billion. Together the consuming countries, including the United States, are estimated to increase the total value of their net energy imports to about $53-$71 billion, from a 1970 level of import value of $14 billion.[16] Confronted with such magnitudes, the problem of maintaining adequate monetary reserves becomes serious (leaving aside the problem of defining "adequate"). Most of the consumer countries will have to borrow heavily, and many of them are not accorded a sufficiently high credit standing, especially in face of the sums involved.

In short, when viewing the magnitude of the immediate oil bill against the international reserves of these countries ($173 billion including gold holdings), it is theoretically possible in several years that the entire foreign exchange holdings in question could shift ownership to five or six countries. But before this point is attained, in the absence of compensatory policies, large-scale monetary dislocations

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[15] M.S. Mendelsohn, "World Money--What Is Not Happening, and Why," Euromoney (May 1974), p. 32.

[16] U.S., Congress, Senate, Oil and Gas Imports Issues, p. 469 (Statement by William Letson).

will arise, including extensive depreciation signalling the loss of purchasing power of these foreign exchange assets.[17]

The balance of payments issue from the perspective of the consumer countries illustrates the high degree of interpenetration of national economies; the magnitudes involved highlight a dramatic and even sharp increase in international transactions. It may well be that the traditional principles of national sovereignty become singularly inappropriate in such a world. This increase in global transactions is further highlighted by transfer of funds to the producing countries. There emerges a mirror-image interdependence problem: what appears to be a balance of payments problem for the consuming countries becomes a problem of absorption of surplus petroleum revenues in the producing states.

C. Second-Order Effects: Surplus Revenues for the Producers

The criticality of petroleum in the commodity export trade of the oil-producing countries indicates a dependency upon oil that ranges from 100% in the cases of Abu Dhabi and Qatar to 44.6% in the case of Indonesia. In terms of trade in petroleum as a percentage of total trade, the other countries rank as follows: Libya (99.9%), Saudi Arabia (96.8%), Kuwait (95.5%), Iraq (93.7%), Venezuela (90.3%), Iran (88.7%), Algeria (63.3%), and Nigeria (57.5%). These are 1971 figures. In the absence of oil exports the trade balance of these countries would have large deficits, the same would be true for other years. (Table 11 presents the value of petroleum exports as a percentage of total exports.)

Ambiguities in exchange rates, fluctuations in such rates, and accounting differences between oil revenues and oil receipts all make it difficult to identify precisely the role of oil revenues in the total revenues for each government. Nonetheless, existing figures indicate

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[17] Pedro-Pablo Kuczynski, "The Effects of the Rise in Oil Prices on the Third World," Euromoney (May 1974), p. 37.

Table 11

PETROLEUM EXPORTS AS A PERCENTAGE OF TOTAL EXPORTS, 1970

(in millions of U.S. dollars)

COUNTRY	TOTAL EXPORTS	OIL EXPORTS	% OF OIL TO TOTAL	TRADE BALANCE	TRADE BALANCE EXCLUDING OIL
Algeria	1009	639	63.3	-248	-887
Indonesia	1009	450	44.6	126	-324
Iran	2355	2089	88.7	697	-1392
Iraq	1100	1031	93.7	591	-439
Kuwait	1654	1580	95.5	1029	-551
Libya	2357	2355	99.9	1803	-552
Nigeria	1240	713	57.5	183	-532
Saudi Arabia	2334	2259	96.8	1624	-635
Venezuela	2655	2398	90.3	1015	-1383

Source: OPEC, Annual Statistical Bulletin: 1971 (Vienna: OPEC, 1972).

Table 12

PETROLEUM REVENUES AS A PERCENTAGE OF TOTAL GOVERNMENT REVENUES (1971)*

(in million U.S. dollars, December 1971)

COUNTRY	GOVERNMENT REVENUES	OIL REVENUES	PERCENT OF OIL TO TOTAL REVENUES
Abu Dhabi	376.19	467.98	100+
Algeria (1970-71)	1,422.47	325.0	22
Iran	9,241.5	5,832.75	63
Iraq	1,625.79	911.21	56
Kuwait	1,093.18	1,076.46	98
Libya	1,922.49	1,804.85	93
Nigeria (1969-70)	871.87	501.60	57
Saudi Arabia	2,601.36	1,944.9	74
Venezuela	2,694.00	1,759.09	65

*The figures for government revenues are for the fiscal year 1971-72 except where noted. The figures for petroleum revenues, on the other hand, are for the calendar year 1971. The petroleum revenues are understated as to their relationship to government revenues, largely as a result of the large increases in oil revenues during this period. The only major discrepancy is in the case of Abu Dhabi.

Sources: OPEC, Annual Statistical Bulletin: 1971 (Vienna: OPEC, 1972); Iran Almanac: 1971 (Teheran: Echo Publications, 1971).

that in 1971-72 Kuwait received 98.5% of its total government revenues from the sale of oil; Libya obtained 93.9%, and Venezuela received 65.5%. While precise figures for the other states are difficult to obtain, one could speculate that the oil share of total government revenues would be greater for Abu Dhabi and Saudi Arabia and lower for Nigeria and Algeria. Furthermore, it is extremely unlikely that any of the oil-producing states would have accounted for less than 50% of all government revenues. With increases in petroleum prices, the oil share in national revenues will increase substantially. Table 12 gives the percentage of oil revenues to total government revenues for the major oil producers.

An appreciation for the rate of increase in petroleum revenues can be obtained by examining the annual percentage change of oil revenues between 1968 and 1970--three years preceding the first major increase in petroleum prices. In terms of average annual increase over the three years, the following percentages emerge: Abu Dhabi (34.9%), Algeria (24.4%), Iran (17.9%), Iraq (19.8%), Kuwait (1.6%), Nigeria (227.1% for 1969 and 1970), Qatar (10.2%), Saudi Arabia (10.4%) and Venezuela (4.3%). For some years the increase was considerably more, for others it was less.[18] The substantial cut in production between 1970 and 1972 experienced by many of these countries is partially reflected in these figures. Nonetheless, on balance, the trend is on the upswing. With rising petroleum prices, they will increase accordingly. This nearly total dependence of the oil-producing countries on petroleum revenues more than matches the dependence of the consumers on petroleum imports. In those terms, neither has any viable alternative to the other as a trading partner. The dependence of the producers upon the consumers more than offsets the dependence of the consumers on the producers. But this assessment does not take into account the time dimension, that is, the options available to each state as they seek to manipulate the behavior of the other.

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[18] Organization of Oil Exporting Countries, Annual Statistical Bulletin, 1971, (Vienna: OPEC, 1972).

The consumer countries could not sustain a long-term denial of petroleum; their economies are almost totally dependent upon this one source of energy. The producing countries might, with judicious use of revenues and sound investment policies, be able to withstand a long-term denial of oil revenues. Again, however, the abilities of each country to accommodate to the denial of a critical resource is not unknown for either producers or consumers. For the former, the key considerations pertain to population size, rate of change, economic development, alternative sources of revenues, economic policies and priorities, and so forth. For the latter, the most critical considerations pertain to their access to alternative sources of energy. Thus, the range of factors that affect the ability to withstand the denial of critical resources is much broader for the producing countries than for the consuming countries.

This simple fact, though of marginal importance in its own right, assumes new significance when viewed in the context of a changing structure of the world petroleum system and in evolving institutional arrangements seeking to accommodate the demands of the producing states. These demands are conditioned as much by a realization of the criticality of their resource to the global economy as their awareness of its criticality in their own economies and in development planning. Thus, factors that might appear exogenous to the flows of petroleum as such will increasingly condition the petroleum policies of the producing states. The structure of the world petroleum system and its institutional basis is becoming increasingly conditioned by the needs and requirements of the producing countries and not by the demands of the consumers or by the interests of the multinational corporations, both of which have traditionally shaped and controlled the world's petroleum system. (Chapter V focuses on these issues.)

There is also considerable debate regarding the magnitudes of the surplus revenue to be transferred to the oil-producing countries. Some authorities have calculated that these countries might control over half the world's monetary reserves in the next decade. Assuming the

continuation of present trends, some estimate that Arab monetary reserves will increase from $10 billion at present to over $100 billion by 1980.[19] The Middle East monetary reserves have increased by more than 50% over the past year. Saudi Arabia alone has tripled its central bank reserves since 1971. It is also estimated that cumulative OPEC surpluses, including returns on investment, would increase to about $450 billion by 1980.[20] Still other estimates yield a projection of OPEC surpluses at an average of $40 billion per year to 1980. This estimate is predicated on the assumptions of dampening petroleum prices, a reduction in the demand for petroleum (from an increase of 11% to 12% per year to about 4%), and a growth in OPEC imports of about 15% per year. The development of alternative sources of petroleum supply might decrease demand for Middle East oil beyond 1980. Nonetheless, accumulated reserves of $240 billion by 1980 appear highly plausible. Accumulated interest and dividends, in addition to prevailing balances of $15 billion would increase this total to some $300 billion.[21] Regardless of the precise figures involved, however, it appears certain that the resulting monetary consequences reflect qualitative and not merely quantitative changes, and signal a marked transformation of established modes of economic transactions.

Projecting such trends into the future, it is not improbable for the oil-producing countries' financial assets to reach 2% to 3% of the total world financial market by 1980.[22] The highest estimate in this regard is that the oil producers will earn about $1 trillion in less than 30 years.[23] Today, the Arab oil-producing countries control 4.4% of the

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[19]U.S., Congress, Senate, Oil and Gas Imports Issues, p. 813 (Statement by Ronald Koven).

[20]Pollack, "Economic Consequences," p. 461.

[21]Stauffer, "Oil Money," p. 323.

[22]Ibid., p. 324.

[23]U.S., Congress, Senate, Oil and Gas Imports Issues, p. 811 (Statement by Ronald Koven).

world's monetary reserves; they have 1% of the world's population.[24] These countries have per capita monetary reserves ranging from one to twenty times that of the United States. The magnitudes are indeed staggering. The Middle East is rapidly becoming the world's most rapidly growing store of capital.

An added dimension of the international ramifications lies in the fact that the major oil-producing countries, exerting extensive foreign exchange earnings from the export of petroleum to Western Europe and Japan in 1980, might trigger competition among the oil-importing nations to increase their exports to these countries in order to protect their currencies. Such competition would place further strain in world monetary and trade interactions. While the importing countries will be transferring payments to OPEC, their balance of payments problems will also involve financial relations among the importing countries and cannot be thought of solely in terms of transfer of revenue to the producers.

From the perspective of the producing countries, their ability to absorb surplus revenue internally is an important consideration in their choice of investment policies. A decision by OPEC to export more oil than is required to pay for imported goods and services amounts to a decision to invest abroad.[25] Their plans and policies regarding internal development will govern and be governed by the development of absorptive capabilities and, by extension, investment opportunities at home and abroad. There are extensive differences among the oil producing countries in each of these respects, and to consider them all in the aggregate would be to overlook precisely those differences upon which internal OPEC policies are predicated. Indeed, differences in the policies and postures of individual oil-producing nations can be accounted for in large part by their own domestic attributes and characteristics, petroleum production

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[24]U.S., General Accounting Office, Issues Related to Foreign Sources of Oil for the United States, Report B-179411, January 23, 1974, p. 55.

[25]Pollack, "Economic Consequences," p. 453.

and estimated reserves, population level and rate of growth, political orientations toward modernization and mobilization, and level of economic development. Foreign policy objectives and imperatives, and relations with the consuming nations, are all derived from these basic structural considerations. Illustrating this proposition in the context of evolving patterns of interdependence will be the task of Chapter V. Here we seek only to highlight the financial interdependencies that emerge from the flow of petroleum across national boundaries.

D. Third-Order Effects: Policy Options and Manipulables

There are several policy options available to both consumers and producers in response to these critical economic interdependencies. Each is accompanied by costs and benefits, and each involves a different set of policy instruments. Thus, the consumers may seek to (1) promote their exports to the producers by way of attempting to offset financial deficits; (2) concentrate on reducing capital outflows and encouraging compensating inflows; (3) invest in the economies of the oil-producing countries; (4) actively solicit downstream investments from the producers; (5) accommodate their mutual deficits by reciprocal arrangement and collaborative financial policies; and/or (6) reduce markedly the consumption of petroleum-based energy. Other policy options are available, but these are the ones that appear most frequently in any assessment of the options available to the consumers.

On the other hand, the producers can seek to (1) absorb the surplus revenues by importing goods or services from the consuming countries; (2) restrict their production of petroleum, thus placing bounds on surplus revenue; (3) seek downstream investments in the consumers economies; and (4) develop collaborative arrangements with other producing nations in their financial interactions with the consumer countries. There are numerous other possibilities. To some extent reciprocal processes are at work whereby the options available to the consumer countries are accompanied by a similar set of options open to the producers. The

parallel is in no way complete, but the mutual sensitivities and vulnerabilities persist.

The promotion of exports as a means of offsetting the balance of payments effects associated with higher prices for petroleum imports is a policy option of limited economic impact. In 1970 the United States exported about $440 million of goods and services to five major oil producers, a total which comprised 11% of their combined imports. It is expected that the value of U.S. exports to these countries will reach $1.5 billion by 1980. It is thus plausible for the United States to offset $1.5 billion of the $6 billion to $9 billion foreign exchange earnings of these five countries. Under such circumstances, there will be about $4.5 billion to $7.5 billion in surplus foreign exchange earnings from the exports of oil to the United States in 1980.[26] On balance, therefore, the possibility of increasing exports to the oil-exporting countries, particularly the five major Middle Eastern producers, is limited.

Aside from Germany, whose trade balance is strongly in surplus, the other consuming countries will also have difficulties paying their oil bill. Despite anticipations of substantial growth in trade over the next few years--at 10% per year for Western Europe compounded over the decade, and 17% for Japan--these countries will find it difficult to employ trade as a means of countering the consequences of increased petroleum prices. In the case of Italy and the United Kingdom, the currency drains occasioned by increasing petroleum prices exacerbate net dollar outflows, leaving these countries with no way of absorbing such increases or developing immediate and effective responses to such a drain on dollar reserves[27] (although the U.K. may be self-sufficient by 1980).

The limited potential of trade for offsetting the oil deficits has led analysts to view compensatory capital flows as a more viable policy

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[26]U.S., Congress, Senate, Oil and Gas Imports Issues, p. 471 (Statement by William Letson).

[27]Stauffer, "Oil Money," p. 323.

option. Thus, another means of reducing the negative balance of payments is to encourage large-scale investments in the United States by the oil-producing countries. Such a policy would increase the stake of the producers in the continued economic well-being of the consumers and especially of the United States.

Encouraging the repatriation of profits accrued from the foreign investments of American oil companies provides another option. At present such investments amount to between $1.5 and $2.0 billion a year. The expansion of such investments and the accompanying repatriation of profits would increase the net contribution to the balance of payments.[28]

The inflationary impact of increasing oil prices on the gross national product of the consuming countries can be ascertained by comparing the increased costs of petroleum to total gross national product, and indicates the direct impact of such increases on domestic prices. In the case of the United States, the effect of higher petroleum import prices is an increase of 0.7% in the price level. For the Netherlands it is much greater (2.5%) and for Canada, much lower (0.4%). The inflationary impact upon the largest industrial economies is basically similar, converging around 2 percentage points in the price level.[29]

The overall effects of increasing deficits for the advanced industrialized societies can also be ameliorated through the devaluation of currency. Viewed in isolation, any individual country would need to undertake monetary adjustments equal to the overall trade deficit. In these terms, Japan might devalue about 10% to 20%, and the United States about 13%.[30] Devaluations of such magnitudes, though not totally uncommon, would increase the necessity for collaborative arrangements and the development of joint monetary policies.

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[28] U.S., Congress, House, Foreign Policy Implications, p. 162 (Statement by Robert E. Hunter).

[29] Stauffer, "Oil Money," p. 322.

[30] Ibid., p. 323.

The reduction of consumption is largely a longer term policy. Its effects would not be immediate, in that new habit patterns need to be developed, new policies for restricting consumption adopted, and new methods for enforcing such policies established. Furthermore, there are some limits beyond which advanced industrial societies may not readily cut back on their consumption of energy. Sharp reductions in the rate of increase in petroleum consumption would not substantially affect the high levels of consumption prevailing in the industrialized societies. Meeting present needs already amounts to a major challenge. The policy instruments for preventing further increases in consumption are not well developed nor are goals clearly articulated.

E. Third-Order Effects: Policy Constraints on Producers and Consumers

The oil-producing countries could control more than half of the world's monetary reserves in the next decade. These countries have the financial resources to invest in any enterprise domestically or overseas, and they possess the resources that will yield income for future investments. Yet they are constrainted by their own absorptive capabilities and by the availability of investment opportunities abroad. Some of the oil-producing countries, like Iran and Venezuela, are in the position to utilize the surplus revenue and associated purchasing power for investment projects designed to expand their own domestic production capabilities. They possess the population base and the economic and managerial skills to make use of surplus revenues. Other countries, like Kuwait, Libya, Iraq, and Saudi Arabia, are not able to absorb additional purchasing power within their own borders. They cannot substantially increase their imports over the short range nor can they make effective use of oil revenue. They possess neither the population base, in terms of sheer size, nor the entrepreneurial or economic capabilities in sufficient scale to draw adequately upon the surplus revenue of the magnitudes in question. These countries will invest their revenue in foreign markets and will tend to dispose large sums of money in the industrialized countries. In those terms, there is no "average" oil-

producing country. The differences in absorptive capability, population size, level and rate of economic growth, and availability of managerial and entrepreneurial capabilities are sufficiently extensive as to belie any ready generalization. Nonetheless, both groups appear to seek downstream investments in the economies of the consuming countries. The relative differences in the magnitudes of such investments will depend upon differentials in absorptive capability.

In the long run, the domestic investments by the oil-producing countries will have impact on the balance of payments of the consuming countries by generating goods produced locally that can compete with foreign imports or even be exported in foreign markets. In countries where the population base is small, industrialization will give rise to an expanded export market which would not necessarily be accompanied by an expansion of imports. Such a situation might provide the oil-producing countries with still another leverage point in interactions with the consumer countries.[31]

Those countries that have invested abroad have tended to concentrate on the European currency market, rather than in national money markets or in direct security investments. Such a policy is guided by the desire to protect their anonymity in foreign markets and to obtain high returns on short-term deposits. The Eurocurrency is an efficient mechanism for financial transfers of this nature. The funds are rapidly circulated, and anonymity serves as protection against their use as "hostages" abroad.[32]

Their investment policies in foreign money markets will bear increasingly upon the development of oil production and export policies in the producing states. The inducements that the consuming countries might employ to persuade the OPEC to invest its surplus revenue in constructive and stable ways point to the increasing recognition of the

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[31]Pollack, "Economic Consequences," p. 454.

[32]Ibid., pp. 458-59.

strong economic interdependencies linking producing and consuming states which were brought to the fore by marked increases in petroleum prices. OPEC'S willingness to produce and export petroleum at levels and rates consistent with the needs of the consumers will be a key policy decision.

In the long run, the most extensive potential for investments of surplus revenue lies in the oil-producing community. To some extent such investments are already apparent. For example, Kuwait is estimated to have provided at least $1.0 billion in grants, loans, and gifts to the other Arab countries.[33] The nature and extent of such investments will be shaped by their present investments in foreign money markets. The more the oil-producing countries become integrated in the global economy as large-scale investors, the more likely it is that they will seek to coordinate their investment policies with those of the advanced industrial societies. Furthermore, successful investment policies on the part of the oil-producing states will invariably lead them to seek actively to penetrate the consumer countries' economies through downstream investments.

In September 1973, Saudi Arabia suggested to the United States that its exports to this country be free of the oil import quota, in return for which the Saudis would make extensive investments in the United States.[34] But this request was rejected. The encouragement given to OPEC investments in the United States has been limited to placing their representatives in contact with investment houses and with experts who could provide them with financial advice. Beyond that, no other specific measures have been undertaken. If countries like Saudi Arabia become involved in direct investments in downstream refineries or marketing outlets, there will be greater economic interdependence among producers and consumers of crude petroleum.

Present developments in OPEC participation in downstream activities

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[33] U.S., Congress, Senate, Oil and Gas Imports Issues, p. 815, (Statement by Ronald Koven).

[34] Ibid., p. 1073, (Statement by M.A. Adelman).

are essentially of two kinds. One is the case of Iran, where the objective is participation in downstream operations at home, while seeking to export refined products. The second is exemplified by Saudi Arabia, where participation in downstream investments abroad seeks only to export crude oil. In principle, this latter approach could lead to substantial investments in the consumer countries, including investments in refining activities in the United States. In practice, however, there is considerable doubt as to whether such investments could in fact absorb all of Saudi Arabia's excess earnings, particularly if future returns on these investments are taken into account.[35]

The consumer countries might not be prepared to accept the fact of mass foreign ownership of major enterprises, particularly if the investors are foreign governments who might employ their investments as leverage in a political dispute. Furthermore, any efforts by OPEC to focus their investments on a limited number of securities might raise antitrust problems in the United States as well as possibilities of disturbances in equity markets.[36] Such considerations reinforce the producing countries' concern for maintaining anonymity in their investments. They are only too well aware of the hazards of foreign ownership.

While the precise magnitudes of the resulting interdependencies between producers and consumers in purely economic terms are difficult to gauge with any degree of precision, it is clear that the resulting situation is one of high mutual sensitivity and vulnerability. The political implications are also difficult to gauge, but, again, it is clear that each party is capable of employing substantial leverage to influence the behavior of others. Marked asymmetries persist in the degree of influence and potential leverage, but the high degree of mutual vulnerability has sensitized each side to the political objectives and aspirations of the other.

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[35] Ibid., p. 518 (Statement by William Letson).

[36] Pollack, "Economic Consequences," p. 456.

There appear to be few clear financial limits on the ability of the consumer countries to absorb OPEC funds, but there are indeed clear political and psychological problems. Increasingly, "recycling" of surplus funds appears to be the only foreseeable equilibrating means for resolving current imbalances. The consumer countries' trade deficits become the producers' financial surpluses, and the recycling question is whether sums of such magnitude can be invested by the producing countries without disrupting financial markets.[37] Nonetheless, several of the consumer countries have tended to believe that any such recycling arrangements cannot be effective. They argue that increases in petroleum prices must cease or prices be cut. Indeed, the issue of a "just" price is becoming of major economic and political importance.

Despite differences in options and perspectives, it seems clear that trade balances of conventional goods alone would not alleviate the balance of payments issue for the consuming countries, nor would large-scale weapons transactions sufficiently compensate for the deficit. Yet there are serious constraints to unlimited capital flows and investments of the producing countries in the financial markets of the consumers. Any attempt to attain some resolution of the seeming economic impasse lies in the cooperation between producers and consumers and among each of these. Individual government-to-government agreements for oil supplies persist, and in several cases the consuming countries have undertaken barter arrangements with the producer countries. There exists no agreed-upon procedure or code of conduct in relations between producer and consumer or among either group. The present regime is predicated on national initiatives and incentives, with little direct consideration of implications for international institutions.

Most of the countries represented at the Washington Conference of February 1974 have agreed to place some confidence in the plans of the International Monetary Fund to institutionalize the "recycling" of balance of payments deficits. The OPEC countries have yet to be persuaded to

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[37] Stauffer, "Oil Money," p. 323.

accept some international guarantee against inflation. The Fund could lend money to consumer countries faced with extensive oil deficits in order to buttress their access to the Eurodollar markets. Such markets, in turn, are increasingly likely to draw upon the surplus revenues of the producing countries. The International Monetary Fund would employ commercial rates of interest in supplying these borrowers.[38] To date, procedures such as these have not been worked out. But they reflect an increasing concern by all parties to develop viable means of cooperation and to institutionalize more acceptable modes of interaction. Indeed, we are now witnessing a concerted search for a viable global energy regime, the economic basis of which would be predicated upon agreements between producers and consumers and with the active participation of international monetary institutions.

Clearly, the higher the prices and the greater the accompanying increases, the more likely it is that the consumer countries will make greater investments in the development of alternative sources of energy. Thus, while the producers might seek to increase the price of petroleum, their ability to do so is contingent upon, first, their own cooperation among themselves to avoid possibilities of unilateral price-cutting, and, second, their assessment of the threshold beyond which further price increases would accelerate investments in alternative sources of energy. These dual constraints highlight the mutual vulnerabilities generated by balance of payments and surplus revenue problems.

F. Fourth-Order Effects: Economic Impacts on Other States

The non-oil-producing developing countries will be most affected by increases in the price of oil. Although the precise consequences are difficult to predict, there are some obvious implications. For example, any reduction in the economic growth of industrial countries will decrease

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[38] Jack Hartshorn, "A Diplomatic Price for Oil?," Pacific Community 5 (April 1974), p. 375-376.

Table 13

ESTIMATED BALANCE OF PAYMENTS DEFICITS ASSOCIATED WITH INCREASED PETROLEUM PRICES

Country	Estimated 1974 Oil Costs (millions $ U.S.)	Foreign Trade Balance 1973 (millions $ U.S.)
India	1241	163
Pakistan	266	55
Philippines	693	251
Thailand	657	-280
Tanzania	62	36
Sierra Leone	29	20
Sudan	127	25
Ethiopia	51	105

Source: Petroleum Economist, Vol. 41, No. 2 (February 1974), p. 47.

their demands for primary products and, by extension, reduce the foreign exchange earnings of many developing countries. Shortages in oil-based fertilizers may become so serious as to jeopardize the agricultural viability of many of these countries. Further, a deterioration in the balance of payments position of the advanced industrial societies will reduce official transfers and capital flows to the non-oil-producing developing countries.[39] Increases in oil prices will inevitably damage the financial position of these countries and will affect their ability to receive security loans. While they will not become bankrupt in the technical sense, such a burden could not be borne without extensive foreign assistance.[40]

An illustration of some financial consequences of increased petroleum prices for the non-oil-producing developing countries is presented in Table 13 based on the assumption of normal petroleum requirements and an average landed price of $10. The anticipated cost of oil for 1974 is formidable, as is the effect upon the foreign trade balance for 1973.

OPEC as a whole has been unresponsive to the financial problems of the non-oil-producing countries. Secretary General of the Arab League, Mahmoud Riad, stated that: "It is not possible to make two different prices. It is now an international price and the Arabs made it clear there could be no discrimination."[41] Similarly, Planning Chief of the Venezuelan government, Antonio Casas Gonzales, refused to sell oil to the Central American states at a discount.[42] Individual members of OPEC, however, have made some effort to respond to the needs of the non-oil-

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[39]Declan Duff, "Why Countries Default," Euromoney (May 1974), p. 45.

[40]Ibid.

[41]Kuwait Times, January 23, 1974.

[42]The Daily Journal (Caracas), January 17, 1974.

producing countries. For example Iran has worked out the equivalent of a two-tier price system with India, according to which portions of the cost of petroleum imports would be deferred and treated as a debt.[43] Saudi Arabia has tended to make cash gifts to several non-oil-producing developing countries. But there exists as yet no institutionalized response to the financial implications of increased oil prices for the non-oil-producing developing countries.

Although we have treated these issues in terms of fourth-order effects of increased petroleum prices, we do not imply that they are unimportant or will occur only over the long run. These problems are immediate and further illustrate the economic interdependencies that emerge from flows of petroleum across national boundaries.

The following chapter examines politics among the producing countries and the network of interdependencies that bind them in a common quest for economic and political gains associated with their control of this globe's most critical industrial commodity.

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[43] Kuczynski, "The Effects of the Rise," 1974, p. 41.

Chapter V

INTERDEPENDENCE IN THE MIDDLE EAST

with the collaboration of
Ijaz Gilani

This chapter focuses on the Arab states in the Middle East in order to probe further into some of the emerging interdependencies among oil-producing countries. In so doing we do not seek to minimize the importance of the non-Arab members of OPEC, but rather to recognize the fundamental reality that the center of petroleum power in the world today lies in the Middle East. Furthermore, the objectives of the non-Middle Eastern oil-producing countries can be maximized more by cooperation with the Middle East oil producers, rather than by any overt strategy of conflict.

The positions that the Arab states take within OPEC are invariably affected by the nature of inter-Arab politics. And Arab politics must always be viewed in the context of a shared language, religion, culture, and history. But the ties that bind these people together do not overshadow some important diversities. There is, indeed, a marked heterogeneity among the countries of the Middle East,[1] and much of this difference is manifested in their respective positions on the present petroleum crisis.

To a very large extent, the pricing policies of the producing countries are shaped by their own requirements of surplus revenues, domestic growth, and long-range plans for economic development. These requirements, in turn, are shaped by the population levels and rates of growth of these countries, their level of technology and economic development, and their resource endowments and demands. Together, differentials in population, resources, and technology have tended to dictate the policy options available to each state.

The purpose of this chapter is to describe those differentials and indicate how they have given rise to a complex network of interdependence which may serve as the basis for institutionalized cooperation among pe-

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[1]The Middle East is defined here primarily in terms of the Arab countries exclusively: Algeria, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Saudi Arabia, Sudan, Syria, Tunisia, and the United Arab Emirates. Though not territorially bounded, the Palestinians are included.

troleum producers and consumers. In the Middle East, this interdependence is manifested in economic, technological, demographic, and security terms. The critical issue is the extent to which evolving regional interdependencies coincide with, or reinforce, emerging patterns of global interdependence.

A. Critical Differentials in the Middle East

The countries of the Middle East are characterized by profound differentials in attributes and capabilities in terms of population, resources, and technology, the political implications of which are often overlooked. These differentials have delineated the lines of cleavage in the area, shaped attendant constraints on policy and behavior, and defined policy imperatives for each state. Even more elusive is the realization that critical differentials in attributes and capabilities have given rise to a network of interdependencies that transcend the common bounds set by a shared heritage. At the same time, the attendant cleavages are more profound than is conventionally recognized, and the possibilities of developing coordinated petroleum policies increasingly fragile.

With respect to population, the differentials in size and rate of growth are formidable indeed, giving rise to different levels of economic needs and demands and different requirements for basic resources. Population size in the Middle East ranges from about 35.9 million in Egypt to 500,000 in Kuwait and even lower in the neighboring principalities. Iran and Turkey are the next two most populous states, followed by the Sudan and the Maghreb countries. The vast gap in size alone provides some basic parameter differences that become even more salient when viewing differentials in annual rates of growth. The highest rates of increase are found in the Arabian Peninsula where the annual rate of growth in Kuwait is about 8% per year (much of which is accounted for by immigration), Qatar 7.3%, and Trucial Oman 5.3%. In North Africa the highest rates of growth are reported in Libya (with a population of about 4 million) and the lowest in Egypt and Tunisia, both of which average around

2.0%-2.3% per year. Thus, the smallest states are growing more rapidly. The largest states have a lower rate of growth, yet with every added increment, the numbers involved are markedly greater. (Table 14 illustrates some basic differences among these countries.)

These basic demographic differentials are accompanied by different needs and demands and different economic imperatives. The vast differentials among the Middle East countries in terms of resource availability, or constraints, reinforce the differentials in population size. The recource-rich countries are those with the smallest populations and, by extension, those with the least need for surplus revenue. Even among the oil-producing countries there are dramatic differentials in population size. The two largest producers, Kuwait and Saudi Arabia, have the smallest population. Iran and Algeria, both with large populations (31 million and 15.2 million), are also major producers today, but their reserves are clearly inferior to those of Kuwait and Saudi Arabia.

The need for petroleum revenues differs accordingly. The needs of Iran and Algeria are more immediate, more pressing, and more extensive than those of Kuwait or Saudi Arabia. In addition, the absorptive capabilities of these countries differ extensively. Countries like Algeria and Iran have developed the institutional bases that could draw upon petroleum revenues and channel these into required economic projects. Countries like Kuwait, Saudi Arabia, and Libya do not have the absorptive capabilities required to draw upon the vast sums accrued from petroleum revenues. All three countries lack the sufficient population base. Two of them--Libya and Saudi Arabia--also lack the underlying institutional base. These differences tend to shape their respective policies toward production, pricing, and investments. Thus, the policy imperatives for Algeria or Iran differ substantially from those for Kuwait, Saudi Arabia, or Libya.

Differentials in knowledge and skills are even more striking. The most populated and resource-poor countries are also the most technologically advanced; the resource-rich countries are those with the greatest needs for skilled manpower. Thus, Egypt is by far the most technologi-

Table 14 SELECT ECONOMIC INDICES FOR SEVEN MIDDLE EASTERN COUNTRIES

Country	Population in Millions 1972 Estimate	Density 1972 in Square Kilometers	Percent Urban in 1970	Percent Literate Male Different Years and Age Groups	Gross Domestic Product in Million U.S. Dollars 1970 or 1971	Percent GDP Derived from Agriculture Recent Years	GDP Per Capita Recent Years in US dollars	Energy Consumption 1970: Million Metric Tons of Coal Equivalent	Per Capita Energy Consumption 1970 Kilograms/Capita
Algeria	15.2	6	43	30 1966 15+	u	u	218	6.586	460
Egypt	35	35	43	69 1960 20-24	8,923	26	186	8.717	262
Iran	31	19	41	47 1971 7+	9,647.8	19	287	25.435	887
Iraq	10	23	47	u	3,139.6	18	292	5.820	617
Kuwait	.467	47 (1971)	22.1	u	3,967.6	.20	u	6.582	8661
Morocco	15.8	35	32	20 1960 15+	3,959	31	172	3.014	194
Saudi Arabia	8.2	4	24	u	3,249.8	6	227 (1963)	6.399	827

SOURCES: Nazli Choucri, "Interstate Migration in the Middle East: Governmental Response and Public Policy," (Cambridge: M.I.T. Center for International Studies, 1974); United Nations, National Accounts Statistics: 1972 (New York: United Nations, 1972).

Dorothy Nortman, "Population and Family Planning Programs: A Factbook," (New York: Population Council, 1971).

u = Data unavailable.

cally advanced of the countries of the Middle East--having the largest population and the greatest needs for resources--but no appreciable petroleum reserves. Kuwait and Saudi Arabia are the most resource-rich, have low populations, and are in great need of technical skills.

These imbalances have contributed to large-scale interstate population movements among skilled manpower--from the countries with high populations but low resources to those with high resources and low populations. Over half the population of Kuwait is drawn from neighboring countries and well over 70% of the labor force are non-Kuwaiti citizens. Similarly, educated Egyptians, Lebanese, Jordanians, and Palestinians find employment in the resource-rich, oil-producing countries. These facts highlight an important aspect of interdependence in the Middle East. Any governmental policies designed to prevent the movement of population across national boundaries will invariably have political impact upon both donor and recipient countries.

Such patterns of population movements are increasingly contributing to the redistribution of knowledge and skills in the area. As a result, there is developing in the Middle East awareness among the respective national leaderships of the enormous potentials for interstate cooperation. In addition, the flow of funds from the resource-rich to the resource-poor countries--in the form of government-to-government grants or subsidies, or remittances from migrant workers--further reinforces the evolving networks of interdependence. The political implications of these developments are yet to be officially recognized by either the leaderships or the politicized publics in the areas.

B. Cleavages and Constraints

These basic differentials in population, resources, and technology have provided important cleavages among the oil-producing countries and presented OPEC with a set of constraints which are difficult to transcend. The more heavily populated members have indicated that the benefits of high prices outweigh the benefits of membership in OPEC or even of pursuing coordinated petroleum policies. Thus, President Pérez of Venezuela

has stated that his country will maintain its high price "even if others cut theirs."[2] Jamshid Amouzegar, Iranian Minister of Finance, has stated that his country "will not let the price of oil drop below its existing level, even if this means the break-up of OPEC."[3] Algeria and Indonesia have argued at the March 19, 1974 meeting for raising the posted price of Gulf petroleum to $14.00 per barrel. Nigeria and Iran endorsed this proposal.[4] These countries all share roughly similar needs for revenues accrued from the sale of petroleum and are reluctant to allow any unilateral (or even joint) moves toward the reduction of petroleum prices.

Saudi Arabia alone has argued for the reduction of prices, on the grounds that the long-term stability of the petroleum market requires it. The Oil Minister of Saudi Arabia, Yamani, has asserted, in effect, that Saudi Arabia would set her own prices, below those stipulated by OPEC directives, if other countries insisted on raising the posted price.[5] Kuwait and Abu Dhabi have placed in the record of the OPEC meeting of March 19, 1974, a motion to censure Saudi Arabia, accusing it of attempting to discourage oil buyers from making bids for auctioned oil.[6] These two countries do not have the same pressing need for petroleum revenues felt by the larger states, but have deemed it politically and economically desirable to encourage cooperation among the members of OPEC and counter any such moves that might potentially harm the effectiveness of that organization.

Most of the statements quoted above in part may reflect rhetorical postures. The outcome of the March 19 meeting was, in effect, a price freeze. Yet there is ample evidence to suggest that Saudi Arabia may indeed lower petroleum prices in clear defiance of OPEC directives. On

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[2] Financial Times (London) March 12, 1974.

[3] Financial Times (London) March 8, 1974.

[4] New York Times, March 20, 1974.

[5] New York Times, March 20, 1974.

[6] New York Times, March 20, 1974.

March 17 the New York Times reported an offer of oil totalling two million tons at a price of $8.50 a barrel. The companies making the offer were Exxon, Standard Oil of California, Texaco, and Mobil, all members of Aramco, which operates exclusively in Saudi Arabia. This offer was considerably lower than the current price which ranges from $9.00 to $11.00 per barrel. The Secretary General of OPEC, Abderrahman Khene, of Algeria, acknowledged that the Saudis could unilaterally change the price structure overnight. At the same time, he charged that this offer was a move to drive down oil prices. However, Khene did not link Saudi Arabia to this move. The cohesion of OPEC had to be maintained, at least until its members officially clarified their own postures and preferences.

Two factors contribute to the Saudi position on petroleum prices and distinguish it from other OPEC members: (a) a small population, and (b) a control of one-third of the world's proven reserves. These factors dictate a long-term perspective on petroleum policies including price and production schedule. There are no immediate demands for added petroleum revenues and no other marketable resources. Should Saudi Arabia decide to sell its oil on a very high volume and at a low price, this decision would contribute to lowering OPEC prices. Should the other members of the organization opt for a strategy of intransigence and oppose lower prices, the long-range consequences for Saudi Arabia would be dramatic indeed: there is no foreseeable outcome other than the depletion of reserves in 10 to 20 years.

The depletion of petroleum reserves is a constraint which faces all the members of OPEC, and some more than others. It is ironic that Saudi Arabia, which has the least short-term or long-term need for revenues of such magnitudes and has neither the absorptive nor the institutional capabilities to accommodate such revenue, is in fact in control of the pricing policies of OPEC. Saudi Arabia alone does not need to include depletion as a critical factor in its overall policy calculations. Iran, Algeria, and other large oil producers must take into account the eventual depletion of their petroleum reserves and weigh this factor against their immediate and even longer term needs for the attendant revenues. These countries also have the absorptive capability required to make use of

such revenues and thus, in the short run, are considerably more constrained than in the case of Saudi Arabia. However, possibilities of reducing their dependence on petroleum revenues in the long run make depletion of a resource less of a constraint.

There is still another consideration which emerges from an increasing awareness of the finiteness of this globe's resources. Several of the oil-producing countries, most notably Libya, are seeking to protect their resources from rapid and unplanned exploitation. They have neither the reserves of the Saudis nor the absorptive capability of the Iranians. Their depletion concerns and their apparent willingness to moderate the rate of petroleum production appears as still another consequence of the basic differentials in population, resources, and technology. While the Libyan posture might be interpreted in purely ideological terms, it is also extremely consistent with their desire to develop viable long-range resource planning policies. What might appear as an unwarranted ideological move to some observers is viewed more appropriately by others as a shrewd economic move.

The cleavages within OPEC must also be viewed against a long tradition of efforts toward community-building. Indeed, the region is notable for its ability to absorb disagreements, conflicts, and differences in policies and perspectives within a basic foundation of cooperation and consensus. Yet there are severe bounds or limits to this consensus. And, in recent years, the Arab countries have attempted to develop a sound basis of cooperation predicated not on political integration and unification, but on a new division of labor based on comparative advantage among the Arab countries of the Middle East. The new order appears predicated not upon conformity but on diversity. And this change in emphasis has been accompanied by new types of political and economic interdependencies, providing an added dimension in the efforts to develop viable petroleum policies.

C. New Policy Directions

Efforts toward community-building in the Middle East are not new.

The failures to attain this objective are remarkable. The Arab revolt of 1916 against Ottoman rule marks the first overt act of modern Arab nationalism. The leaders of the revolt had expected British support for an Arab political entity; but this support was withheld. Several further plans were put forth for unity (then viewed in primarily political terms), but in 1945 the Arab League developed as the only institutionalized means of cooperation among the Arab countries. The formation of the United Arab Republic in 1958 represented the first official attempt toward national merger. Its short life represented once again the inappropriateness of political integration as a base for community-building in the Middle East.

The years following the break-up of the first Arab Republic often witnessed bitter diplomatic, and in some cases, military, confrontation among competing Arab regimes. The war with Israel in 1967 was undoubtedly an important landmark in the development of regional community in the Middle East. The Arab states were confronted once more with the futility of inter-Arab conflicts. The devastating nature of that defeat affected all the Arab regimes. Its most dramatic consequence was a reassessment of the basis of inter-Arab politics and the development of a more realistic view of the possibilities for, and types of, cooperation in the area. This new sense of realism provides much of the background for present attempts to develop viable policies toward petroleum prices and production. Increasingly, it is realized that such policies cannot be made on economic grounds alone, but that the political objectives and aspirations of the Arab countries--resource-rich as well as resource-poor--must also be taken into account. It is for this reason that the petroleum issue assumes much greater political significance in the Middle East than might be warranted by its purely economic implications.

The 1967 defeat of Egypt, Syria, and Jordan was a humiliation shared by all Arabs. The war proved an enormous burden on the Egyptian economy, severely shook Egypt's traditional role as leader of the Arab states, and destroyed the belief in Nasser's Arab "revolution." Egypt had now become dependent upon the resources of the oil-rich, and politically conservative, Arab states. The underlying differentials in population, resources, and

technology provided the basis for Saudi Arabia's willingness to replace the loss of revenues from the Suez Canal. And the Egyptians had, in effect, agreed to reassess their regional as well as international policies.

The most notable consequence of the aftermath of the 1967 war was the relative depoliticization of community-building in the Arab world. The traditional symbols signifying political unity were replaced by diplomatic and consensual relations among the Arab regime. The death of Nasser effectively removed the most serious impediments to such depoliticization, and the defeat at the hand of the Israelis left none of the Arab leaders with any prestige to protect or to fight for. The old ideological conflicts had also lost their meaning and, certainly, their salience. The Israelis had defeated Nasserite Egypt, Baathist Syria, and Hashimite Jordan--all with equal ease.

A process of dispersion of political power was now occurring in the Middle East. Egypt had abandoned its revolutionary policies and relinquished its pivotal position in the Arab world, partly because of its dependence on subsidies from the oil-producing countries. Saudi Arabia was emerging, by common consensus, as the new economic power in the region. Symbolic revolutionary status had been taken over by the Palestine Liberation Organization (PLO) and, to some extent, by Libya as well. Algeria was emerging as the new technocratic leader, and Kuwait was gradually assuming the position of the new research and development center of the area. An appreciation of the underlying differentials in attributes and capabilities has accorded the Arab states with a new basis for interdependence, one explicitly predicated upon the capabilities of each state and its comparative advantage in relation to the others.

The Arabs had always been aware of the importance of their key resource--petroleum--but they had not previously possessed the ability to make use of this source for political purposes. The convergence of a series of events contributed to this new awareness. The advanced industrial societies needed access to that resource. The Arabs had developed sufficient consensus for coordinated action. The oil-rich countries pos-

sessed surplus revenues that would cushion the loss of added income. They had developed the technical and managerial capabilities to operate their critical resource as an instrument for political action. More important, they had also become aware of the extensive interdependence between their own economic policies and those of the advanced industrial countries. They understood the convergence between the balance of payments problems and those of surplus petroleum revenues.

But the new basis of consensus is by no means devoid of potential conflict. Arab policies during and after the 1973 war with Israel were not highly coordinated. Different Arab countries have made contributions toward a unified strategy in some areas but withheld their cooperation in others. This procedure is a reaffirmation of the new distribution of power in the area and the development of functionally specific cooperation. Thus, Iraq cooperated in the military sphere by sending troops to the Syrian front, but refused to participate in the oil embargo. Libya assisted the Egyptians financially, but withheld support for Egypt's policy of moderation toward Israel. Saudi Arabia and Kuwait assumed leadership of the oil embargo but made no military contribution. Algeria, Morocco, and Tunisia gave complete political support, but only symbolic military assistance. Such selected and functionally specific cooperation reflects an evolving pragmatic approach to Arab politics and a recognition of the futility of the insistence on all-encompassing cooperation. It also reflects different interpretations of interest. The critical differentials in attributes and capabilities appear to provide a viable base for substantial, though selective, cooperation and have contributed to new types of interdependencies.

The Arab states continue to exchange public criticism of each other. However, neither their selective cooperation nor their public disagreements have led to the abandonment of unified and coordinated action. The oil embargo was not a total failure in its limited objectives. The periodic summit meetings have not terminated in total disarray as had previously been the case. They have been successful in developing consensus regarding broader political leadership by accommodating both the economic power of Saudi Arabia and the political and to some extent technological power

of Egypt. For the first time, Egypt is sharing leadership with Saudi Arabia. Sadat and Faisal are providing the core leadership for the Arab world and are seeking coordinated action, even in the absence of substantial cooperation among the Arab states. The sharp differentials in population, resources, and technology have become complementary, providing the foundation for effective political collaboration on critical policy issues.

D. Regional Interdependence and Evolving Consensus

To summarize, the major political issues around which inter-Arab politics revolved had been four: (a) differences in ideological orientation, with variations of radical, moderate, conservative, or feudal regimes, with variations of each; (b) the question of concentration of power versus its distribution over various states according to their attributes and capabilities; (c) the degree of commitment to community-building, in terms of unitary community versus a more pluralistic notion of cooperation; and (d) the leadership issue, in terms of an ideological leadership versus a more pragmatic orientation toward the leadership role. By the close of 1973, the Arab states had begun to collaborate successfully on each of these issues. Power in the area had become more evenly distributed, both actually and symbolically. A process of differentiation of power was taking place, thereby creating a possibility for interdependence and replacing the dependence of smaller states upon the larger ones which had characterized Arab politics before 1967.

A calculus of mutual constraints was also taking shape, each state's commitment to regional collaboration being both shaped and limited by its own capabilities. Gradually the constraints were internally generated and not imposed externally by other states in the area. During the past months the Arabs have demonstrated an ability, albeit limited, to absorb both conflicts and dissensions on communal policies. More important, the leadership in the area had become one of moderation in the larger spectrum of inter-Arab politics, thus providing greater possibilities for cooperation with the West and opening avenues for potential resolu-

tion of both the Israeli impasse and the petroleum problem.

The present collaboration among Arab states is accompanied by a reduced emphasis upon symbolic politics and greater reliance upon mutual responsiveness and accommodation. By the same token, the possibilities for reaching some settlement with Israel rest on the conversion of the conflict from a symbolic dispute to one that involves bargaining and negotiation. Thus, the prospects for settlement coincide with, and reinforce, present lines of cooperation and collaboration among the Arab states. A settlement with Israel is now emerging as a unifying force in the Arab community. No longer is hostility toward Israel the focal point of Arab politics.[7]

Inter-Arab politics are now based upon a recognition not only of differentials in attributes and capabilities but also of basic resource and technological inequalities throughout the area. Some inequalities are accepted. And others are being adjusted through the transference of resources from the rich to the poor. Still others are being resolved through the transfer of technology from the more advanced to the less advanced. And the movement of skilled manpower across national boundaries in the Middle East emerges as an accommodating factor, reducing technological differentials.

The prospect of tangible political and economic gains is a critical consideration explaining the present Arab posture. More important, the gains of one nation are not regarded as losses to another. Improved relations with the United States is undoubtedly the most dramatic consequence of the 1973 war. Such relations are still under considerable strain. They affect as much the potential resolution of the conflict with Israel as they do the impasse over petroleum production and pricing. In a very real sense, the United States emerges in a pivotal role. Egypt, Saudi Arabia, and Syria are opting for a strategy of partial trust in the U.S. posture. They are the advocates for the viability of the American promise. Others, like Algeria, have still to endorse this strategy. Iraq

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[7] New York Times, July 24, 1974.

and Libya are in opposition. Failure to obtain some resolution of the Palestinian issue will weaken the position of the core leadership and strengthen that of the opponents to rapprochement with the United States.

Regardless of eventual outcomes, this much is clear: Evolving patterns of regional interdependence in the Middle East will invariably affect the nature of the world petroleum system in the immediate future; and this interdependence is predicated as much upon underlying differentials in attributes and capabilities as upon differences among competing political regimes. This competition will shape subsequent interactions with the outside world and will determine the eventual nature of community-building in the Arab world.

E. Community-Building, Evolving Interdependence, and Competing Regimes

The development of consensus in the Arab world must be viewed against a background of perennial conflict and disagreement regarding political objectives and national orientations. Arab regimes differ substantially on the definition of the central goals of the broader community as they do with regard to their own individual goals. Countries such as Saudi Arabia and others in the Gulf area are concerned mainly with preserving traditional values in an era where accelerated social change is both promoted and encouraged. Others, such as Egypt, Algeria, Tunisia, and Lebanon, have placed economic development at the forefront of their national priorities. Still others, such as Syria, Iraq, and Jordan, are motivated primarily by security considerations, viewing the protection of their own polities as the primary national objective. Libya and the Palestine Liberation Organization have as their primary goal the establishment of the Palestinian identity separate from and independent of that of the other Arab states.

These diverse goals and underlying values and objectives provide different and sometimes conflicting directives. Nonetheless, consensus-building is taking place in terms of careful reaggregation of diverse values in ways that maximize the gains of national policies to the community as a whole. This gradual reaggregation has been accompanied by a sharp redefinition of individual national roles and a search for compat-

ible, rather than conflicting, goals and objectives.

Nowhere is this transformation more apparent than in the case of Saudi Arabia. When King Faisal came to power, the country's finances were in poor condition. By the late 1960s the Saudi economy was organized and its resources managed more securely. The war in Yemen had placed severe drain upon the country's finances. The 1967 war had, to some extent, assisted in resolving this problem. Revenues increased dramatically as the price of petroleum increased. Saudi Arabia now controlled resources of such magnitude that it could readily subsidize the war effort in Jordan and Egypt. Gradually Saudi Arabia assumed the economic leadership of the Arab countries. By 1973 Saudi Arabia had assumed a pivotal role in petroleum policies and the country was now wielding the political power that was congruent with its economic role, and certainly with its traditional role as the spiritual leader of the Moslem world. In all three counts, it was encouraged by the other Arab states. Saudi Arabia's close relations with the United States may have been instrumental in enabling it to obtain the support of other Arabs for a posture of moderation. No longer were the Saudis viewed as peripheral to Arab politics. They had attained a pivotal position.

Unlike the tribal desert society of Saudi Arabia, Egypt had entered the post-war era with the heritage of an old civilization and an effective modernization experience under British and French rule. Its bureaucratic and institutional capabilities were far more developed than the other Arab countries, and for a long time it had the only university in the region. Its population size and advanced technology in comparative terms had contributed to its position of leadership in the Arab world. But the decade of the 1960s witnessed a steady decline in Egypt's regional power. The breakdown of the United Arab Republic, the apparent ineffectiveness of its socialist policies, and the quagmire in Yemen all had contributed to its particularly debilitating position. The 1967 war simply reaffirmed its loss of power and prestige. The change of name, from the U.A.R. to the Arab Republic of Egypt, illustrated a change in policy and reaffirmed the limited scope of the country's regional objectives. The new leadership recognized the criticality of interdependence with other Arab leaders.

Sadat consciously and systematically sought to reconcile Egypt's relations with both reactionary and revolutionary regimes in the area. By the end of September 1973, Egypt had improved its relations with all the other Arab states. The Arab community presented a facade of consensus and collaboration.

In changing its role of a hegemonial to an interdependent power in the area, Egypt recognized the importance of the differentials in attributes and capabilities that characterized the Arab regimes and sought to draw upon these differentials in developing a broad consensus and support for its war against Israel. The war paved the way for coordinated action not by dependence or domination, but by cooperation among interdependent units.

In the case of Algeria, the transformation was also dramatic. The country's long war for independence against French colonial rule had given rise to a revolutionary regime, seeking leadership of the Arab world. The technocratic leadership which had overthrown Ben Bella in 1964 redirected the country's goals and objectives away from revolution, toward development and growth. They increased their level of knowledge and skills and improved their management of the national oil industry. Throughout, they were remarkably successful in maintaining close ties with France. Equally remarkable was their ability to develop institutionalized means for exporting unskilled labor to France, thereby increasing their interdependence with the former colonial regime. In the 1973 oil embargo, it was the oil minister of Algeria who accompanied the Saudi oil minister on his tour to the consumer capitals. The Algerian oil minister symbolized the Arab countries' capabilities of increasing their own technical expertise without total reliance upon the West. Belad of Algeria and Yamani of Saudi Arabia were poles apart on political orientations and regimes preferences. But they represented the new Arab technocrats: political differences were cast aside in recognition of the criticality of developing coordinated policies.

The transformation of the Libyan political regime was equally, if not more, extensive. The country had traditionally remained on the

periphery of inter-Arab politics, and the traditional monarchy espoused politically reactionary values. The radicalism of Colonel Khaddafi's regime had been accompanied by economic gains for Libya. Indeed, it was Libya that had precipitated the increases in petroleum prices by unilateral action in 1970. But rather than concentrating on economic gains, Khadaffi entered the politics of symbolism. Vast oil revenues were employed to subsidize a variety of radical causes. Thus, while Egypt moved away from the politics of symbolic appeal, Libya assumed a position of leadership in that area.

In Syria, too, a policy change was taking place. The country's marked concern for national security emerged directly from its colonial heritage. Historical Syria had consisted of the entire Fertile Crescent, with Damascus and Baghdad as key metropolitical centers. Syria was at the forefront of the movement against Ottoman rule in order to establish an Arab state. At the close of World War I they had found themselves divided into three separate protectorates. Iraq and Transjordan went to the British; Syria was accorded to the French. Thus of all the Arab lands, the Fertile Crescent had not retained a political entity congruent with its geographical bounds. The other Arab countries had been more fortunate.

Despite these developments, Syria had maintained intellectual leadership of the Arab nationalist movement. The Baathist concept of unity was considerably more sophisticated than Nasser's populism. And the Syrians have always found it difficult to accommodate to the Egyptian interpretation of Arab unity. The defeat of 1967 accentuated further the country's concern for security and accounts for the relatively "hard" stance in negotiations with Henry Kissinger. But the agreement, working out a disengagement procedure for the Syrian-Israeli troops following the 1973 war, amounts to an important landmark and an indicator of the change in the regime's external orientation. There, too, a distinctly pragmatic approach to Arab problems was emerging.

The Palestinians also have assumed a new role in Arab politics. They are a nonstate group, and their own effectiveness is predicated on the

ineffectiveness of the Arab states in their attempts to move toward a resolution of the conflict with Israel. They had been extremely effective in the 1930s when they opposed British plans in Palestine. After World War II the Arab states took over the cause of the Palestinians, effectively displacing the latter as their own spokesmen. The defeat of 1967 changed this situation. The leaders of the Palestinians became the leaders of a specific national cause which was to be viewed as a cause distinct from broader Arab unity. Gradually the core leadership, under Arafat, became accepted by the Arab states as the legitimate leader of a broad section of the Palestinian movement. These developments further illustrate the emerging differentiation of power in the Middle East and the evolving patterns of regional interdependence.

F. Regional Interdependence and Petroleum Politics

The Arab regimes in the Middle East differ substantially on the choice of a central goal for a united Arab polity. Countries such as Egypt, Tunisia, and Algeria wish development to become the focus for the broader community. Others emphasize security or preservation of national identity. The challenge to community-building in the Middle East and to reinforcing evolving patterns of regional interdependence is to bring about a situation in which different states, with different underlying regime orientations, make a contribution to the broader community in accordance with their own attributes and capabilities and in congruence with the general differentials in population, resources, and technology that characterize the region as a whole.

Such a challenge requires that interdependence in the Middle East, and attendant efforts at community-building, be predicated upon pluralistic rather than hegemonial or amalgamated principles. Furthermore, the differentiation of power in the Arab world--with each state placing emphasis upon a distinct issue area--is contributing to a diversification of activities predicated on principles of comparative advantage. The emerging commitments to community-building in the Middle East are more limited, more pragmatic, and more directed than were the results

of earlier efforts at unification. In the last analysis, therefore, the interdependencies resulting from differentials in attributes and capabilities, and from a long heritage of common language, religion, culture, and history are providing the basis for cohesion and consensus-building among competing political regimes in the Middle East. And these interdependencies may well enable Saudi Arabia to convince the Arab members of OPEC not to increase further the prices of petroleum. Indeed, Saudi Arabia might manipulate these evolving interdependencies among the Arab world to present OPEC with significant obstacles to further price increases.

Despite the dominance of the Arab oil-producing countries, the policies of OPEC do not depend upon them alone. Iran, Venezuela, and Nigeria also exercise major roles. Of the three, Iran is undoubtedly the most critical. This country's relations with the Arabs have always been uneasy. Although the two groups share a common history, religion, and to a great extent, culture as well, Iran has been concerned with maintaining its own identity. Recently, the Shah has indicated his desire to reestablish over the Gulf area the hegemony that had once been exercised by the Persian Empire. This posture has given rise to considerable apprehension on the part of the Gulf states who prefer to call that waterway the Arabian Gulf. Iran has always been apprehensive of a stronger Arab entity, and its relations with the Arab states had been particularly bad when Nasser announced his policy of radical Arab nationalism. While Iran might readily tolerate closer cooperation among the Arabs, any formal cooperation on an institutionalized basis would be regarded with some apprehension.

Iran's posture on the price issue had been predicated upon the need for petroleum revenues. The country's institutional and absorptive capabilities are such that added revenues could readily be employed for development purposes. In addition, the Shah has made substantial arms purchases from the West, payments of which would be made against petroleum revenues.

The other OPEC countries are relatively less critical in the Organi-

zation's overall price strategy. Neither Venezuela nor Nigeria, for instance, possesses known reserves of such magnitudes as to provide effective countervailing influences to the Saudi Arabian posture. Both are more likely to side with Iran on the issue of increasing petroleum prices, yet neither can substantially influence nor manipulate OPEC decisions in this regard.

G. Regional Influences on Global Interdependence

Much of what has been said so far has tended to isolate the Arab Middle East from larger global politics. It must be recognized that regional responses to external influences will invariably affect petroleum policies. In turn, any politics bearing upon petroleum will have an impact upon the decision of the consumer countries to invest in alternative sources of energy. Thus, discrete short-term policies will result in long-term effects upon the world energy system. Subsequent chapters of this volume examine these in greater depth. Here we examine the major external influences that bear upon regional interdependence and community-building in the Middle East.

At the present time the United States holds a pivotal position as a major power in the area. The U.S. has declared two major goals for its policies in the Middle East: (a) to encourage a settlement between Arabs and Israelis, and (b) to ensure unimpeded flow of petroleum to the consumer countries. Both of these objectives require some degree of consensus among the Arab states and some cooperation among competing regimes. Yet it is unclear whether a unified Arab posture would amount to a help or a hindrance for the United States. A united Arab position would eliminate extremist options and assume a more moderate posture, but it would also provide a more coherent front in any interactions with the United States or, eventually, with Israel.

The presence of small and weak political units in the midst of larger polities provides an added element of volatility in the area, and potentially a rationale for external intervention. Two cases illustrate such possibilities. First, the leader of the Kurdish community in Iraq has

declared that he would be willing to cooperate with the West, with the oil companies, and even with Israel should that assist his people's cause. There exists no better, nor more frequently employed, rationale for foreign intervention than that provided by the appeals from a dissident group. Second is the case of Abu Dhabi whose small population (110,000 individuals, including expatriates) and enormous petroleum revenues (estimated to exceed $6 billion dollars in the near future) may provide a base for external intervention. It is alleged that during the Arab oil embargo of 1973-74, the United States had drawn up contingency plans for landing marines in the oil field, and had selected Abu Dhabi as their site.[8] The possibility of such eventuality is enhanced by the relative weakness of the small polity in question. And while the actual decision to send the marines may never have been seriously entertained, it is a possibility that becomes increasingly plausible given the site selected.

The change in the United States' role in the Middle East has been dramatic. The Arabs have come to realize that only the United States might effectively persuade Israel to adopt a more flexible posture, and that it is in the interests of the U.S. to do so. They have also realized that the Soviet Union's maneuverability in the area has been effectively neutralized, in part by its perennial disagreements with Egypt regarding control over the armed forces, and in part as a consequence of the rise in U.S. influence.

To the extent that the Soviet Union chooses to support and collaborate with the U.S. policies in the Middle East, it is likely to be favorably disposed toward increasing regional interdependence among constituent polities and would encourage community-building. However, should the Soviet Union oppose U.S. policies, it will tend to support the more radical regimes and encourage their opposition to a moderate Arab posture. The reserve displayed by the Soviet Union toward the cooperation between

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[8]"American Intentions in the Middle East: Haikal's Controversial Article," Journal of Palestine Studies, vol. 3, no. 3 (1974), pp. 167-69.

Egypt and Saudi Arabia is probably indicative of its potential posture toward evolving Arab consensus on relations with the major powers.

The West European nations have adopted policies of concerted bilateral interactions with individual countries of the Middle East. The issue of inter-Arab cooperation or evolving regional interdependence does not bear upon any bilateral arrangements, economic or political, other than giving each of the parties involved greater maneuverability in its relations with the other. There is little consensus among the consumer countries regarding their relations with the producers or with other states in the Middle East. Each is concerned primarily with security of supply. Price is important, but it is not as crucial. In this respect, both the West Europeans and the Japanese regard OPEC as a central coordinating agency, which could effectively be bypassed through a series of bilateral arrangements. Only the United States presently regards a strong OPEC as particularly undesirable on the grounds that a strong opponent is more difficult to deal with. Other reasons for this assessment are not fully articulated. Western Europe and Japan are concerned less with the issue of petroleum "blackmail" since vulnerability is assumed; it is not at issue. And within this context, they have not shared the United States' opposition to bilateral arrangements, nor have they accepted the argument that such arrangements necessarily encourage higher prices. As a result, they are confronted with fewer tensions in their relationships to the oil-producing countries.

The petroleum policies of the producer and consumer countries converge around the issue of price. For the producers, the question of price is intimately linked to the nature of the value of the goods and services which their oil revenues can purchase, their needs for such goods and services, and their preferences in terms of investment policies--all in relation to the value of petroleum in the ground. We have described how the basic petroleum policy decisions can change depending on the national attributes and characteristics of the producing state.

The consumers, on the other hand, appear to have little of the flexibility enjoyed by the producers. For them, the issue of price is linked to

the political and economic consequences of external dependence for a critical industrial resource and the optimization of internal welfare policies. Nowhere are the dilemmas of both producers and consumers more clearly demonstrated than in the United States, which until recently had been the world's largest producer as well as largest consumer of crude petroleum.

The solution of basic incompatabilities between producer and consumer over price can be attained, within the broader petroleum system, by other policies of mutual accommodation or by capitulation of one party or the other. This latter option appears implausible at the present time. Neither will the producers unilaterally reduce prices drastically, nor will the consumers withdraw their demands for lower prices. Thus, the only viable alternative within the global petroleum system is the development of policies of mutual accommodation. But the consumer countries do have another option which may increase their flexibility in any negotiations with the producers. This alternative, though decidedly affected by petroleum pricing policies, operates on constraints exogenous to the global petroleum system. That policy is the development of alternative sources of energy.

The following chapter presents a critical assessment of the implications for the world petroleum system by summarizing our conclusions regarding the evolving patterns of global interdependence. The remaining chapters of this volume focus on alternative sources of energy.

Chapter VI

A SUMMARY ASSESSMENT OF INTERDEPENDENCE IN THE WORLD PETROLEUM SYSTEM

The conclusion to be drawn from our analysis of the world petroleum system is that the tendency is clearly toward increasing global interdependence in the sense of significant mutual dependencies. Both producers and consumers are linked in complex ways, their needs and demands being to a large extent complementary, and their ability to develop mutually acceptable forms of interaction emerging as the most critical problem. Both the consumer and the producer nations are in effect dependent upon each other--one for access to critical resource; the other for access to the technology that would make this resource economically beneficial, for the revenues accrued from the sale of petroleum, and for opportunities of investing such revenues in world money markets. Yet there are basic differences among the producers and among the consumers, as there are between producer and consumer regarding the extent of mutual dependence and the degree of sensitivity and vulnerability to mutual preferences and policies.

Our findings can be summarized as follows:

First, an extraordinary rise in world petroleum production over the past decades provides the single most important fact underlying the global energy network. This rise is accompanied by increasing consumption in all the advanced industrial societies which has, to a large extent, been responsible for the alleged "crisis" of petroleum supply by accelerating the demand for petroleum imports. The four issues at the core of the present "crisis"--possibilities of further oil embargo, the explosion of demand and reluctance of producers to expand production capacity, the question of price, and the scarcity of auxilliary service--are all potentially manipulable, with varying social and economic costs.

Second, patterns of production have also undergone considerable change, in terms of (a) magnitudes of production and (b) centers of production. Changes in production have been accompanied by changes in exports of crude petroleum, particularly in terms of (a) a transformation from the Western Hemisphere as the focal point of petroleum exports to other areas of the world and (b) changes in the rank ordering of exporter countries in terms of magnitudes of exports, again with a receding focus

upon Western Hemisphere exporters in the face of the rapid development of new oil fields and new producing states.

Third, these changes in production, consumption, and exports have affected the patterns of crude petroleum imports. Increasingly, there emerges (a) an increased reliance of consuming countries upon imports for meeting rising domestic demands; (b) an increased trend toward diversification of sources of imports; (c) clear asymmetries with respect to mutual dependencies among producers and consumers resulting from petroleum flows; and (d) the fact that such asymmetries may favor the exporter or the importer. In only one case (Japan) are flows so mutually congruent as to suggest a high degree of petroleum-based interdependence.

Fourth, the structural changes in the world petroleum system which have resulted from changing patterns of flows are to a large extent mirrored in the changing role of the international oil companies and the Organization of Petroleum Exporting Countries.

Fifth, patterns of total trade in all commodities also reflect some fairly regular tendencies: (a) there are also pronounced asymmetries, in this case revealing the degree of penetration of the producing countries by the advanced industrial societies; (b) there appears to be an extensive diversification in trade concentration of the consuming countries reflecting an effective division of market control of the producers by the consumers; and (c) the producers also exhibit a high degree of concentration in their trade with the consumers.

Sixth, although the oil-producing countries rely heavily on the consuming countries for trade in capital-intensive commodities--electric machinery, nonelectric machinery, and transport equipment--these commodities can be obtained from the consuming countries interchangeably, thus providing the producers with certain maneuverability. Only with respect to imports of cereal and flours are the producing countries almost entirely dependent upon the United States; but, for a variety of reasons, this dependence does not appear to afford the U.S. commensurate maneuverability in relation to the producers.

Seventh, the balance of payments issue provides an almost unique

example of the intricate interdependencies among actors in the world petroleum system, indicating ways in which one state's policies become the constraints of another; ways in which seemingly straightforward flows of funds may create complex linkages, the full implications of which are not obvious at first glance; and ways in which novel economic linkages provide the basis for evolving structures of economic interdependence.

Eighth, the criticality of petroleum revenues to the economies of the producing countries places them in a position of dependence upon their petroleum exports that is nearly total in most cases. In others, it is so extensive as to be a critical component of governmental revenue. This nearly total dependence of the oil-producing countries on petroleum revenues more than matches the dependence of the consumers on petroleum imports. The parameters of economic interdependence are clearly in evidence.

Ninth, there are emerging networks of interdependence among the countries of the Middle East (oil-producing as well as non-oil-producing) based on differentials in attributes and capabilities and upon complementarity in such differentials. This interdependence will have a strong influence upon global interactions and upon the future shape of the world petroleum system.

Tenth, joint economic problems linking producers and consumers are illustrated by surplus revenue problems on the one hand, and by balance of payments problems on the other. The solution to each problem--if such can be identified--depends to a large extent upon the cooperation, if not ccllaboration, of each party. In this necessary collaboration (possibly joint action) would lie further evidence of global interdependence. For example, a producer decision to increase production amounts to a decision to invest in the consumer countries. The extent and nature of such investments would require joint action.

These ten conclusions suggest, in effect, that neither the producers nor the consumers can "opt out" of the petroleum network. A situation of strong mutual constraints has developed which has shaped and

conditioned their interactions. The two-way flow of commodity, services, technology, and resources has provided a complex network of linkages among producers and consumers which has transformed a situation of initial dependence of the consumer countries upon the producers to one of overall net interdependence.

The nature of the foreign investments of the producer countries and the restrictions placed upon such investments by the consumer countries are further illustrative of the mutual sensitivities and vulnerabilities associated with such transactions. In effect, each provides important constraints upon the other, and each is vulnerable to the policies and actions of the other. What might appear initially as a situation of dependence of one party upon the other becomes, in reality, one of interdependence of mutual vulnerability and sensitivity, and of mutually compatible asymmetries in transactions.

Such asymmetries and mutual sensitivities and vulnerabilities are also predicated upon critical differentials--in resources, technology, and levels and rates of population change. We have illustrated the implications of such differentials with reference to regional interdependence in the Middle East. The same type of dynamics serves to shape and condition relations among the consuming countries and their interactions with the producers. Nowhere are the implications of such differentials more salient than in the case of the countries at the periphery of the world petroleum system, those that depend upon petroleum but whose level of economic development and financial viability are such as to present ready accommodation to the recent increases in petroleum prices. There, low level of resources, and low levels of knowledge and skills combined with a high rate of population growth, are providing seemingly insurmountable obstacles to meeting the economic loads imposed by higher petroleum prices.

The links that bind producers and consumers within the world petroleum network have also given rise to different conceptions and preferences with respect to the rules and regulations governing petroleum transactions. In increasing prices unilaterally, the producing countries

have, in effect, rejected existing principles governing such transactions and have sought to establish new rules with new priorities and governed by new preferences. The consumers, on their part, also seek to develop viable means of regulating the present price system, in ways that they deem more equitable. Their preferred rules have, as yet, not been fully articulated, but they are not likely to be fully congruent with those of the producing countries.

The producers also differ among themselves regarding their preferences and priorities. These differences, in turn, are shaped by differentials in population, resources reserves, and relative absorptive capabilities. Thus, the priorities of Iran differ substantially from those of Saudi Arabia or Kuwait, as do its petroleum production and price policies. Similarly, the consumers also differ among themselves. Neither Western Europe nor Japan tends to view a strong OPEC as unfavorably as does the United States. Western Europe and Japan also tend to pursue bilateral arrangements and seek to develop viable means of accommodation on a bilateral basis more readily than does the United States. Again, the basic differentials in attributes and capabilities account in large part for such differences in politics and postures.

In the preceding pages, we have delineated some basic mirror-image problems confronting both producers and consumers. Yet differentials among them in terms of levels of knowledge and skills tend to distort the mirror-image analogy. In seeking to undertake as systematic an inquiry as possible, we have found it necessary to probe into four dimensions of interdependence in international politics, namely in terms of: (a) political and economic consequences, (b) security of access to the critical resource, (c) implications for community-building, and (d) potentials for environmental impact. The first three dimensions were examined in considerable detail. We have drawn some conclusions regarding the fourth primarily on an inferential basis, and with little depth. Our conclusions need further inquiry and further substantiation. But the major thrusts are well specified. By way of summarizing our investigations into the world petroleum system and its implications for evolving patterns

of global interdependence, Table 15 presents a checklist of major points discussed and major issues raised--some explicitly and in great detail, others implicitly and with less emphasis. Together, they provide the basis for the preceding assessment of patterns of global interdependence evolving from transactions in the world petroleum system.

The existence of alternative energy sources presents both the consumers and the producers with additional mirror-image problems--much as do the present balance of payments and surplus revenue issues. To the extent that the oil producers persist in their demands for higher prices, the net effect would be to accelerate investments in alternative sources of energy. However, to the extent that the consumer countries seek lower oil prices, the investments required in alternative sources of energy would be forestalled for the lack of adequate financial incentives for private enterprise. Furthermore, there are enormous trade-offs to be obtained in terms of short-term costs and long-term benefits. To a large extent, therefore, the producer countries are in the position of influencing the energy policies of the consuming countries. They, too, are confronted with critical trade-offs.

The following chapter examines the implications of alternative sources of energy for evolving patterns of global interdependence and looks at the prospects for, and consequences of, alternative modes of accommodating the diverse energy needs and demands of different nations.

Table 15

DIMENSIONS OF PETROLEUM INTERDEPENDENCE

SPECIFIC ISSUES

POLITICAL AND ECONOMIC CONSEQUENCES	SECURITY OF ACCESS TO RESOURCE	IMPLICATIONS FOR COMMUNITY-BUILDING	POTENTIAL FOR ENVIRONMENTAL IMPACT
1) Balance of payments deficits 2) Types of cash flows 3) Downstream investment 4) Price(s) of oil 5) Flexibility of international economic system 6) Absorption of oil revenues 7) Role of multinational corporations 8) Expansion and exploration of oil reserves 9) Alternative policy options 10) Role of government 11) Policies toward petroleum dependencies 12) Economic criticality of oil	1) Reliance on imported oil 2) Issue divergences 3) Criticality of oil for national defense 4) Criticality of arms flows for security policies 5) Potentials for regional domination 6) Strategic importance of region 7) Maritime vulnerability	1) Degree of shared interests 2) Existence of positive trade-offs 3) Potentials for cooperation in developing alternative energies 4) Nonoil-shared issue areas 5) Cooperation among multinational corporations	1) Overall environmental costs of petroleum use 2) Ecological dislocation of production, transportation, and refining of petroleum

Chapter VII

ALTERNATIVE GLOBAL ENERGY SYSTEMS

The higher the price of crude petroleum, the more likely it will be that the consumer countries will make greater investments toward the development of alternative sources of energy. Different sources of energy will invariably generate different patterns of global interdependence. And the linkages pertaining to petroleum will not necessarily hold in a world energy system predicated upon nuclear fission or fusion, solar energy, coal, or other sources of energy. So, too, different sources of energy will highlight different types of inequalities among nations, defining the "haves and have-nots" differently, and giving rise to different sets of national options and priorities. This chapter summarizes the salient features of alternative energy sources and their implications for global interdependence, as background for the analytical perspectives on world energy regimes presented in the following chapter.

A. Perspectives for Assessing the Implications of Alternative Energy Sources

Our analysis of the world petroleum network and the related commercial, financial, and political factors has pointed to four important aspects of global interdependence. Thus, (a) transnational economic problems emerging from the flow of petroleum, (b) problems related to access and security of supplies, (c) questions of community-building among producers and consumers and within each group, (d) issues pertaining to petroleum production and conservation of reserves have tended to shape the foreign policies of nations in ways that had not been fully apparent before the petroleum "crisis" of late 1973.

These four dimensions of interdependence appear generic to both international and transnational relations, however their specific manifestations would differ depending on the type of transaction involved, or as in the case of our analysis, the source of energy examined. The generic issues pertaining to energy in an interdependent world involve the economic cost of developing alternatives to petroleum on a commercially viable basis; the security issue of access to stable sources of energy; the community-

building question of developing regularized and viable means of interactions among producers and consumers of alternative energy sources; and the environmental issue of minimizing dislocations occasioned by the development and use of alternative energy sources.

Differentials in technology and in the availability of basic resources underlying alternative sources of energy are two of the most intricate. With respect to petroleum, the technology-poor nations are resource rich, and nations that needed resources are technology rich. These asymmetries have shaped the nature of the resulting transactions and interdependencies. With respect to alternative sources of energy, however, the asymmetries are quite different. The consuming nations control the advanced technology that would allow for the development of alternative sources of energy. They will in effect become the producers. The asymmetries in technology will invariably become more important than any asymmetries in the availability of the critical underlying resource. Thus, from a global perspective, those that control the technology will also control access to alternative energy sources. The patterns of interdependence that would emerge will be shaped by the nature of the technology and the types of control exercized.

Our analysis of the petroleum system has also examined the changing institutional structures involved in the production, control, and distribution of crude oil. The multinational corporations, the governments of the producer and consumer nations, and the Organization of Petroleum Exporting Countries have all undergone major changes over the past two decades. These changes have been propelled by changes in the pattern of petroleum flows. But the effects were interactive. Thus, organizational changes affected the petroleum flows, and changes in flows reinforced the need for further institutional transformations. The interaction is generic. Its specific manifestations are not.

The global institutional arrangements governing transactions in alternative sources of energy are yet to be developed. But it is clear that the national governments will assume a primary role in the shaping of such arrangements. The development of national energy policies has

become an issue of top priority for the governments of today's consuming nations. Thus, interactions among these governments will set the basis for such institutional arrangements.

Our analysis of the petroleum situation has highlighted the different preferences and priorities of consumers and producers. We have implied--and will discuss more fully in the following chapter--that different preferences are accompanied by different means of accommodating conflicting preferences and different ways of regulating resource-related interactions. In short, the major actors seek to develop viable regimes for meeting their energy needs. Whatever agreements producers and consumers of crude petroleum might develop in the immediate future, it is extremely unlikely that such arrangement could be transferrable to another alternative source of energy. Thus, the question of competing regimes for alternative energy sources emerges as a critical dimension in evolving patterns of global interdependence.

The major alternatives to petroleum are coal, natural gas, nuclear fission, nuclear fusion, solar energy, geothermal energy, tar sands, oil shale, and other exotica.[1] Different cost factors and time perspectives are attached to each, and different technological imperatives. So, too, the security issues are different, as are implications for community-building among nations, and potentials for environmental degradation.

B. Coal: Resource Base and Technological Constraints

Coal is an abundant resource. The world reserves estimated in 1964 for coal and lignite at present rates of consumption can last for well over 800 years.[2] More recent estimates have not changed this assessment. The U.S. Geological Survey has estimated the country's coal resources at 3.2 trillion tons. About 150 billion of this total constitutes recoverable coal located in formations of comparable thickness and depth to

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[1] We have made the decision not to include an analysis of natural gas in this volume because of the unique position of this energy source in the U.S. economy. The distortions in consumption brought about by the regulations on price preclude a realistic analysis of the effects of natural gas on global interdependence.

[2] Peter T. Flawn, Mineral Resources (Chicago: Rand McNally, 1966), p. 286. (There are differing assessments of the magnitude of coal reserves at usable economic costs.)

those being extracted with present technology.[3] Although demand for coal will undoubtedly increase in the future, production to 1985 will draw upon only 10% of the 150 million tons of readily available coal.[4] Coal has an important advantage over other sources of energy, namely its relatively high energy content per unit of weight. This characteristic enables its transportation at relatively low cost. But it is cumbersome to handle, generates considerable smoke when burned, and yields marked ash residuals to be disposed of.[5] Additionally, there are serious environmental and technological constraints to the further development of the coal industry.

These problems do not negate the fact that a coal-based energy system in the United States would decrease dependency upon petroleum imports and attendant economic consequences. But it would not necessarily reduce U.S. interdependence in a world energy system, primarily because of possibilities of coal exports. In such eventuality, the U.S. might become a major supplier of coal and find itself in a pivotal position, not an implausible possibility given the magnitude of the country's reserves.

Reliance on coal would reduce balance of payments deficits associated with the cost of importing petroleum. Under favorable technological circumstances, exports of coal could be employed to offset the U.S. balance of payments. Increased use of coal in the United States would complement present sources and usages. In addition, developing further coal mines would provide impressive domestic economic payoffs, most notably providing employment in the depressed mining areas and potential benefits to the railroad companies who own much of the coal and who would be expected to transport the coal.

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[3] National Petroleum Council, U.S. Energy Outlook (Washington: National Petroleum Council, 1972), p. 4.

[4] Ibid., p. 135.

[5] Nathaniel B. Guyol, Energy in the Perspective of Geography (Englewood Cliffs, N.J.: Prentice-Hall, 1971), p. 23.

However, reliance on coal would not completely reduce the need for petroleum, since 50% of the oil consumption in the United States is in the area of transportation. Nonetheless, developing coal as a viable alternative to petroleum would substantially alter the nature of U.S. international energy transactions.

Given the large coal reserves in the United States, there would be no problem of securing access to supplies nor would strategic vulnerability be at issue. In this respect, at least, coal would present none of the security-related problems associated with access to petroleum. Furthermore, since the world's largest reserves of coal are found in the Soviet Union, potential competition between U.S. and U.S.S.R. for security of access will also not be at issue. The reliance on coal would also have a positive effect upon U.S. relations with Western Europe and Japan by reducing competition for Middle East oil. But such an eventuality might also broaden the gap between U.S. interests and those of its allies in terms of policies toward energy utilization and the oil-producing countries.

A U.S. commitment to a coal-based energy system would generate new types of interdependence and eliminate old ones. For example, the economic and financial problems occasioned by petroleum imports would disappear, thereby increasing U.S. international monetary flexibility. On the other hand, the possibilities of transferring gasification technology to other countries--most notably those allied with the United States--would forge new linkages among them.

None of the advanced industrial states (with the exception of the Soviet Union) possess coal reserves of sufficient magnitudes to offset their energy needs entirely. However coal gasification technology would have a marked impact within existing reserves. On balance, it appears that a coal-based energy system would significantly reduce the immediacy of present patterns of global interdependence. Coal would enable the development of strategies of independence in energy policy. But it will not necessarily ensure that this independence would extend to other issue areas. Unlike petroleum, therefore, there would be no ready spill-over effects across issue areas, either favorable or unfavorable.

The greatest obstacles to the development of coal as a viable source of energy are technological and bear directly upon environmental effects of present coal extraction processes, and, by extension, the costs of mining, processing, transportation, and distribution. Coal is not presently being produced at full capacity because of relatively low demand for sulfur fuel, new federal mine safety rules, federal environmental laws, and the need for capital. Only 50% of known reserves are recoverable within foreseeable technological bounds. Problems related to accessibility of deposits and the profitability of extraction are considerable. Existing extracting processes leave much burnable coal. Furthermore, there are substantial costs to the environment, in terms of subsidence, acid drainage, earth waste, and erosion. (Scenic degradation is an added factor.) Most of these costs are difficult to translate into precise economic terms, but are of nonnegligible magnitudes. Health and safety measures add further to the economic burdens involved.

There are additional considerations. For example, at present the coal industry cannot increase production to supply plants burning fuel oil and natural gas along the East Coast without new facilities. Such facilities would require at least three years in construction. Facilities for distribution of coal need to be updated. Transportation systems require modernization and expansion, and sufficient distribution networks are yet to be established.

Coal gasification emerges as one of the most probable technological developments of the coming decade. The need for large amounts of water will be great and scarcities in mountain areas accentuate such needs. Overall, the nature of the U.S. water resources provides an important constraint upon the large-scale development of gasification technology.

Thus, while abundant coal reserves offer a rich promise for the development of alternative sources, the costs involved amount to an important constraint. Coal may allow greater energy independence for the United States, and will undoubtedly change the nature of present interdependencies, but will also give rise to new ones. The overall cost calculus of reliance upon coal may not necessarily produce an entirely

favorable net effect. In terms of resource asymmetries and technological differentials, the United States would be at a clear advantage, effectively reducing its vulnerability to the policies and postures of other nations. From this perspective, reliance upon coal would yield a net gain. In terms of domestic economic costs involved in making such a commitment, however, the gains are less obvious. But strategic decisions regarding national security and vulnerability are seldom made on economic grounds.

C. Nuclear Energy: Fission and Fusion

The eventual development of nuclear power as a commercial source of energy will fundamentally transform the energy problem, and a global energy system predicated on nuclear power will give rise to different sets of interdependencies among nations. Petroleum and coal will come to play a different role than they do today, and the attendant asymmetries and differentials will also be different. The goal is the development of nuclear energy at prices competitive with those based on fossil fuels, but the performance of present nuclear plants is not yet equivalent to that of fossil-fuel plants, and the price mechanism reflects this difference. Indeed, even with breeder reactors, the relative costs of nuclear power and fossil fuels are not clear.

The major disadvantages of nuclear fission as a source of energy are operating hazards, technological failures, unforeseen natural disasters, and susceptibility to interference by human action through error or intentional sabotage. The critical advantages include the fact that nuclear energy emits fewer pollutants than fossil fuels, particularly in terms of sulfur oxides and other combustion products; it is a compact energy source; there are lower mining and transportation costs, less water pollution, and land disruption. Possibilities of routine human injuries are also less; but large-scale disasters, should they occur, would have far greater consequences.[6]

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[6] Allen L. Hammond, "Fission: The Pro's and Con's of Nuclear Power," Science 175 (October 13, 1972), p. 147.

If a complete breeder reactor system could be produced on a commercially viable basis, power generation could be increased 400 times above present levels. Such a development would extend the utilization of present energy sources at the consumption level anticipated for 1980 perhaps 1000-3000 years. However, the immediate problem lies in the scarcity of fuel available until 1980, when presumably, it is anticipated that breeder reactors will become a commerical reality. Thus, one expert has summarized our present predicament as follows: "Unless we find a lot more uranium, or pay a lot more money for it, or get a functioning complete breeder reactor or contained nuclear fusion within 10 to 15 years, the energy picture will be far from bright. There is good reason to hope that the breeder will come, and after it contained fusion, if the U235 and helium hold out--but there is no room for complacency."[7]

Breeder reactors are likely to offer lower thermal pollution, cheaper electric energy, and more efficient use of uranium reserves--they produce more fuel than they consume--when compared to conventional nuclear power plants.[8] The development of breeder reactors on a commercial basis has not been as rapid as was anticipated in the United States, resulting in growing criticism of how the U.S. program is being run. More specifically, it has been charged that current designs are too conservative and thus not likely to be economically attractive; that the U.S. effort is not keeping pace with those in other countries, despite large expenditures and investments; and that research on more economic fuels and potentially lower cost reactors has not received the financial support required.[9]

The installation of nuclear power plants in the next 10 to 15 years will be influenced by a number of factors, including site selection, availability of construction labor, environmental considerations, and

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[7]U.S., Congress, House of Representatives, Subcommittee of the Committee on Government Operations, The Effects of Population Growth on Natural Resources and the Environment, Hearings, 91st Cong., 1st sess., September 15-16, 1969, p. 225.

[8]Allen L. Hammond, "Breeder Reactors: Power for the Future," Science 174 (November 19, 1971), p. 807.

[9]Ibid.

safety measures.[10] Nuclear reactor hazards and safety are the subject of considerable controversy. The key issue is the ability of nuclear reactor safety systems to guard against accident should a nuclear plant lose its emergency core cooling system. Indeed, it is thought by some experts that existing safety measures may be less capable of preventing disastrous accidents than is commonly assumed.

While environmental problems are always associated with the development of any source of energy, certain consequences are unique to, or accentuated by, nuclear plants. First, there is radioactivity released in the form of radiation and radioactive liquids; second, there is marked heat dissipation from cooling water; third, these two problems increase the possibility of release of radioactivity due to potential malfunctioning of the emergency core cooling system; and fourth, there are also low-level radioactive wastes resulting from normal operation procedures.[11] Furthermore, the long delay between the generation of persistant pollutants--such as radioactive waste storage--and their appearance in the environment implies that vast amounts of pollution may be generated before there is any effective means of countering their consequences. Such countermeasures may appear too late to avoid unacceptable pollution damage. Some experts have concluded therefore, that, on balance, "fission energy does not represent an acceptable solution to the energy problem. It would place an unendurable burden on the safety and health of future generations."[12]

Controlled fusion is probably attainable, but not in the immediate future. If fusion reactors are to be commercially viable, there are other important requisites. For example, sufficiently large volumes of magnetic field at low cost need be produced, the effects of material

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[10] National Petroleum Council, U.S. Energy, p. 180.

[11] National Petroleum Council, U.S. Energy, p. 181.

[12] Dennis L. Meadows, "Nuclear Energy and Growth," Science 179 (March 2, 1973), p. 856.

damage by high energy neutrons need be minimized, and so forth.[13] Progress toward a hydrogen fusion reactor as an alternative to the breeder reactor has been slow because it involves the development of a new science, plasma physics. None of the systems of magnetic containment of fusion reaction that have been tested so far have indicated that net production of energy is economically feasible. One estimate is that controlled fusion with magnetic containment systems might be possible by about 1980.[14] But this is an optimistic assessment.

A nuclear-based energy system would reduce United States dependency upon petroleum and its interdependence in a global petroleum system. But it would not eliminate U.S. reliance upon oil as a major source of energy in the foreseeable future. Reliance on nuclear power would reduce the balance of payments deficits associated with the costs of importing petroleum. However, the very high capital costs associated with the development of nuclear energy plants and the probable increases in the costs of manufactured products associated with higher energy costs may well provide long-range adverse effects on the balance of payments. The net consequences are not necessarily positive. Despite long-range technological developments, nuclear power would not totally meet the United States' energy needs. There are some areas in which nuclear power could not be employed as a viable energy source, most notably in the transportation system.

In terms of economic interdependence, an important effect of a U.S. energy system based on nuclear power would be to reduce its reliance upon external sources. But the net economic effects for global interdependence would depend on the extent to which other states made compatible transitions to nuclear energy, their level of technological development,

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[13]David J. Rose, "Controlled Nuclear Fusion: Status and Outlook," Science 172 (May 21, 1971), p. 797.

[14]William D. Metz, "Magnetic Containment Fusion: What are the Prospects?," Science 178 (October 20, 1972), p. 291.

and the extent to which they become recipients of U.S. technology in this area. The U.S. will undoubtedly have a pivotal position in any global energy system based on nuclear power, and the rules and regulations for interaction among nations would also be developed with a strong U.S. role. Yet there are many uncertainties and potential problems. The use of nuclear power could have at least two destabilizing effects from the perspective of national or global security. First, there are increased proliferation possibilities with inadequate safeguards; second, there are possibilities of terrorist potentials in the use of plutonium itself, or in the manufacture of nuclear weapons, or in sabotage of nuclear plants. Such developments accentuate the possibility that one nation's security will be another's insecurity.

The absence of agreed-upon procedures for the diffusion of nuclear power technology throughout the international system simply aggravates the issues at hand. Lesser powers, such as India, Israel, South Africa, and Canada, are not likely to accept the directives of the major powers. Nor are the major powers likely to encourage the advent of lesser powers in the nuclear arena where their potential for acquiring nuclear weapons may be increased. The development of agreed-upon procedures for regulating the development, employment, transference, and diffusion of nuclear technology amounts to a formidable challenge and remains as the most serious gap in international transactions yet to be resolved.

Reliance on nuclear power will inevitably affect U.S. relations with its allies, perhaps in the same way as reliance on coal. It would free Middle East petroleum reserves for the use of the allies and increase the potential for U.S. detachment from West European interests. There e possibilities for the transfer of nuclear technology, yet these are less immediate than in the case of coal transfers. There are also considerable avenues for conflict among the advanced industrial societies in terms of energy policies, options and priorities which may detract from means of regulating the development of nuclear technology on a global level.

The world nuclear capacity has grown at exponential rates--from a

capacity to generate 8,356 megawatt of nuclear-produced electricity in 1960 to 39,864 megawatts in 1972. The United States had the largest capacity in that year, controlling 41% of the world's total capacity. The United Kingdom ranked second, (15%), followed by the U.S.S.R. and France (7% each). During the same year, the United States had 32 operating nuclear generating units, the United Kingdom 29, the U.S.S.R. 16, and West Germany 11. (See Figure 2.)

Reserves of the underlying resource--uranium--pose no immediate problem (see Figure 3). The United States has by far the largest reserves of less expensive uranium and also the world's largest reserves even under assumptions of high prices. These reserves might very well be underestimated since uranium prospecting in the United States has not expanded in recent years. Japan controls sufficient uranium supplies to meet its demands for the immediate future, and Japanese companies have concluded long-term supply contracts with bilateral arrangements with the West, most notably Canada and the U.S. Enriched uranium is to be supplied by the United States and there are also possibilities for domestic production of this underlying resource: uranium trade may enhance community interdependence.

In general, on economic grounds alone, the demand for uranium is likely to be met. With the development of breeder reactors (of which three are also presently under construction in the United Kingdom, the U.S.S.R., and France) the demand for uranium ore as a source of fuel among the industrialized nations will be reduced by as much as 60%. These extimates are speculative, yet appear increasingly plausible. The Soviet nuclear program to develop large, economical, and fast breeder reactors is moving more rapidly than in the United States or Western Europe, but the emphasis and the technological base are different, the Soviets preferring the use of graphite, not pressurized water reactors, as cheaper and safer than conventional reactors of similar size.[15] Fewer nuclear power plants

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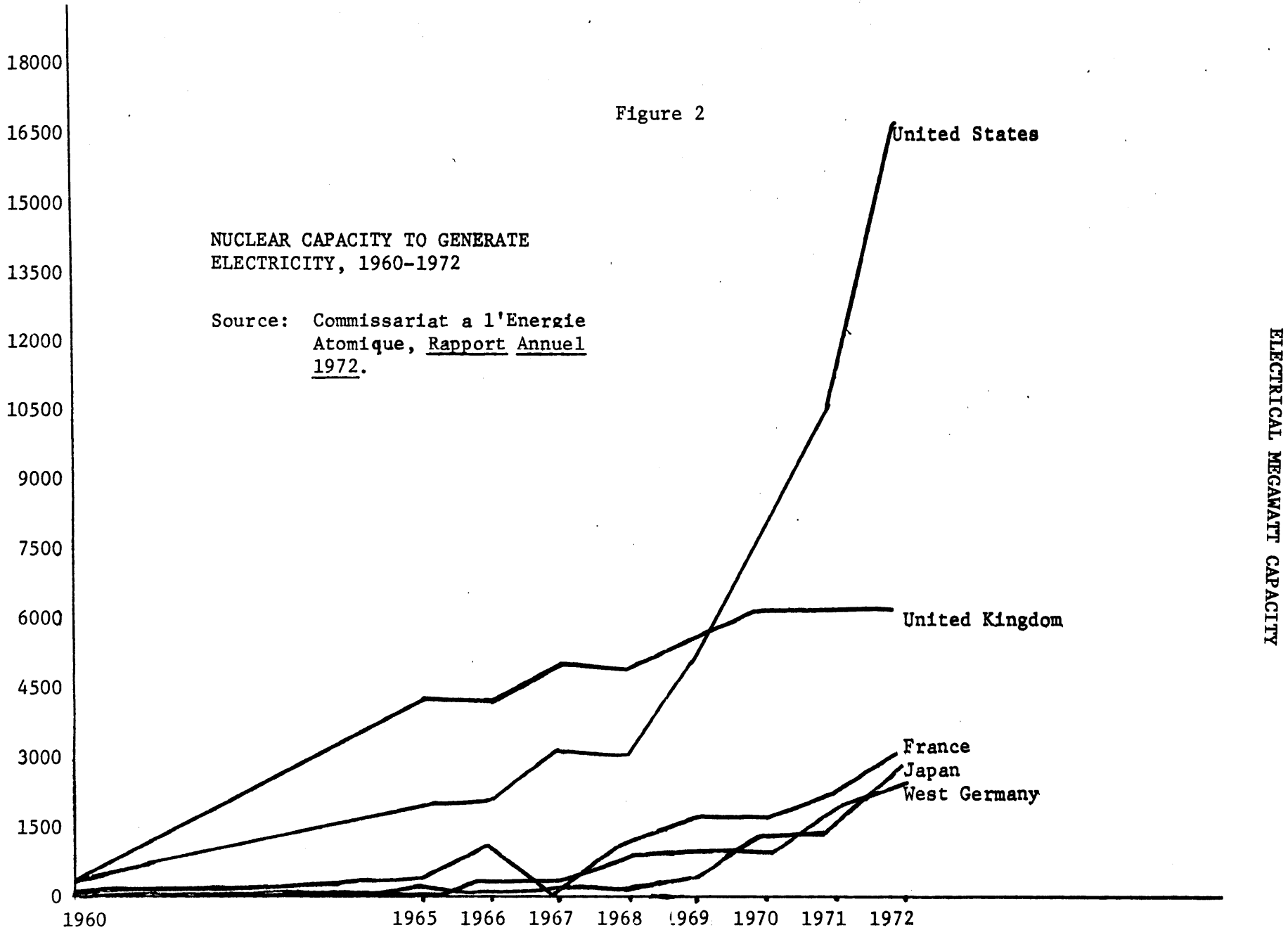
[15] Robert Gillette, "Nuclear Power in the U.S.S.R.: American Visitors Find Surprises," Science 173 (September 10, 1971), p. 1003.

Figure 2

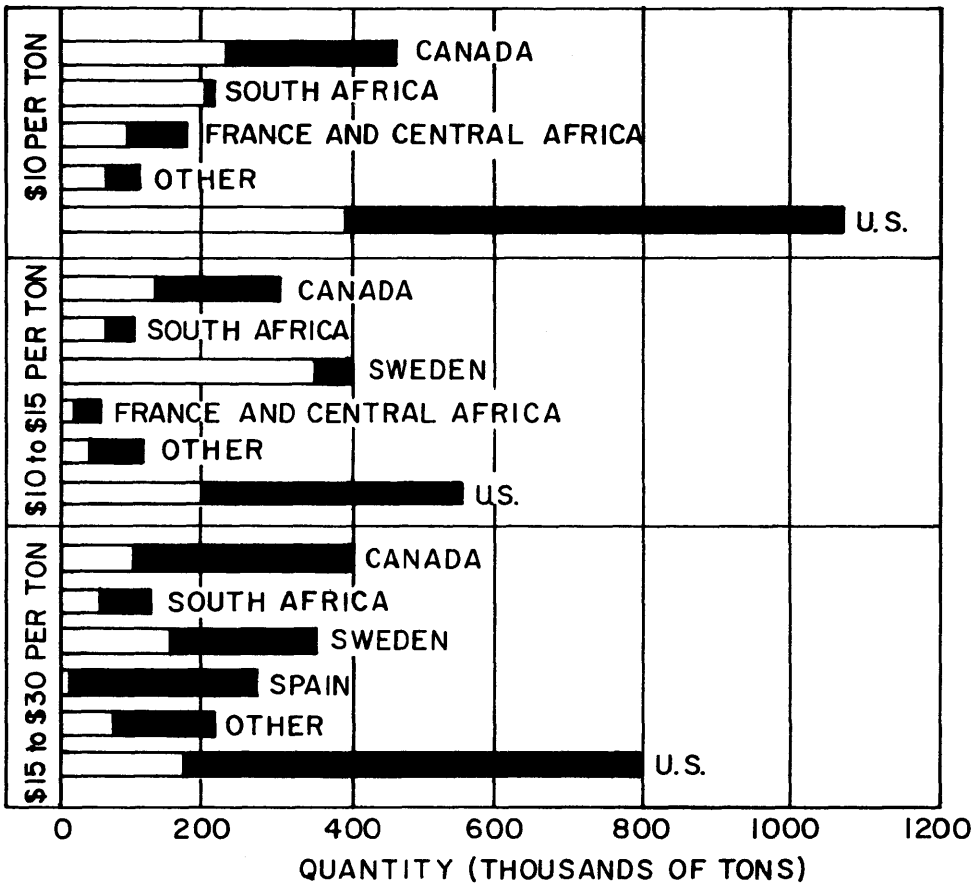


NUCLEAR CAPACITY TO GENERATE ELECTRICITY, 1960-1972

Source: Commissariat a l'Energie Atomique, Rapport Annuel 1972.

Figure 3

ESTIMATED WORLD RESERVES OF URANIUM
AT VARIOUS PRICES



WORLD RESERVES OF URANIUM, which would be the source of nuclear power derived from atomic fission, are given in tons of uranium oxide (U_3O_8). The white part of each bar represents reasonably assured supplies and the black part estimated additional supplies.

Source: M. King Hubbert, "The Energy Resources of the Earth," in Energy and Power, Scientific American (San Francisco: W. H. Freeman and Company), p. 40.

are being installed in Russia than in the U.S., in part because the Soviet Union has more untamed rivers and untapped reserves of fossil fuels. But, as in the U.S., population concentrations are far from cheap fuel supplies.[16] Thus, the Soviet nuclear program is motivated also by anticipated large-scale domestic demands.[17] Projected use of nuclear power in the Western Hemisphere is noted in Table 16.

The projected growth of reliance upon nuclear power is exponential, doubling approximately every 5 years. This rate of growth is accounted for largely by the initial low level of nuclear power for less than 1% of its energy needs; by 1985 this figure is projected to range from 15%-30% of the country's total energy requirements.

United States consumption of energy is increasing at about 6% per year; present energy sources cannot keep up with this rate of growth. Thus the development of nuclear alternatives is designed to assist in closing the anticipated gap between supply and demand. There is always the danger that the advent of nuclear power will aggrevate energy shortages by unrealistic expectations regarding unlimited sources of energy. The proverbial "ultimate energy source" is not yet on the operational horizon ; substantial obstacles are still to be overcome. The breeder reactor is anticipated as the next immediate phase in the development of energy technology. 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% to about 60% - 70%. Thermo-nuclear fusion is the next phase after the breeder reactor. Fusion represents a virtually inexhaustible source of energy. Although the dramatic successes of a Russian nuclear fusion research system (in plasma physics) have lead to optimism regarding the possibilities of controlling this energy source, the transition from the laboratory to the power station

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[16] Ibid, p. 1006.

[17] Ibid.

TABLE 16

COUNTRY BREAKDOWN OF PROJECTED USE OF NUCLEAR POWER

(GWe - 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: Rapport Annuel 1972, Commissariat a l'Energie Atomique, p. 14.

will pose formidable problems.[18] The basic problem is developing a practical way of maintaining a comparatively low-density plasma at a temperature sufficiently high so that the output of some other type of energy can be supplied to the plasma. A major focus has been on the use of magnetic fields to confine the plasma.

D. Solar Energy

Solar energy is essentially inexhaustible. But sunlight is diffuse and in some areas intermittant. The major obstacles are technological. New proposals to capture the sun's energy appear to be increasingly technically and economically feasable, but the time perspective is still in doubt. Clearly, this is not an alternative for the immediate future. The most promising developments involve collecting surfaces, specially coated and heated by super "greenhouse" effect to temperatures as high as 540°C. The heat would then be stored in a thermal reservoir attached to conventional steam boilers, turbines, and electrical generating equipment.[19] Alternatively, solar cells can be harnessed to generate electricity directly by means of photovoltaic processes bypassing an intermediate thermodynamic cycle.

Other proposals for harnessing solar energy include centralized solar-powered stations, as well as large global orbiting stations that would transmit power back to earth. Technological problems include finding ways of reducing the cost of solar cell arrays by more than a hundred times present estimates, increasing their lifetime, and developing means of energy storage.

The major advantages include the virtually unlimited availability

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[18] Robert C. Cowen, "Fusion Power: Ten Years to the Great Decision," Technology Review 73 (January 1971), p. 7.

[19] Allen L. Hammond, "Photovoltaic Cells: Direct Conversion of Solar Energy," Science 178 (November 17, 1972), p. 733.

of solar energy, with little of the environmental contamination associated with the alternatives. But while the radioactivity hazards of nuclear power systems will be avoided, cooling water for steam turbines will be required, thus the potential for thermal pollution will remain. Solar power used on a large scale may also alter the thermal balance in central power plants. Resulting thermal pollution may be an even greater problem than for nuclear power plants. The costs involved are still enormous, and their reduction requires greater investments in research and development than has been the case to date. Because the technology is still not well developed, solar power is less likely to be a candidate for a global energy system even by the turn of the century. It is estimated that its maximum contribution to total energy requirements will not be greater than 20% of expected consumption. On balance, however, once the many technological problems are resolved, the advantages by far offset the disadvantages.

The use of solar energy in the United States would reduce the balance of payments deficits associated with the costs of importing petroleum. But, as in the case of nuclear energy, reliance upon solar power may increase the price of U.S. manufactured goods (over and above regular inflationary effects) because of the high capital costs involved. The net effect may well be a worsening of U.S. balance of payments. But many exogenous factors are involved which would essentially invalidate such sweeping generalizations.

Because solar power would be a renewable, nonexhaustible source of energy, it would evoke none of the problems associated with securing access to scarce supplies. 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 supplies available to its allies. Therefore, a major consequence of such a development would be to reduce the interdependence

between the energy-related interests of the United States and those of its allies. Alternatively, the possibilities for shaping solar technology might increase possibilities for community-building, 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. In those terms, the resulting global linkages will be along the lines of increasing dependence rather than interdependence, as is presently the case with respect to petroleum. There are also possibilities of employing solar (or any advanced) technology as a political instrument 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. Its specific manifestations will undoubtedly differ, but the basic types of dependencies (rather than interdependencies) will continue.

From a global perspective, the most critical problem involves the development of regularized means of interactions and transactions related to access and transmission of solar energy. There are no existing international (or even national) institutions yet vested with the responsibility of examining alternative means of regulating such transactions or even anticipating the political and other global implications of a world energy system based on solar power.

E. Geothermal Energy

Geothermal power is already employed to generate electricity through the use of volcanic steam and, for space heating, through the use of hot water.[20] But its overall use as a source of energy is still quite limited. Geothermal heat could be employed more extensively in the near future, but important technological problems still remain. Geothermal plants have environmental problems ranging from air and water pollution to land

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[20]Guyol, Energy in the Perspective, p. 49.

disturbances occasioned by pumping. But many of these problems can be resolved given present levels of technology.

Geothermal heat is essentially a form of fossil nuclear energy produced primarily by the decay of radioactive materials in the earth's interior.[21] 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.[22] But there are major uncertainties regarding the magnitude of recoverable reserves and resource bases. The absence of sufficient investments in research and development has 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. The major obstacle lies in the ability to drill holes of greater depth than is presently possible.[23]

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.

Under the optimistic assumption that geothermal sources of energy could be developed on a competitive economic basis in the near future, these would supply no more than 1% of anticipated U.S. energy requirements in 1985. Indeed, there are major uncertainties associated with existing projections of energy to be obtained from geothermal sources.[24] Thus,

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[21] Allen L. Hammond, "Geothermal Energy: An Emergency Major Resource," Science 177 (September 15, 1972), p. 978.

[22] National Petroleum Council, U.S. Energy, p. 229.

[23] Ibid., p. 230.

[24] Ibid., p. 228.

its total contribution to U.S. energy uses would be negligible, except perhaps in areas of the West and Southwest where the underlying resource base would make it economically possible to draw upon geothermal energy.

The use of geothermal energy would have marginal, if any, effects upon U.S. balance of payments or other economic interactions at a global level. It would complement existing sources of energy, but in no way provide an extensive impact on either national or world energy systems. In all respects, the development and use of geothermal energy would be a highly capital-intensive and highly costly enterprise.

Because geothermal energy is a nonvulnerable energy resource, it will be subject to none of the security-of-access problems associated with petroleum. And while the possibilities of technology transfer in the areas of exploration and exploitation exist, they are as yet sufficiently limited so as not to provide an important input in U.S. relations with its allies or with the rest of the world. Again, regularized means of global interaction in a world energy system based on geothermal power do not exist, nor is their development anticipated or foreseen in the immediate future or even by the turn of the century. As such, the large-scale reliance upon geothermal energy does not appear to be a credible alternative at the present time.

F. Tar Sands and Shale Oil

The term "tar sands" refers to hydrocarbon-bearing deposits distinquished 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 oil production. Reservoir energy is minimal, so that some outside form of energy is needed to produce energy from tar sands.[25]

There are large tar sand deposits in Canada, Venezuela, and possibly

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[25] Ibid., p. 225.

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. The large deposits of tar sands in Canada will not allow a rapid rate of production by 1985. Technological problems, construction lead time, saturation in the construction industry, and capital requirements will all tend to limit the installation of new plants.[26] On balance, it is expected, therefore, that the rate of production by 1985 will not exceed 1.25 MMB/D regardless of rises in the price of alternative sources of energy.[27] Since Canadian tar sands and heavy oil deposits will be the only source of commercial production for this type of energy at least through 1985, it is not anticipated to make any significant contribution to the meeting of energy consumption levels in the United States.[28]

Oil shale is an oil-bearing rock which may be burned directly and distilled to obtain oil products.[29] The United States has extensive reserves of oil shale which could be marshalled as a viable source of energy. However, plans to develop these deposits have temporarily been put aside largely because the extraction of oil shale requires large amounts of water to process the oil from shale, and water is extremely scarce in areas where shale is available. 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.

World production of shale oil is about 25 million tons per year. This figure does not include production in mainland China; it does,

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[26] Ibid., p. 226.

[27] Ibid.

[28] Ibid., p. 225.

[29] Guyol, Energy in the Perspective, p. 49.

however, allow for the estimate that the Soviet Union is the main producer of shale oil.[30] Oil shale deposits in the United States western areas are estimated to yield possibly 1.8 trillion barrels of crude shale oil. But less than 6 billion barrels of recoverable reserves could be obtained given limitations imposed by construction time and environmental and legal constraints.[31]

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 construction, and in the establishment of increased automation must be removed before any significant cost reductions will be possible.[32] There are also considerable ambiguities regarding the legal status of shale lands. Mining claims are yet to be accorded clear legal status. Federal leasing policies will invariably influence the level and rate of production, largely because over 80% of oil shale resources are located on Federal lands.[33] Again, as national energy priorities are reassessed, and appropriate measures taken, such problems might be resolved satisfactorily in a direction that would enhance the potential contribution of shale oil to U.S. energy needs.

It is extremely unlikely that reliance on shale oil would have any direct impact on U.S. economic or political relations with its allies or with other countries. The potential global interdependencies associated with coal, nuclear power, or solar energy are not likely to extend to tar sands or shale oil. In this respect, the international implications of greater utilization of tar sands or shale oil would be similar to those pertaining to geothermal energy. All three sources of energy will bear only negligibly on evolving patterns of global interdependence in the energy field.

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[30] Ibid.

[31] National Petroleum Council, U.S. Energy, p. 4.

[32] Ibid., p. 219.

[33] Ibid., p. 206.

G. Global Interdependence and Alternative Energy Sources

Our analysis of the interdependence implications of each of these alternative sources has focused upon their individual attributes. Table 17 presents a comparative assessment of the alternatives to petroleum in terms of their implications for global interdependence, highlighting the comparative costs, gains, and losses associated with each alternative energy source. Some of these inferences are predicated on empirical data, others are speculative; yet all point to the marked differences in the implications for global interdependence associated with the alternatives to petroleum. The linkages in a world energy system based on oil imports and exports will not persist in a world of nuclear or solar energy. Similarly, the implications for the development of viable patterns of global interdependence will also differ.

For the United States (or other industrial countries) to invest in the development of alternatives to petroleum is to make some commitment toward autonomy of action in the energy field. In many cases, this autonomy would be too costly--in political, environmental, as well as dollar terms. Some alternatives might indeed yield national autonomy. But this independence might have global implications which transcend national boundaries, possibly giving rise to new types of interdependencies. We have noted such potentials with respect to coal and to nuclear fission and fusion. In each case, possibilities of sharing or transferring advanced technology--or withholding such technology--would have marked implications for community-building among the advanced industrial societies and for their relations with the less advanced states.

The development of any alternative to petroleum would not eliminate the United States' use of oil as a primary source of energy. But it would reduce its dependence on imports for meeting consumption needs. The development of any alternative to petroleum would certainly enhance the United States' position in the world energy system. It would place the U.S. in a pivotal position. In effect, the United States would become the functional equivalent of OPEC in the present petroleum market.

While any alternative to petroleum will also ensure U.S. dominance in

Table 17

ALTERNATIVE ENERGY SYSTEMS AND ISSUES IN GLOBAL INTERDEPENDENCE

	COAL	FISSION	FUSION	SOLAR	GEOTHERMAL	TAR SANDS OIL SHALE
Political and economic consequences	1) Expansion of total resources 2) Exportable 3) Domestic gains 4) Transport costs 5) Balance of payments reduction	1) Expansion of total energy resources 2) High cost 3) High capital use 4) Uranium costs 5) Reduced B of P	1) Expansion of total energy resources 2) High cost 3) High capital use	1) Expansion of total energy resources 2) High cost 3) High capital use	1) Expansion of total energy resources 2) High cost	1) Expansion of total energy resources 2) High cost 3) Exportable
Security of access	1) Nonvulnerable resource	1) Nonvulnerable resource 2) Proliferation potential 3) Terrorist potential	1) Nonvulnerable resource 2) Proliferation potential	1) Nonvulnerable resource	1) Nonvulnerable resource	1) Nonvulnerable resource
Implications community-building	1) Frees oil resources for allies 2) Technology transfers 3) Divergent allied interests	1) Frees oil resources for allies 2) Divergent allied interests	1) Frees oil resources for allies 2) Divergent allied interests	1) Frees oil resources for allies 2) Technology transfers	1) Frees oil resources for allies 2) Technology transfers	1) Frees oil resources for allies 2) Technology transfers
Potential of environmental impact	1) Strip mining costs 2) Black lung costs 3) Air pollution costs	1) Radiation hazards 2) Accident potential 3) Waste disposal 4) Thermal pollution	1) Radiation hazards 2) Accident potential 3) Thermal pollution	1) Heat release costs	1) Air pollution costs 2) Land disturbance 3) Water pollution	1) Water use costs 2) Strip mining costs

the global energy system, the economic costs of this dominance are extensive, as will be the environmental costs. And the bounds of global interdependence so clearly delimited in the petroleum system will give way before more ambiguous needs, demands, and ways of satisfying them. So too, the petroleum system has emerged as testimony to the pervasiveness of interdependence between producers and consumers. The development of alternative sources will most certainly destroy these linkages, substituting a new set of relationships, the implications of which are not yet delineated.

Yet this much is clear: because of the countervailing global effects of alternative energy sources--tending toward cooperation on the one hand and conflict on the other--it is important that both consuming and producing nations develop viable means of regulating their interactions and accommodating their needs and demands. Every alternative to petroleum requires major technological developments, and only the advance industrial societies are in a position to make the required investments. Differentials in levels of technology throughout the globe will result in marked inequalities of access to primary energy in the years to come. Thus, the question of developing viable global energy regimes amounts to a major challenge. Regulating interactions, transactions, and flows of energy throughout the international system will rapidly become the single most critical issue confronting all nations, large and small. Access to sources of energy is a basic prerequisite to national survival in an industrialized world. The following chapter illustrates some alternative global energy regimes associated with petroleum and its alternatives. The focus will be upon control and distribution of energy resources, alternative price systems, and alternative regulatory mechanism for global interactions.

Chapter VIII

ALTERNATIVE ENERGY REGIMES AND PATTERNS OF GLOBAL INTERDEPENDENCE

The development of alternative sources of energy for use on a world-wide basis would give rise to fundamentally different patterns of global dependencies and interdependencies. Such patterns may in turn provide the basis for different foreign policy options and different preferences regarding energy transactions. More important, the alternatives to petroleum would shape the nature of global equalities and inequalities differently. So, too, the implicit and explicit rules by which trans-national factors regulate the production and distribution of energy would change.

The different regime possibilities associated with alternative sources of energy are shaped by (a) the structure of the economic and political relations among actors, particularly the flows of energy across national boundaries; (b) the organizational and institutional mechanisms designed to regulate such flows; (c) the strategic and security concerns of the individual actors; and (d) the expected impacts upon the environment. Flows of energy give rise to higher order effects, particularly economic ones. In Chapter IV we described the second and higher order effects resulting from increases in the price of petroleum.

Similarly, there are higher order effects of a political and environmental nature which have been noted, though not described in any great detail. Energy systems--whatever the underlying resource might be--are characterized by basic asymmetries in relations among nations. These asymmetries are manifested in flows of energy across national boundaries (much as has been described in the case of petroleum), asymmetries in resource control (as illustrated by changing relations among the multinational corporation, OPEC, and the producing and consuming countries), asymmetries in distribution of energy (characterized primarily with reference to the role of the oil companies in transferring petroleum from producers to consumers), and asymmetries in technology (again, illustrated by the waning dependence of the producing countries upon the knowledge and skills of the oil companies). The underlying asymmetry in the petroleum system, however, pertains to the location of oil in technology-poor areas and the concentration of advanced technology

in resource-poor areas. This basic imbalance has provided the foundation for the resulting interdependencies among producer and consumer countries.

Asymmetries such as these are, in turn, shaped by differentials among nations, in terms of level of knowledge and skills (technology), resource availability (in terms of the energy base), and population (in terms of the needs for energy). Such differentials dictate policies regarding energy demand and desired price. Indeed, the price issue lies at the core of any energy system: the higher the price of petroleum, the greater the investments in alternative sources.

The absence of agreements among nations over the control of the energy source, its distribution, and price becomes reflected in the nature of the regulatory mechanisms that may emerge. Such mechanisms might be explicit, or they may be implicit in terms of the ways one nation (or groups of nations) affects the behavior of others. Increasingly OPEC has provided the major regulation in the world petroleum system by establishing prices and providing guidelines for production and exploration. Sufficient development of alternative energy sources would undermine the role of OPEC and render it a nonrelevant actor in the new global energy system.

The constraints on the development of alternative energy systems are primarily technological and bear directly upon economic costs and environmental impact. There are fundamental differences among alternative sources of energy and among the regimes they would shape.

A. Control of Energy Sources

Control over the initial availability of the energy product is predicated on either geographical or technological grounds. For example, in the case of petroleum, the underlying resource is geographically based, giving some nations control over a scarce resource more or less by geological accident. The same is true for geothermal energy. But control over nuclear energy (fission and fusion) and solar power is primarily technological. Nations with advanced levels of knowledge and skills, and

with the required capital for research and development, will exercise a control that is not shared by others.

Differentials in rates of technological advance will further exacerbate the gap between the technologically rich and technologically poor nations. Increasingly, the transfer of technology across national boundaries will become a major dimension of international transactions, giving rise to new types of dependencies. And, given the technological inequalities, it is not clear how such dependencies may be transformed into interdependencies. Additionally, the time lags involved in the transfer of technology are such as to preclude any rapid technological transformations which might reduce the differentials among nations.

Only in the case of oil shale and tar sands will control be shaped by geographic as well as technological factors. Geological developments make the underlying resources available to one nation rather than another; but the ability to exploit such developments is predicated on the availability of the required technology.

B. Distribution of Energy Resources

Economic and political factors tend to determine the distribution patterns of energy as a basic resource. While the specifics differ from case to case, certain general patterns can be identified. In the case of petroleum the multinational corporations have for long exercised control over the flows of petroleum and the ways in 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 a petroleum "weapon" as a policy instrument is testimony to this development.

A similar combination of economic and political factors will serve to shape the distribution of nuclear energy. While initially the availability of uranium might be geographically determined, technological

developments, notably in the form of breeder reactors, will play an increasing role in the distribution and 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 the major donors.

The distribution (and diffusion) of solar power, energy from shale oil 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.

C. The Issue of Price

Both control and distribution of energy resources bear directly upon the issue of price. The price of petroleum is presently determined primarily by economic factors and by the concentration of oil in certain countries. While the price bears little relation to the cost of extraction, economic considerations exogenous to the petroleum system have tended to shape the price parameters. Although political factors (most notably inter-Arab politics) have become crucial, an adequate explanation of the present price predicament can be undertaken on purely economic grounds. The financial gains accrued to the producer countries by virtue of an increase in petroleum prices are sufficiently great as to provide a powerful rationale for such increases, with political considerations emerging as multiplier effects.

A similar assessment can be made with respect to nuclear energy, with the difference that the price system will be determined by the advanced industrial societies. Their monopoly over the technological developments underlying the use of nuclear energy will provide them with substantial control, if not domination, of a global energy system predicated on

nuclear fission. As with petroleum, it is quite likely that the price of energy will not be directly related to the cost of making the underlying resources available. In many ways, a nuclear-based world energy system will share some of the attributes of the present petroleum system, with the difference that control over product, distribution, and price will be exercised by the advanced industrial societies.

The price for other sources of energy--solar power, oil shale and tar sands, and geothermal energy--will be determined primarily by economic factors. Since the commercial viability of these sources is still not immediate, the factors that might divorce cost from price are not readily identifiable. Nonetheless, the focus of control will be with the technologically advanced societies.

D. Regulatory Mechanism for Alternative Energy Systems

Despite the absence of multinational organizations to regulate energy interactions among nations, some specific institutions presently perform this task. Thus, in the case of petroleum, the Organization of Petroleum Exporting Countries performs the major regulatory activities within the world petroleum system. Although the members of OPEC do not wish to be viewed as a cartel, the consumer countries do regard them as such and acknowledge their effectiveness to date in influencing the price of petroleum.

The major regulatory mechanisms in a nuclear energy system are likely to be, first, national, and then, if a regime of transactions develops, possibly international as well, but control will be wielded primarily by national authorities and only secondarily by coordination among the technologically developed countries. The inability of states to develop viable means of regulating the development, transfer, and diffusion of nuclear technology is only further evidence of the difficulties of establishing a viable international regime for the regulation of nuclear energy.

The major regulatory mechanisms for other alternative sources of

energy within the foreseeable future will most likely be national. The development of technology for solar power, energy from shale oil and tar sands, and geothermal energy has been initiated, controlled, and financed nationally. And while private companies may have a crucial role in the development stage, national governments will increasingly exercise control over international transactions.

In political terms, the major issues of the future thus concern the control, allocation, distribution, and cost of energy resources and the technology required to make them available. The greater the quantities of energy at man's disposal, the more crucial becomes the old Roman question: "Quis custodiet custodies?" ("Who is to control the controllers?"). The question pertains not only to whatever type of international institution might be developed for the control of nuclear weaponry, but more critically, to the regulation, access, and availability of energy allocated for peaceful uses and the technology for generating and applying it. However indispensable many of them may be, the international institutions that have been developed to date are scarcely adequate for regulating the transactions associated with alternative sources of energy.

An immediate difficulty emerges from the fact that we do not fully understand the potential political and other implications associated with the development and use of different sources of energy, nor are the overall environmental effects completely apparent. A vast amount of research needs to be done. But new policies and new programs do not await such investigations. The next 10 years will be critical, and there will be time lags associated with even the more determined efforts to explore these issues. At the very least, we need to develop means of overcoming incremental and piecemeal bureaucratic approaches to such issues; we need to take into account the long-range implications of energy-related decisions made today; and we need to find ways of avoiding the common snow-balling process whereby efforts to find a solution to one problem generate other problems, the solutions of which, in turn, give rise to still further problems.

E. Alternative Energy Regimes: An Illustration

The problem of establishing international patterns of collaborative behavior in the energy field is undoubtedly one of the most critical of our times. The absence of agreements among nations regarding control of energy products, distribution, price system, and regulatory mechanism accentuates the need for the development of collaborative behavior. A brief illustration of four alternative modes of regulating international energy transactions is presented in Table 18. Each alternative addresses itself to the control and distribution of energy products, to the price system, and to the underlying regulatory mechanism. The purpose of this table is thus to indicate the differences among free market, joint, multilateral, and international regimes in their accommodation to the requirements of collaborative behavior.

An international energy regime based on free market principles would also predicate control of energy products upon resource, capital, and technological considerations and the distribution of energy upon market functions. But, specific national interests would be taken into account, allowing national governments to exercise direct control over the structure of the emerging regime. And finally, a joint regime 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 regimes would differ substantially in their underlying premises and in their approach to the issues of price, control, and distribution of energy products. A multilateral regime 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 energy regime would develop institutionalized means of assessing the energy needs of its members and develop means of apportioning available resources accordingly. In such a situation, the conventional market function would be superseded by institutionalized means of

Table 18

FACTORS IN THE CONTROL, DISTRIBUTION, PRICE, AND REGULATION

OF ALTERNATIVE ENERGY SOURCES

	PETROLEUM	NUCLEAR	SOLAR	OIL SHALE & TAR SANDS	GEOTHERMAL
CONTROL OF PRODUCT	GEOGRAPHIC BASE	TECHNOLOGICAL BASE	TECHNOLOGICAL BASE	GEOGRAPHIC & TECHNOLOGICAL BASE	GEOGRAPHIC BASE
DISTRIBUTION OF PRODUCT	ECONOMIC & POLITICAL	ECONOMIC & POLITICAL	ECONOMIC	ECONOMIC	ECONOMIC
PRICE	ECONOMIC DETERMINANTS & MONOPOLY	ECONOMIC DETERMINANTS & MONOPOLY	ECONOMIC DETERMINANTS	ECONOMIC DETERMINANTS	ECONOMIC DETERMINANTS
REGULATORY MECHANISM	CARTEL	NATIONAL & INTERNATIONAL	NATIONAL	NATIONAL	NATIONAL

regulating energy flows based on procedures agreed upon by all members of the regime. The distribution of energy products in a multilateral regime would differ from that in an international regime. 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 regime is likely to be predicated upon principles of community equity as well as supply and demand factors; but in an international regime, a broader view of equity would predominate, encompassing the interests of all members of the regime. Similarly, the underlying regulatory mechanisms would also differ. Thus, a multilateral regime would develop means of regulating energy transactions according to community-oriented rules and regulations, whereas an international regime 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 regimes would be fundamentally different from those for free market or joint regimes.

Table 19 illustrates the differences between these four regime alternatives and highlights the range of governmental control over modes of interaction and the extent to which transactions are explicitly controlled on a formal bureaucratic basis. In each case, direct government-to-government relations are accompanied by transactions at the nongovernmental level. Thus there is a transnational dimension to each of these alternative energy regimes.

Autarky is still another option. But such a posture would, in effect, negate the possibility of developing a viable regime. An autarky policy amounts to a nonregime 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

Table 19

SYSTEM REQUISITES FOR ALTERNATIVE ENERGY REGIMES

ALTERNATIVE REGIME / SYSTEM REQUISITES	FREE MARKET REGIME	JOINT REGIME	MULTILATERAL REGIME	INTERNATIONAL REGIME
CONTROL OF PRODUCT	BASED ON RESOURCE, CAPITAL, & TECHNOLOGY CONSIDERATIONS	BASED ON RESOURCE, CAPITAL, & TECHNOLOGY CONSIDERATIONS	COMMUNITY-BASED BENEFITS	INSTITUTIONALIZED CONTROL OF DEMAND CONSIDERATIONS
DISTRIBUTION OF PRODUCT	MARKET FUNCTION	MARKET FUNCTION & ACCOMMODATED NATIONAL INTERESTS	COMMUNITY INTERESTS AND MARKET FUNCTION	SOCIAL WELFARE CONSIDERATIONS
PRICE	SUPPLY & DEMAND FACTORS	SUPPLY & DEMAND FACTORS	COMMUNITY EQUITY & SUPPLY & DEMAND FACTORS	INTERNATIONAL EQUITY
REGULATORY MECHANISM	PRICE	PRICE AND NATIONAL INTEREST	COMMUNITY ORGANIZATION	INTERNATIONAL PUBLIC ORGANIZATION

such transactions. The choice of such means is basically a question of regime. The alternatives noted here have been presented merely for illustrative purposes. Tables 18 and 19 are only a point of departure. Much more remains to be done.

BIBLIOGRAPHY

BOOKS

Acosta Hermoso, Eduardo. Analisis Historico de la OPEP. Merida: Facultad de Economia Universidad de Los Andes, Talleres Graficos Universitarios, 1969.

_____. La Comision Economica de la OPEP. Caracas: Editorial Arte, 1971.

Ad Hoc Forum Policy Committee. Uranium Enrichment. New York: Atomic Industrial Forum, 1972.

Adams, Michael. The Middle East: A Handbook. New York: Frederick A. Praeger, 1971.

Adelman, Morris Albert. The World Petroleum Market. Baltimore: Resources for the Future, The Johns Hopkins University Press, 1972.

Albers, John P. et a. Summary Petroleum and Selected Mineral Statistics for 120 Countries, Including Offshore Areas. Washington, D. C.: U. S. Government Printing Office, 1973.

American Petroleum Institute. Annual Statistical Review: 1956-1970. Washington, D. C.: American Petroleum Institute, 1971.

_____. Petroleum Facts and Figures. New York: American Petroleum Institute, 1971.

Armstead, H. Christopher, ed. Geothermal Energy. New York: UNESCO, 1973.

Beaton, Leonard. The Reform of Power. New York: Viking Press, 1972.

Bergsten, C. Fred, ed. The Future of the International Economic Order: An Agenda for Research. Lexington, Mass.: D. C. Heath and Company, 1973.

Bhagwati, Jagdish N., ed. Economics and World Order: From the 1970's to the 1990's. New York: The Free Press, 1972.

Blondel, Sprinelli Daniele. L'Energie dans l'Europe des Six, Fondements d'une Politique Energetique Commune. Paris: Editions Cryas, 1966.

Bobo, D. L. et al. A Survey of Fuel and Energy Information Sources. McLean, Va.: Mitre Corporation, 1970.

Booth, J. L. Fuel and Power in Ireland. Dublin: Dublin Economic Research Institute, 1966.

The British Petroleum Company. BP Statistical Review of the World Oil Industry - 1972. London: The British Petroleum Company, 1973.

Brockett, E. D. Petroleum Resources Under the Ocean Floor. Washington, D. C.: National Petroleum Council, 1969.

Calleo, David P., and Rowland, Benjamin M. America and the World Political Economy. Bloomington: Indiana University Press, 1973.

Campbell, John C., and Caruso, Helen. The West and the Middle East. New York: Council on Foreign Relations, 1972.

Chase Manhattan Bank. Outlook for Energy in the United States. New York: Chase Manhattan Bank, 1968.

Clarke, J. L., and Fisher, W. B. Populations of the Middle East and North Africa: A Geographical Approach. New York: Africana Publishing Corporation, 1972.

Cohen, Benjamin J. The Question of Imperialism: The Political Economics of Domination. New York: Basic Books, 1973.

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

Congressional Quarterly. Energy Crisis in America. Washington, D. C.: U. S. Government Printing Office, 1973.

Cooper, Richard N. The Economics of Interdependence. New York: McGraw-Hill Book Company, 1968.

Copeland, Miles. The Game of Nations. London: Weidenfeld and Nicolson, 1969.

Coplin, William D., ed. The Analysis of Transnational Policy Issues: A Summary of the International Relations Panels of the 1974 American Political Science Convention. Ithaca, N. Y.: The Consortium for International Studies Education, 1974.

Darmstadter, Joel. Energy in the World Economy. Baltimore: The Johns Hopkins University Press, 1971

Dawn, Ernest. From Ottomonism to Arabism: Essays on the Origin of Arab Nationalism. Bloomington: Indiana University Press, 1973.

DeGolyer and McNaughton. Twentieth Century Petroleum Statistics: 1973 Dallas: DeGolyer and MacNaughton, 1973.

Ebel, Robert E. Communist Trade in Oil and Gas. New York: Frederick A. Praeger, 1970.

The Economist Intelligence Unit. International Oil Symposium: Selected Papers. London: The Economist Intelligence Unit, 1972.

Emmanuel, Arghiri. Unequal Exchange: A Study of the Imperialism of Trade. New York: Monthly Review Press, 1972.

Evron, Yair. The Middle East: Nations, Superpowers and Wars. New York: Montly Review Press, 1972.

Fisher, Eugene M., and Bassiouni, M. Cherif. Storm Over the Arab World. Chicago: Follett Publishing Company, 1972.

Flawn, Peter T. Mineral Resources. Chicago: Rand McNally and Company, 1966.

Garvey, Gerald. Energy, Ecology, Economy. New York: W. W. Norton and Company, 1972.

Gray, T. J., and Gashus, O. K., eds. Tidal Power. New York: Plenum, 1972.

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

Haas, Enrst B. Tangle of Hopes: American Commitments and World Order. Englewood Cliffs, N. J.: Prentice-Hall, 1969.

Haim, Sylvia G., ed. Arab Nationalism: An Anthology. Berkeley: versity of California Press, 1962.

Halloran, Richard. Japan: Images and Realities. Tokyo: Charles E. Tuttle Company, 1972.

Halperin, Morton H. et al. Bureaucratic Politics and Foreign Policy. Washington, D. C.: The Brookings Institution, 1974.

Hammond, Allen L.; Metz, William D.; and Maugh, Thomas M. Energy and the Future. Washington, D. C.: American Association for the Advancement of Science, 1973.

Harris, C. P. Nationalism and Revolution in Egypt: The Role of the Muslim Brotherhood. The Hague: Mouton and Co., 1964.

Hartshorn, Jack E. Oil Companies and Governments: An Account of the International Oil Industry in Its Political Environment. London: Faber and Faber, 1962.

Helfrich, Harold W., Jr., ed. The Environmental Crisis. 2 vols. New York: Yale University Press, 1970.

Hellmann, Donald C. Japan and East Asia: The New International Order. New York: Frederick A. Praeger, 1972.

Hirst, David. Oil and Public Opinion in the Middle East. New York: Frederick A. Praeger, 1972.

Hittman Associates. Study of the Future Supply of Low Sulfur Oil for Electrical Utilities. Columbia, Md.: Environmental Protection Agency, Office of Air Programs, 1972.

Hopkins, Harry. Egypt the Crucible: The Unfinished Revolution in the Arab World. London: Seeker and Warburg, 1969.

Hottel, H. C., and Howard, J. B. New Energy Technology - Some Facts and Assessments. Cambridge: M. I. T. Press, 1971.

Hsiao, Gene T. Sino-American Detente and Its Policy Implications. New York: Frederick A. Praeger, 1974.

James, Alan, ed. The Bases of International Order: Essays in Honour of C. A. W. Manning. London: Oxford University Press, 1973.

Jensen, Walter Godfried Willem. Energy and the Economy of Nations. Henley-on-Thames, Oxfordshire: G. T. Foulis and Co., 1970.

_____. Energy in Europe, 1945-1980. London: G. T. Foulis and Co., 1967.

_____. Nuclear Power. Henley-on-Thames, Oxfordshire: G. T. Foulis and Co., 1969.

Kaplan, Morton. Strategic Thinking and Its Moral Implications. Chicago: University of Chicago Center for Policy Studies, 1973.

Kapoor, A., and Grub, Phillip D. The Multinational Enterprise in Transition. Princeton: The Darwin Press, 1972.

Kerr, Malcolm. The Arab Cold War, Gamal Abdal Nasir and His Rivals, 1958-1970. New York: Oxford University Press, 1971.

Kindleberger, Charles. The International Corporation. Cambridge: M. I. T. Press, 1970.

Kneese, Allen V., and Blair, R., eds. Environmental Quality Analysis, Theory and Method in the Social Sciences. Baltimore: The Johns Hopkins University Press, 1972.

Kohnstamm, Max, and Hager, Wolfgang, eds. A Nation Writ Large? New York: John Wiley and Sons, 1973.

Kramish, Arnold. Atomic Energy in the Soviet Union. Stanford, Calif.: Stanford University Press, 1959.

Lacouture, Jean. Nasser. New York: Alfred A. Knopf, 1973.

Landen, Robert Geran. Oman Since 1856: Disruptive Modernization of a Traditional Arab Society. Princeton: Princeton University Press, 1967.

Landsberg, Hans M., and Schurr, Sam H. Energy in the United States. New York: Random House, 1968.

Lesh, Donald R., ed. A Nation Observed: Perspectives on America's World Role. A Potomac Associates Book. New York: Basic Books, 1974.

Little, Arthur D. Energy Policy Issues for the United States. Cambridge, Mass.: Arthur D. Little, 1971.

Lockwood, William W. The Economic Development of Japan: Growth and Structural Change: 1868-1938. Princeton: Princeton University Press, 1968.

Mallakh, Ragaei El-. Economic Development and Regional Cooperation: Kuwait. Chicago: University of Chicago Press, 1968.

Marine Engineers' Beneficial Association. The American Oil Industry. New York: Marine Engineers' Beneficial Association, 1973.

Martinez, Anibal. Nuestro Petroleo, Defense de un Recurso Agotable. Madrid: Taller de Artes Grafica Minerva, 1963.

May, Ernest R. "Lessons" From the Past: The Use and Misuse of History in American Foreign Policy. New York: Oxford University Press, 1973.

McDonald, Robert W. The League of the Arab States: A Study in the Dynamics of Regional Organizations. Princeton: Princeton University Press, 1965.

McGowan, Patrick J., ed. Sage International Yearbook of Foreign Policy Studies. vol. 1. Beverly Hills, Calif.: Sage Publications, 1973.

McGowan, Patrick J., and Shapiro, Howard B. The Comparative Study of Foreign Policy: A Survey of Scientific Findings. Sage Library of Social Research, vol. 4. Beverly Hills, Calif.: Sage Publications, 1973.

Mepple, Peter, ed. Petroleum Supply and Demand. London: Institute of Petroleum, 1966.

Mikdashi, Zuhayr. The Community of Oil-Exporting Countries. Ithaca, N. Y.: Cornell University Press, 1972.

Mikesell, Raymond F., ed. Foreign Investment in the Petroleum and Mineral Industries. Baltimore: The Johns Hopkins University Press, 1971

Ministry of Mines Staff. Venezuela and OPEC - Documents, Speeches and Venezuelan and World Views Relating to the Antecedents and Creation of OPEC. Caracas: Imprenta Nacional, 1961

Mitre Corporation. Energy, Resources and the Environment. Springfield, Va.: U. S. Department of Commerce, 1972.

Montiel Ortega, Leonardo. Conflicto en el Petroleo Venezolano. Caracas: Editorial Artegrafia, 1972.

Morgenstern, Oskar; Knorr, Klaus; and Heiss, Klaus P. Long Term Projections of Power: Political, Economic and Military Forecasting. Cambridge, Mass.: Ballinger Publishing Company, 1973.

Morrison, Warren E. An Energy Model for the United States. Washington, D. C.: U. S. Department of the Interior, 1968.

National Petroleum Council. Emergency Preparedness for Interruption of Petroleum Imports Into the United States. Washington, D. C.: National Petroleum Council, 1973.

National Petroleum Council, Committee on Petroleum Resources Under the Ocean Floor. Washington, D. C.: National Petroleum Council, 1969.

National Petroleum Council, Committee on U. S. Energy Outlook. U. S. Energy Outlook. Washington, D. C.: National Petroleum Council, 1972.

Neuchterlein, Donald E. United States National Interests in a Changing World. Lexington: University Press of Kentucky, 1973.

Nye, Joseph and Keohane, Robert, eds. Transnational Relations and World Politics. Cambridge: Harvard University Press, 1972.

Odell, Peter R. An Economic Geography of Oil. New York: Frederick A. Praeger, 1964.

_____. Oil and World Power. Baltimore: Penguin Books, 1970.

Odum, Howard T. Environment, Power and Society. New York: Wiley-Interscience, 1971.

OECD Oil Committee. Oil: The Present Situation and Future Prospects. Paris: Organization for Economic Cooperation and Development, 1973.

Office of the Foreign Secretary, National Academy of Sciences, ed. Rapid Population Growth. Baltimore: The Johns Hopkins Press, 1971.

Osgood, Robert E. et al. Retreat from Empire: The First Nixon Administration. Baltimore: The Johns Hopkins Press, 1973.

Owens, Henry. The Next Phase in Foreign Policy. Washington, D. C.: The Brookings Institute.

Packenham, Robert A. Liberal America and the Third World. Princeton: Princeton University Press, 1973.

Perez Alfonso, Juan Pablo. El Pentagono Petrolero. Caracas: Editorial Revista Politica, 1967.

The Petroleum Publishing Company. International Petroleum Encyclopedia, 1973. Tulsa: The Petroleum Publishing Co., 1973.

Potier, Michel. Energie et Securite. Paris: Mouton and Co., 1969.

Ramazani, Rouhollah K. The Persian Gulf: Iran's Role. Charlottesville: University of Virginia Press, 1972.

Resources for the Future. Energy Research Needs. Washington, D. C.: Resources for the Future, 1971.

Ridgeway, James. The Last Play. New York: Mentor, 1973.

Rocks, Lawrence, and Runyan, Richard P. The Energy Crisis. New York: Crown Publishers, 1972.

Rouhani, Fuad. A History of OPEC. New York: Frederick A. Praeger, 1971

Sadik, M. T.; and Snavely, W. P. Bahrain, Qatar and the United Arab Emirates: Colonial Past, Present Problems and Future Prospects. Lexington, Mass.: Lexington Books, 1972.

Safran, Nader. Egypt in Search of political Community: An Analysis of the Intellectual and Political Evolution of Egypt 1804-1952. Cambridge, Mass.: Harvard University Press, 1961

_____. From War to War: The Arab-Israeli Confrontation, 1948-1967 - A Study of the Conflict From the Perspective of Coercion in the Contenxt of Inter-Arab and Big Power Relations. New York: Pegasus, 1969.

Sayed, Mustafa el-. L'Organisation des Pays Exportateurs de Petrole. Paris: Imprimerie Nationale, 1967.

Sayegh, F. A. Arab Unity: Hope and Fulfillment. New York: The Devin-Adain Company, 1958.

Schurr, Sam H., ed. Energy, Economic Growth and the Environment. Baltimore: The Johns Hopkins University Press, 1972.

Schurr, Sam H. and Homan, Paul T. Middle Eastern Oil and the Western World: Prospects and Problems. New York: American Elsevier Publishing Company, 1971.

Scientific American. Energy and Power. San Francisco: W. H. Freeman and Company, 1971.

Sharabi, Hisham. Nationalism and Revolution in the Arab World. Princeton, N. J.: Van Nostrand Company, 1965.

Skolnikoff, Eugene B. The International Imperatives of Technology: Technological Development and the International Political System. Berkeley: Institute of International Studies, University of California, 1972.

Smith, Clagett G., ed. Conflict Resolution: Contributions of the Behavioral Sciences. Notre Dame, Ind.: University of Notre Dame Press, 1971.

Spanier, John. Games Nations Play: Analyzing International Politics. New York: Frederick A. Praeger, 1972.

Spanier, John and Uslaner, Eric M. How American Foreign Policy Is Made. New York: Frederick A. Praeger, 1974.

Stanford Research Institute. Patterns of Energy Consumption in the United States. Washington, D. C.: U. S. Government Printing Office, 1972.

Stephenson, Hugh. The Coming Clash. New York: Staurday Review Press, 1972.

Stern, R. M. The Balance of Payments: Theory and Economic Policy. Chicago: Aldine-Ahterton, 1973.

Stobaugh, Robert B. The International Transfer of Technology in the Establishment of the Petrochemical Industry in Developing Countries. New York: United Nations Institute for Training and Research, 1971.

Stocking, George. Middle East Oil: A Study in Political and Economic Controversy. Nashville: Vanderbilt University Press, 1970.

Strassmann, W. P. Technological Change and Economic Development. Ithaca, N. Y.: Cornell University Press, 1968.

Szeto, G. C. The U. S. Energy Problem. 2 vols. Washington, D. C.: U. S. Department of Commerce, 1971.

Tanzer, Michael. The Political Economy of International Oil and the Underdeveloped Countries. Boston: Beacon Press, 1969.

Task Force on Energy of the Subcommittee on Science, Research and Development. Energy Research and Development. Washington, D. C.: U. S. Government Printing Office, 1972.

Texas Eastern Transmission Corporation. Competition and Growth in American Energy Markets, 1947-1985. Houston: Texas Eastern Transmission Corporation, 1968.

_____. Energy and Fuels. Houston: Texas Eastern Transmission Corporation, 1961.

Tucker, Robert W. A New Isolationism: Threat or Promise? Washington, D. C.: Potomac Associates, 1972.

Tugendhat, Cristopher. The Multinationals. New York: Random House, 1972.

_____. Oil the Biggest Business. London: Eyre and Spottiswoode, 1968.

United Nations, Statistical Office. World Trade Annual. vol. 2, New York: Walker and Co., 1965-71.

Van Sant, S. Strategic Energy Supply and National Security. Springfield, Mass.: Frederick A. Praeger, 1971.

Vatikiotis, P. J. The Modern History of Egypt. New York: Frederick A. Praeger, 1969.

Vernon, Raymond. Sovereignity at Bay: The Multinational Spread of U. S. Enterprises. New York: Basic Books, 1971.

_____. The Technology Factor in International Trade. New York: Columbia University Press, 1970.

Willrich, Mason, and Taylor, Theodore B. Nuclear Theft: Risks and Safeguards. Cambridge, Mass.: Ballinger Publishing Company, 1974.

Wu Yuan-li. Raw Materials Supply in a Multipolar World. New York: Crane, Russak and Company, 1973.

JOURNALS

Bank Markazi Iran. Bulletin, vol. 12, no. 67 (May-June 1973). Tehran, Iran.

Central Bank of Iraq. Bulletin, no. 4, 1972. Baghdad, Iraq.

Central Bank of Nigeria. Economic and Financial Review, vol. 9, no. 1 (June 1971). Lagos, Nigeria.

Independent Petroleum Association of America. Petroleum Independent (1970-73). Washington, D. C., U. S. A.

McGraw-Hill Book Company. Platt's Oil Price Handbook. 46th Edition (1969). New York, N. Y., U. S. A.

Massachusetts Institute of Technology. Technology Review, vol. 76, no. 2 (December 1973). Cambridge, Mass., U. S. A.

Middle East Institute. Middle East Monitor. Washington, D. C., U.S.A.
vol. I, no. 1 (1 February 1971), pp. 2-3; no. 11 (1 July 1971) p. 2; no. 12 (15 July 1971), pp. 2-3; no. 17 (15 October 1971), p. 1; no. 21 (15 December 1971), p. 7.
vol. II, no. 1 (1 January 1972), p. 3; no. 8 (15 April 1972), p. 6; no. 9 (1 May 1972), p. 1; no. 11 (1 June 1972), p. 1; no. 12 (15 June 1972), pp. 1-2; no. 16 (15 August 1972), p. 1; no. 19 (1 October 1972), p. 1.
vol. III, no. 2 (15 January 1973), pp. 1-2; no. 3 (1 February 1973), pp. 1, 5-6; no. 6 (15 March 1973), p. 1.

Middle East Petroleum and Economic Publications. International Crude Oil and Product Prices. (1972 - to date.) Beirut, Lebanon.

Mona Palmer Publishing Company. World Petroleum Report. (1968), p. 81. London, U. K.

OECD. Oil Statistics. (Annual. 1961-70). Paris, France.

OPEC. Annual Statistical Bulletin - 1968. (June 1969). Vienna, Austria.

_____. Annual Statistical Bulletin - 1971. (June 1972). Vienna, Austria.

Petroleum Engineer Publishing Company. The Petroleum Data Book. (1970-73). Dallas, Texas, U. S. A.

_____. Pipeline and Gas Journal. (1970-73). Dallas, Texas, U.S.A.

The Petroleum Publishing Company. Petroleum and Petrochemical International. (1973). London, U. K.

PUBLIC DOCUMENTS

United Nations. Committee on Natural Resources, 1st Session, 1971. Natural Resources Development and Policies, Including Environmental Considerations. Addendum: Natural Resources - Definitions and Concepts. (E/C.7/2/Add.9), 1971, New York: United Nations, 1971.

_____. Department of Economic and Social Affairs. Yearbook of National Account Statistics, 1971. New York: U. N. Publishing Service, 1973.

_____. Department of Economic and Social Affairs, Statistical Office. World Energy Supplies - 1955-71, (ST/STAT/SER. J). New York: U. N. Publishing Service, 1957-73.

_____. Economic Commission for Asia and the Far East. Asian Industrial Development News. New York: United Nations, no. 6, 1970.

United States Atomic Energy Commission. Civilian Nuclear Power. Washington, D. C.: U. S. Government Printing Office, 1962.

_____. Evaluation of Nuclear Power Plant Availability. Washington, D. C.: U. S. Atomic Energy Commission, January 1974.

_____. Survey of U. S. Uranium Marketing Activity. Washington, D. C.: U. S. Government Printing Office, April 1974.

United States Congress. House. Committee on Foreign Affairs. Subcommittee on Foreign Economic Policy. Foreign Policy Implications of the Energy Crisis. Hearings before a Subcommittee of the House Committee on Foreign Affairs, 92nd Cong., 2nd sess., 21, 26 and 27 September and 3 October 1972. Washington, D. C.: U. S. Government Printing Office, 1972.

_____. House. Committee on Interior and Insular Affairs. Fuel and Energy Resources, Parts 1 and 2. Hearings before the House Committee on Interior and Insular Affairs, 92nd Cong., 2nd sess., 10-13 April 1972. Washington, D. C.: U. S. Government Printing Office, April 1972.

_____. House. Committee on Merchant Marine and Fisheries. Growth and Its Implications for the Future. 92nd Cong., 1st sess. Washington, D. C.: U. S. Government Printing Office, 1 May 1973.

_____. House. Committee on Science and Astronautics. Energy Research and Development. 92nd Cong., 2nd sess. Washington, D. C.: U. S. Government Printing Office, December 1972.

_____. Joint Committee on Atomic Energy. Understanding the "National Energy Dilemma." 93rd Cong., 1st sess. Washington, D. C.: U. S. Government Printing Office, 1973.

_____. Joint Economic Committee. Subcommittee on Consumer Economics. The Gasoline and Fuel Oil Shortage. Hearings before a Subcommittee of the Joint Economic Committee, 93rd Cong., 1st sess., 1 and 2 May and 2 June 1973. Washington, D. C.: U. S. Government Printing Office, 1973.

_____. Joint Economic Committee. A Reappraisal of U. S. Energy Policy. 92nd Cong., 2nd sess., 8 March 1972. Washington, D. C.: U. S. Government Printing Office, March 1972.

_____. Senate. Committee on Finance. Subcommittee on Energy. Fiscal Policy and the Energy Crisis. Hearings before a Subcommittee of the Senate Committee on Finance, 93rd Cong., 1st sess., 27-29 November 1973, Parts 1 and 2. Washington, D. C.: U. S. Government Printing Office, 1973.

_____. Senate. Committee on Finance. Subcommittee on International Trade. Multinational Corporations. Hearings before a Subcommittee of the Senate Committee on Finance, 93rd Cong., 1st sess., 26-28 February, 1 and 6 March 1973. Washington, D. C.: U. S. Government Printing Office, 1973.

_____. Senate. Committee on Interior and Insular Affairs. The Energy Information Act. Hearings before the Senate Committee on Interior and Insular Affairs, 93rd Cong., 2nd sess., 14-15 February 1974, Parts 1, 2 and 3. Washington, D. C.: U. S. Government Printing Office, 1974.

_____. Senate. Committee on Interior and Insular Affairs. Federal Charters for Energy Corporations - Selected Materials. 93rd Cong., 2nd sess. Washington, D. C.: U. S. Government Printing Office, 1974.

_____. Senate. Committee on Interior and Insular Affairs. Financial Requirements of the Nation's Energy Industries. Hearings before the Senate Committee on Interior and Insular Affairs, 93rd Cong., 1st sess., March, 1973. Washington, D. C.: U. S. Government Printing Office, March 1973.

_____. Senate. Committee on Interior and Insular Affairs. Fuel Shortages. Hearings before the Senate Committee on Interior and Insular Affairs, 93rd Cong., 1st sess., 1 February 1973, Parts 1 and 2. Washington, D. C.: U. S. Government Printing Office, February 1973.

_____. Senate. Committee on Interior and Insular Affairs. Market Performance and Competition in the Petroleum Industry. Hearings before the Senate Committee on Interior and Insular Affairs, 93rd Cong., 1st sess., 28-29 November 1973, Parts 1 and 2. Washington, D. C.: U. S. Government Printing Office, 1973.

_____. Senate. Committee on Interior and Insular Affairs. Measurement of Corporate Profits. 93rd Cong., 2nd sess. Washington, D. C.: U. S. Government Printing Office, 1974.

_____. Senate. Committee on Interior and Insular Affairs. The National Coal Conversion Act and the National Crude Oil Refinery Development Act. Hearings before the Senate Committee on Interior and Insular Affairs, 93rd Cong., 1st sess., 10 December 1973. Washington, D. C.: U. S. Government Printing Office, 1973.

_____. Senate. Committee on Interior and Insular Affairs. National Goals Symposium, Parts 1 and 2. 92nd Cong., 1st sess., 20 October 1971. Washington, D. C.: U. S. Government Printing Office, October 1971.

_____. Senate. Committee on Interior and Insular Affairs. Oil and Gas Imports Issues. Hearings before the Senate Committee on Interior and Insular Affairs, 93rd Cong., 1st sess., 10-11 and 22 January 1973, Parts 1, 2 and 3. Washington, D. C.: U. S. Government Printing Office, 1973.

_____. Senate. Committee on Interior and Insular Affairs. Survey of Energy Consumption Projections. 92nd Cong., 2nd sess. Washington, D. C.: U. S. Government Printing Office, 1972.

United States Department of Commerce. United States Exports/World Area by Commodity Groupings, FT 455-72, Annual 1972. Washington, D. C.: U. S. Government Printing Office, 1973.

United States Department of the Interior. An Energy Model for the U. S. Washington, D. C.: U. S. Government Printing Office, 1968.

_____. Mineral Industry Surveys - Petroleum Statement. Washington, D. C.: U. S. Government Printing Office, 1971-September 1973 (Monthly).

_____. Supplies, Costs and Uses of the Fossil Fuels. Washington, D. C.: U. S. Government Printing Office, February 1973.

_____. U. S. Energy: A Summary Review. Washington, D. C.: U. S. Government Printing Office, 1972.

_____. U. S. Office of Oil and Gas. U. S. Petroleum through 1980. Washington, D. C.: U. S. Government Printing Office, 1968.

United States Federal Council for Science and Technology. Extraction of Energy Fuels. Bureau of Mines. Open File Report 30-73. Springfield, Va.: National Technical Information Service, September 197 1972.

United States General Accounting Office. Issues Related to Foreign Sources of Oil for the United States, B-179411. Mimeographed. 23 January 1974.

_____. U. S. Actions Needed to Cope with Commodity Shortages. Washington, D. C.: General Accounting Office, 29 April 1974.

United States Government. Cabinet Task Force on Oil Import Control. The Oil Import Question. Washington, D. C.: U. S. Government Printing Office, February 1970.

United States Office of Science and Technology. A Review and Comparison of Selected U. S. Energy Forecasts. Washington, D. C.: U. S. Government Printing Office, 1969.

NEWSPAPER ARTICLES

Cowan, Edward. "Soviet Gas Deal Held Up as U. S. Studies Cost." The New York Times, 9 January 1973, pp. 49, 54.

_____. "Nixon Energy-Policy Outlook." The New York Times, 20 April 1973, p. 8.

"F. P. C. Seeks Curb on Natural Gas." The New York Times, 9 January 1973, pp. 1, 65.

"Getty Begins Supplying Fuel with 3.5% Sulphur to Delmarva P&L Unit." The Wall Street Journal, 3 January 1973, p. 30.

Jensen, Michael C. "King Coal's Comeback Bid." The New York Times, 15 October 1972, p. 1 (Business and Finance Section).

Massachusetts Institute of Technology. "M. I. T. Political Scientists Study Global Impact of Energy Crisis." News Office, Massachusetts Institute of Technology, 22 August 1973, p. 1.

Middleton, Drew. "Oil Shifting U. S. Strategic Interests to Middle East." The New York Times, 20 April 1973, p. 8.

Newman, Barry. "Whether Bureau of Mines Should Continue Enforcing Safety Laws Stirs a Heated Debate." The Wall Street Journal, 3 January 1973, p. 30.

"Oil for U. S. Linked by Saudi to Peace." The New York Times, 16 April 1973, p. 29.

Onis, Juan de. "Mastery Over World Oil Supply Shifts to Producing Countries." The New York Times, 16 April 1973, p. 1.

Place, John B. M. "The Metals Crisis and the 'Quality of Life.'" The New York Times, 6 August 1972, Section 3, p. 12.

PAPERS, ADDRESSES AND REPORTS

Abir, Mordechai. "Red Sea Politics." Adelphi Papers, no. 93 (1972). The International Institute for Strategic Studies. London, U. K.

Bergsten, Fred C. and Halperin, Morton H. "International Economics and International Politics: A Framework for Analysis." Paper. (Typewritten.)

Birks, J. "The Size of the World Offshore Potential." Paper presented at the World Energy Supplies Conference, London, U. K., 18-20 September 1973. (Mimeographed.)

Brown, Lester R. "The Changing Face of Food Scarcity." Communique on Development Issues. Overseas Development Council. No. 21. Washington, D. C., U. S. A.

Choucri, Nazli. "An Assessment and Some Observations." Memorandum prepared for the Conference on the Successes and Failures of Scientific International Relations Research, Ojai, California, 25-28 June 1973.

Debanne, J. G. "A Pollution- and Technology-Sensitive Model for Energy Supply-Distribution Studies." Milton F. Searl, Resources for the Future, ed. Working Papers for a Seminar on Energy Modelling, 25-6 January 1973.

Franssen, Herman T. "Oil and Gas in the Oceans." Summary of a Lecture presented at the Naval War College, 27 September 1972. (Typewritten.)

Gall, Norman. "Oil and Democracy in Venezuela: Part I - 'Sowing the Petroleum'." Fieldstaff Reports, vol. XVII, no. 1 (1973). American Universities Field Staff, Inc.

_____. "Oil and Demoncracy in Venezuela: Part II - 'The Marginal Man'." Fieldstaff Reports, vol. XVII, no. 2 (1973). American Universities Field Staff, Inc.

Griffith, William E. "The Middle East, The Energy Crisis and U. S. Policy." Paper. 4 October 1973. (Typewritten.)

Hunter, Robert E. "The Energy 'Crisis' and U. S. Foreign Policy." Ov Overseas Development Council. Development Paper no. 14. (August 1973.) Washington, D. C., U. S. A.

_____. "The Soviet Dilemma in the Middle East, Part I: Problems of Commitment." Adelphi Papers, no. 59 (September 1969). The International Institute for Strategic Studies. London, U. K.

_____. "The Soviet Dilemma in the Middle East, Part II: Oil and the Persian Gulf." Adelphi Papers, no. 60 (October 1969). The International Institute for Strategic Studies. London, U. K.

Jukes, Geoffrey. "The Indian Ocean in Soviet Naval Policy." Adelphi Papers, no. 87 (May 1972). The International Institute for Strategic Studies. London, U. K.

McLachlan, Keith. "Spending Oil Revenues: Development Prospects in the Middle East to 1975." The Economist Intelligence Unit (1972). QER Special no. 10. London, U. K.

Massachusetts Institute of Technology. Energy Laboratory. "Project Independence: An Economic Evaluation." 15 March 1974. (Mimeographed.)

Meyer, A. J. "The Middle East and World Energy." Keynote Address presented to the Middle East Institute, Washington, D. C., 29 September 1972.

Muraoka, Kunio. "Japanese Security and the United States." Adelphi Papers, no. 95 (1973). The International Institute for Strategic Studies. London, U. K.

Peterson, Peter G. "The Energy Dilemmas." An Address concerning President Nixon's Cabinet-Level Domestic Council Review of Energy Strategies presented to the American Petroleum Institute, The Conrad Hilton Hotel, Chicago, Illinois, 14 November 1972.

Rhee, Sang-Woo; Omen, George; and Rummel, R. J. "Behavior of Nation-Dyads: Data and Codes, 1950-65." The Dimensionality of Nations Project, Research Report no. 67 (June 1973).

Saeki, Kiichi. "Japan's Security in a Multipolar World." Adelphi Papers, no. 92 (1972). The International Institute for Strategic Studies. London, U. K.

Warman, H. R. "The Future Availability of Oil." Paper presented at the World Energy Supplies Conference, London, U. K., 18-20 September 1973. (Mimeographed.)

_____. "The Oil Potential of the North Sea." November 1973. (Mimeographed.)

Wilcox, Wayne. "Japanese and Indian National Security Strategies in the Asia of the 1970's: The Prospect of Nuclear Proliferation." Adelphi Papers, no. 92 (1972). The International Institute for Strategic Studies. London, U. K.

ARTICLES IN BOOKS

Fisher, Joseph L. and Potter, Neal. "The Effects of Population Growth on Resource Adquacy and Quality," in Rapid Population Growth, pp. 222-45, Edited by the Office of the Foreign Secretary, National Academy of Sciences. (Baltimore: The Johns Hopkins Press, 1971.)

Hartshorn, J. "Europe's Energy Imports" in A Nation Write Large?, pp. 102-27, Edited by Kohrstamm and Hager. (New York: John Wiley and Sons, 1973.)

ARTICLES IN JOURNALS

Abelson, Philip H. "Energy Conservation." Science, vol. 178, no. 4059 (27 October 1972), p. 355.

_____. "Energy Independence." Science, vol. 182, no. 4114 (23 November 1973), p. 779.

_____. "Energy and National Security." Science, vol. 179, no. 4076 (2 March 1973), p. 857.

_____. "Importation of Petroleum." Science, vol. 180, no. 4091 (15 June 1973), p. 1127.

_____. "Increasing World Energy Supplies." Science, vol. 182, no. 4117 (16 November 1973), p. 1087.

_____. "Let the Bastards Freeze in the Dark." Science, vol. 182, no. 4113 (16 November 1973), p. 657.

_____. "A Lost Opportunity." Science, vol. 184, no. 4136 (3 May 1974), p. 525.

_____. "Out of the Energy Crunch by 1976." Science, vol. 183, no. 4126 (22 February 1974), p. 708.

_____. "Underground Gasification of Coal." Science, vol. 182, no. 4119 (28 December 1973), p. 1297.

_____. "The Urgent Need for Energy Conservation." Science, vol. 182, no. 4110 (26 October 1973), p. 339.

Adelman, M. A. "Is the Oil Shortage Real?" Middle East Information Series, vol. XXIII (May 1973), pp. 26-35.

Akins, James E. "The Oil Crisis: This Time the Wolf Is Here." Foreign Affairs, vol. 51, no. 3 (April 1973), pp. 462-90.

Amad, Adnan. "History and Fiction in Boasson's Comments on Galtung." Journal of Peace Research, no. 1-2 (1973), pp. 149-54.

American Academic Association for Peace in the Middle East, "The Energy Problem and the Middle East." Middle East Information Series, vol. XXIII, May 1973.

Amuzegar, Jahangir. "The Oil Story: Facts, Fiction and Fair Play." Foreign Affairs, vol. 51, no. 4 (July 1973), pp. 676-89.

Auer, Peter L. "An Integrated National Energy Research and Development Program." Science, vol. 184, no. 4134 (19 April 1974), pp. 295-301.

Ball, George W. "Trilateralism and the Oil Crisis." Pacific Community, vol. 5, no. 3 (April 1974), pp. 335-47.

Barattieri, Vittorio. "The Oil Exporters and the Euromarkets." Euromoney, May 1974, pp. 27-28.

Bechtold, Peter K. "New Attempts at Arab Co-operation: The Federation of Arab Republics, 1971-?" The Middle East Journal, vol. 27, no. 2 (Spring 1973), pp. 152-73.

Berg, Charles A. "Conservation in Industry." Science, vol. 184, no. 4134 (19 April 1974), pp. 264-70.

————. "Energy Conservation Through Effective Utilization." Science, vol. 181, no. 4095 (13 July 1973), pp. 128-38.

Berg, R. R. et al. "Prognosis for Expanded U. S. Production of Crude Oil." Science, vol. 184, no. 4134 (19 April 1974) pp. 331-36.

Bergsten, C. Fred. "The Threat from the Third World." Reprint 268, The Brookings Institution, 1973 pp. 102-124 (reprinted from Foreign Policy, no. 11, Summer 1973).

————. "The Threat Is Real." Foreign Policy, no. 14 (Spring 1974), pp. 84-90.

Berry, John A. "Oil and Soviet Policy in the Middle East." The Middle East Journal, vol. 26, no. 2 (Spring 1972), pp. 149-60.

Billings, Charles E. and Matson, Wayne R. "Mercury Emissions from Coal Combustion." Science, vol. 176, no. 4040 (16 June 1972), pp. 1232-33.

Bloomfield, Lincoln P. "Foreign Policy for Disillusioned Liberals." Foreign Policy, no. 9 (Winter 1972-73), pp. 55-68.

Blumer, Max. "Submarine Seeps: Are They A Major Source of Open Ocean Oil Pollution?" Science, vol. 176, no. 4040 (16 June 1972), pp. 1257-58.

Blumer, Max and Sass, Jeremy. "Oil Pollution: Persistence and Degradation of Spilled Fuel Oil." Science, vol. 176, no. 4039 (9 June 1972), pp. 1120-22.

Boasson, Charles. "Galtung's Version of 'The Middle East and the Theory of Conflict': Can Peace Research Transcend Prejudice and Dogma?" Journal of Peace Research, no. 1-2 (1973), pp. 133-44.

Boulding, Kenneth E. "The Social System and the Energy Crisis." Science, vol. 184, no. 4134 (19 April 1974), pp. 255-57.

Brandon, Henry. "Were We Masterful...", Part I of "Jordan: The Forgotten Crisis." Foreign Policy, no. 10 (Spring 1973), pp. 158-70.

Brown, Lester R. "The Next Crisis? Food." Foreign Policy, no. 13 (Winter 1973-1974), pp. 3-33.

Brown, Seyom. "The Changing Essence of Power." Reprint 270, The Brookings Instituion, 1973, pp. 286-99 (reprinted from Foreign Affairs, vol. 51, no. 2, January 1973).

Brzezinski, Abigniew. "The Balance of Power Delusion." Foreign Policy, no. 7 (Summer 1972), pp. 54-59.

_____. "U. S. Foreign Policy: The Search for Focus." Foreign Affairs, vol. 51, no. 4 (July 1973), pp. 708-27.

Burck, Gilbert. "The FPC Is Backing Away from the Wellhead." Fortune, November 1972, pp. 108-111, 180, 185-86.

Buzzard, Rear-Admiral Sir Anthony. "Middle East Guarantees." Survival, vol. XIII, no. 12 (December 1971), pp. 416-21.

Calvin, Melvin. "Solar Energy by Photosynthesis." Science, vol. 184, no. 4134 (19 April 1974), pp. 375-81.

Campbell, John C. "Middle East Oil: American Policy and Super-Power Interaction." Survival, vol. XV, no. 5 (September/October 1973).

Campbell, John F. "Points of Conflict." Survival, vol. XIII, no. 8 (August 1971).

Carter, Anne P. "Applications of Input-Output Analysis to Energy Problems." Science, vol. 184, no. 4134 (19 April 1974), pp. 325-29.

Carter, Luther J. "AEC Laboratories Would Be Core of Energy R & D Agency." Science, vol. 180, no. 4093 (29 June 1974), p. 1346.

_____. "Alaskan Oil: Court Ruling Revives Canada Pipeline Issue." Science, vol. 179, no. 4077 (9 March 1973), pp. 977-81.

_____. "Alaskan Oil: Court Ruling Revives Canada Pipeline Issue." Science, vol. 179, no. 4077 (9 March 1973), pp. 977-81.

_____. "Alaska Pipeline: NEPA Put Aside." Science, vol. 181, no. 4100 (17 August 1973), p. 641.

_____. "Deepwater Ports: Issue Mixes Supertankers, Land Policy." Science, vol. 181, no. 4102 (31 August 1973), pp. 825-28.

_____. "Jackson Wants Big Energy R & D Effort, á la Apollo." Science, vol. 179, no. 4076 (2 March 1973), p. 879.

_____. "Nuclear Tests: France's Unwelcome Export to the South Pacific." Science, vol. 181, no. 4096 (20 July 1973), pp. 251-52.

Carruth, Eleanore. "The New Oil Rush in Our Own Backyard." Fortune, vol. LXXXIX, no. 6, June 1974, pp. 154-59.

Castor, Gaylord B. "Gasoline Substitutes." Science, vol. 183, no. 4126 (22 February 1974), p. 698.

Chapman, Duane; Tyrrell, Timothy; Mount, Timothy. "Electricity Demand Growth and the Energy Crisis." Science, vol. 178, no. 4062 (17 November 1972), pp. 703-8.

Chase, R. X. "Economic Analysis and Environmental Quality." American Journal of Economics and Sociology, vol. 31, no. 3 (July 1972), pp. 271-82.

Chave, Charles T. "Emergency Core Cooling." Science, vol. 179, no. 4080 (30 March 1973), p. 1281 (Letters).

Conant, Melvin A. "Oil: Co-operation or Conflict." Survival, vol. XV, no. 1 (January/February 1973), pp. 8-14.

Conner, W. L. M. "Viewpoint on Oil: Turning Off the Tap." Middle East International, no. 6 (September 1971), pp. 17-19.

Cook, C. Sharp and Bockris, J. O'M. "Hydrogen and Power." Science, vol. 180, no. 4084 (27 April 1973), p. 370.

Cooper, Richard N. "Macroeconomic Policy Adjustment in Interdependent Economies." The Quarterly Journal of Economics, vol. LXXXIII, no. 1 (February 1969), pp. 1-24.

_____. "Trade Policy Is Foreign Policy." Foreign Policy, no. 9 (Winter 1972-1973), pp. 18-36.

Cooper, Richard R. et al. "The Future of the Dollar." Foreign Policy, no. 11 (Summer 1973), pp. 3-32.

Cowen, Robert C. "Betting on Solar Power." Technology Review, vol. 74, no. 4 (February 1972), pp. 5-7.

_____. "Fusion Power: Ten Years to the Great Decision?." Technology Review, vol. 73, no. 3 (January 1971), pp. 6-7.

Daalder, Hans. "Imperialism." International Encyclopedia of the Social Sciences, vol. 7 (1968), pp. 101-9.

Dean, Genevieve C. "Energy in the People's Republic of China." Energy Policy, vol. 2, no. 1 (March 1974), pp. 33-54.

Demaree, Allan T. "Arab Wealth, As Seen Through Arab Eyes." Fortune, vol. LXXXIX, no. 4, April 1974, pp. 108-119.

Diebold, John. "Why Be Scared of Them?" Foreign Policy, no. 12 (Fall 1973).

Diebold, William Jr. "U. S. Trade Policy: The New Political Dimensions." Foreign Affairs, vol. 52, no. 3 (April 1974), pp. 472-96.

Duff, Declan. "Why Countries Default." Euromoney, May 1974, pp. 43-45.

Dunham, James T., et al. "High Sulfur Coal for Generating Electricity." Science, vol. 184, no. 4134 (19 April 1974), pp. 346-51.

Edsall, John T. "Nuclear Energy." Science, vol. 178, no. 4064 (1 December 1972), p. 933 (Letters).

Eliav, Arie. "We and The Arabs." Foreign Policy, no. 10 (Spring 1973), pp. 62-67.

Emmett, John L.; Nuckolle, John; Wood, Lowell. "Fusion Power by Laser Implosion." Scientific American, vol. 230, no. 6 (June 1974), pp. 24-37.

Ewald, E. "Energy Alternatives: Now and in the Future." Edison Electric Institute Bulletin, vol. 39, no. 2 (March/April 1971), pp. 61-63.

Faltermayer, Edmund. "Clearing the Way for the New Age of Coal." Fortune, vol. LXXXIX, no. 5, May 1974, pp. 215-20.

_____. "The Energy 'Joyride' Is Over." Fortune, September 1972, pp. 99-101, 178, 180, 182, 184, 186, 188, 191.

_____. "It's Back to the Pits for Coal's New Future." Fortune, vol. LXXXIX, no. 6, June 1974, pp. 137-38.

Field, Michael. "Oil: OPEC and Participation." The World Today. vol. 28, no. 1 (January 1972), pp. 5-13.

Frank, Helmut J. "Economic Strategy for Import-Export Controls on Energy Materials." Science, vol. 184, no. 4134 (19 April 1974), pp. 316-21.

Frankel, Ernst. "The 'Energy Crisis' and U. S. Middle East Policy." Middle East Information Series - American Academic Association for Peace in the Middle East, vol. XXIII (May 1973), pp. 8-16.

Frankel, Paul H. "Prospects of the Evolution of the World Petroleum Industry." Middle East Information Series - American Academic Association for Peace in the Middle East, vol. XXIII (May 1973), pp. 17-25.

Friedheim, Robert L. "The 'Satisfied' and 'Dissatisfied' States Negotiate International Law: A Case Study." World Politics, vol. 18, (October 1965), pp. 20-41.

_____ and Kadane, J. B. (with Gamble, J. K. Jr.), "Quantitative Content Analysis of the U. N. Seabed Debate: Methodology and a Continental Shelf Case Study." International Organization, vol. 24 (Summer 1970), pp. 479-502.

Galtung, Johan, "Boasson's Version of Conflict Theory and the Middle East: Apologia or Peace Research?" Journal of Peace Research, no. 1-2 (1973), pp. 145-47.

_____. "Japan and Future World Politics." Journal of Peace Research, vol. 10, no. 4 (1974), pp. 319-40.

_____. "The Middle East and the Theory of Conflict." Journal of Peace Research, vol. 3, no. 4 (1971), pp. 173-206.

Gamble, J. K. Jr. "Quantitative Content analysis of the U.N. Seabed Debate: Methodology and a Continental Shelf Case Study." Robert L. Friedheim and J. B. Kadane (with J. K. Gamble, Jr.). International Organization, vol. 24 (Summer 1970), pp. 479-502.

Gillette, Robert. "AEC Shakes Up Neclear Safety Research." Science, vol. 180, no. 4089 (1 June 1973), pp. 934-35.

_____. "Budget Review: Energy." Science, vol. 183, no. 4125 (15 February 1974), pp. 636-38.

_____. "Energy Crisis: President Sprints to Catch Up With Events." Science, vol. 182, no. 4114 (23 November 1973), pp. 807-8.

_____. "Energy: The Muddle at the Top." Science, vol. 182, no. 4119 (28 December 1973), pp. 1319-21.

_____. "Energy Organization: Love's Labour's Lost." Science, vol. 182, no. 4118 (21 December 1973), pp. 1225-26.

_____. "Energy Policy, Phase II." Science, vol. 181, no. 4095 (13 July 1973), p. 140.

_____. "Energy: President Asks $3 Billion for Breeder Reactor, Fuel Studies." Science, vol. 172, no. 3988 (11 June 1971), pp. 1114-16.

_____. "Energy R & D: Slicing the Promised Pie." Science, vol. 181, no. 4106, pp. 1233-34.

_____. "Energy R & D: Under Pressure, a National Policy Takes Form." Science, vol. 182, no. 4115 (30 November 1973), pp. 898-900.

_____. "Energy R & D: Weinberg Moves to the White House." Science, vol. 183, no. 4122 (25 January 1974), p. 288.

_____. "Energy Reorganization: Progress in the Offing." Science, vol. 184, no. 4135 (26 April 1974), pp. 443-45.

_____. "NAS: Water Scarcity May Limit Use of Western Coal." Science, vol. 181, no. 4099 (10 August 1973), p. 525.

_____. "Nuclear Power in the U.S.S.R.: American Visitors Find Surprises." Science, vol. 173, no. 4001 (10 September 1971), pp. 1003-6.

_____. "Nuclear Reactor Safety: At the AEC the Way of the Dissenter Is Hard." Science, vol. 176, no. 4034 (5 May 1972), pp. 492-98.

_____. "Nuclear Safeguards: Holes in the Fence." Science, vol. 182, no. 4117 (14 December 1973), pp. 1112-14.

_____. "Nuclear Safety (I): The Roots of Dissent." Science, vol. 177, no. 4051 (1 September 1972), p. 771.

_____. "Nuclear Safety (II): The Years of Delay." Science, vol. 177, no. 4052 (8 September 1972), pp. 867-71.

_____. "Nuclear Safety (III): Critics Charge Conflicts of Interest." Science, vol. 177, no. 4053 (15 September 1972), pp. 970-75.

_____. "Nuclear Safety (IV): Barriers to Communication," Science, vol. 172, no. 4054 (22 September 1972), pp. 1080-82.

_____. "Nuclear Safety: AEC Report Makes the Best of It." Science, vol. 179, no. 4071 (26 January 1973), pp. 360-63.

_____. "Oil Shortage: Demand Down Supply Up." Science, vol. 183, no. 4121 (18 January 1974), p. 183.

_____. "One Breeder for the Price of Two?" Science, vol. 182, no. 4107 (5 October 1973), p. 38.

_____. "Plutonium and the'Hot Particle Problem': Environmental Group Proposes a Draconian Answer." Science, vol. 183, no. 4127 (1 March 1974), pp. 834-35.

_____. "Radiation Spill at Hanford: The Anatomy of an Accident." Science, vol. 181, no. 4101 (24 August 1973), pp. 728-30.

_____. "Strip-Mining: House, Senate Gird for Renewed Debate." Science, vol. 181, no. 4099 (10 August 1973), pp. 524-27.

_____. "Synthetic Fuels: Will Government Lend the Oil Industry a Hand?" Science, vol. 183, no. 4125 (15 February 1974), pp. 641-43.

_____. "White House Energy Policy: Who Has the Power?" Science, vol. 179, no. 4079 (23 March 1973), pp. 1211-12.

Gray, Colin S. "The Arms Race Is About Politics." Foreign Policy, no. 9 (Winter 1972-73), pp. 117-29.

Grose, Peter. "Israel Awaits the Doves." Foreign Policy, no. 10 (Spring 1973), pp. 55-72.

Häfele, Wolf. "Energy Choices that Europe Faces: A European View of Energy." Science, vol. 184, no. 4134 (19 April 1974), pp. 360-67.

Halperin, Morton H. "Why Bureaucrats Play Games." Foreign Policy, no. 2 (Spring 1971), pp. 70-90.

Hammond, Allen L. "The Big Accelerators: A Progress Report." Science, vol. 182, no. 4117 (14 December 1973), pp. 1117-20.

_____. "Breeder Reactors: Power for the Future." Science, vol. 174, no. 4011 (19 November 1971), pp. 807-810.

_____. "Conservation of Energy: The Potential for More Efficient Use." Science, vol. 178, no. 4065 (8 December 1972), pp. 1079-81.

_____. "Dry Geothermal Wells: Promising Experimental Results." Science, vol. 182, no. 4107 (5 October 1973), pp. 43-44.

_____. "Energy and the Future: Research Priorities and National Policy." Science, vol. 179, no. 4069 (12 January 1973), pp. 164-66.

_____. "Energy Needs: Projected Demands and How to Reduce Them." Science, vol. 178, no. 4066 (15 December 1972), pp. 1186-88.

_____. "Energy Options: Challenge for the Future." Science, vol. 177, no. 4052 (8 September 1972), pp. 875-76.

_____. "The Fast Breeder Reactor: Signs of a Critical Reaction." Science, vol. 176, no. 4033 (28 April 1972), pp. 391-93.

_____. "Fission: The Pro's and Con's of Nuclear Power." Science, vol. 178, no. 4057 (13 October 1972), pp. 147-49.

_____. "Geothermal Energy: An Emerging Major Resource." Science, vol. 177, no. 4053 (15 September 1972), pp. 978-80.

_____. "Individual Self-Sufficiency in Energy." Science, vol. 184, no. 4134 (19 April 1974), pp. 276-82.

_____. "Neutral Currents: New Hope for a Unified Field Theory." Science, vol. 182, no. 4110 (26 October 1973), pp. 372-74.

_____. "Photovoltaic Cells: Direct Conversion of Solar Energy." Science, vol. 178, no. 4062 (17 November 1972), pp. 732-33.

_____. "Solar Energy: A Feasible Source of Power?" Science, vol. 172, no. 3984 (14 May 1971), p. 660.

_____. "Solar Energy: The Largest Resource." Science, vol. 177, no. 4054 (22 September 1972), pp. 1088-90.

_____. "Solar Energy: Proposal for a Major Research Program." Science, vol. 179, no. 4078 (16 March 1973), p.1116.

_____. "A Timetable for Expanded Energy Availability." Science, vol. 184, no. 4134 (19 April 1974), pp. 367-69.

_____ and Gillette, Robert. "AEC Begins Shaping Federal Energy Policy." Science, vol. 181, no. 4102 (31 August 1973), p. 827.

Haq, Mahbub ul-. "Employment in the 1970's: A New Perspective." International Development Review, vol. XIII, no. 4 (1971), pp. 9-13.

Hartshorn, J. E. "A Diplomatic Price for Oil?" Pacific Community, vol. 5, no. 3 (April 1974), pp. 363-79.

_____. "From Tripoli to Teheran and Back: The Size and Meaning of the Oil Game." The World Today, vol. 27, no. 7 (July 1973), pp. 291-301.

Hawkes, Nigel. "Energy in Britain: Shopping for a New Reactor." Science, vol. 183, no. 4120 (11 January 1974), pp. 57-59.

Haykal, M. H. "Soviet Aims and Egypt." Survival, vol. XIV, no. 5 (September/October 1972), pp. 231-35.

Henderson, Hazel. "Ecologists versus Economists." Harvard Business Review, vol. 51 (July-August 1973), p. 28.

Hirst, Eric and Moyers, John C. "Efficiency of Energy Use in the United States." Science, vol. 179, no. 4080 (30 March 1973), pp. 1299-1304.

Hoffmann, Stanley. "Will the Balance Balance at Home?" Foreign Policy, no. 7 (Summer 1972), pp. 60-86.

Holden, Constance. "Energy: Shortages Loom, But Conservation Lags." Science, vol. 180, no. 4091 (15 June 1973), pp. 1155-58.

_____. "The EPC: Environmental Lobby." Science, vol. 182, no. 4115, (30 November 1973), p. 905.

_____. "New Energy Message Downplays R & D." Science, vol. 180, no. 4085 (4 May 1973), p. 475.

Holden, David. "The Persian Gulf: After the British Raj." Foreign Affairs, vol. 49, no. 4 (July 1971), pp. 721-35.

Hollick, Ann L. "Seabeds Make Strange Politics." Foreign Policy, no. 9 (Winter 1972-73), pp. 148-70.

Hottinger, Arnold. "The Depth of Arab Radicalism." Foreign Affairs, vol. 51, no. 3 (April 1973), pp. 491-504.

Hoyt, Monty. "Middle East Oil: Hobson's Choice for the West." Middle East International, no. 7 (October 1971), pp. 41, 45.

Hub, K. A. "Fast Breeder Reactors." Science, vol. 178, no. 4067 (22 December 1972), pp. 1240-41 (Letters).

Hubbert, M. King. "The Energy Resources of the Earth." Development Digest, vol. X, no. 3 (July 1972), pp. 30-38.

Hughes, Thomas L. "The Flight From Foreign Policy." Foreign Policy, no. 10 (Spring 1973), pp. 141-56.

Hunter, Robert E. "In The Middle In The Middle East." Foreign Policy, no. 5 (Winter 1971-72), pp. 137-50.

_____. "Power and Peace." Foreign Policy, no. 9 (Winter 1972-73), pp. 37-54.

Ickle, Fred C. "Can Nuclear Deterrence Last Out the Century?" Foreign Affairs, vol. 51, no. 2 (January 1973), pp. 267-85.

Irwin, John N. "The International Implications of the Energy Situation." The Department of State Bulletin, vol. LXVI, no. 1714 (1 May 1972), pp. 626-31.

Jahn, Edward. "Inexhaustible Energy." Science, vol. 180, no. 4084 (27 April 1973), pp. 369-70.

Jones, Lawrence W. "Liquid Hydrogen as a Fuel for the Future." Science, vol. 174, no. 4007 (22 October 1971), pp. 367-70.

Kadane, J. B. "Quantitative Content Analysis of the U.N. Seabed Debate: Methodology and a Continental Shelf Case Study." Robert L. Friedheim and J. B. Kadane (with J. K. Gamble, Jr.). International Organization, vol. 24 (Summer 1970), pp. 479-502.

Kennan, Feorge F. "After the Cold War: American Foreign Policy in the 1970's." Foreign Affairs, vol. 51, no. 1 (October 1972), pp. 210-227.

_____. "To Prevent a World Wasteland: A Proposal." Foreign Affairs, vol. 48, no. 3 (April 1970), pp. 401-13.

Keohane, Robert O. "The Big Influence of Small Allies." Foreign Policy, no. 2 (Spring 1971), pp. 161-82.

_____ and Nye, Joseph S. Jr. "Power and Interdependence." Survival, July/August 1973.

Kissell, Fred N.; Nagel, Allan E.; Zabetakis, Michael G. "Coal Mine Explosions: Seasonal Trends." Science, vol. 179, no. 4076 (2 March 1973), pp. 891-92.

Kohjima, Sachio. "Deficit Should Be Manageable." Euromoney, May 1974, pp. 78-79.

Koide, Yoshio. "China's Crude Oil Production." Pacific Community, vol. 5, no. 3 (April 1974), pp. 463-70.

Krasner, Stephen D. "Are Bureaucracies Important?" Foreign Policy, no. 7 (Summer 1972), pp. 159-79.

_____. "The Great Oil Sheikdown." Foreign Policy, no. 13 (Winter 1973-74), pp. 123-38.

_____. "Oil Is the Exception." Foreign Policy, no. 14 (Spring 1974), pp. 68-83.

Kubo, Arthur S. and Rose, David J. "Disposal of Nuclear Wastes." Science, vol. 182, no. 4118 (21 December 1973), pp. 1205-11.

Kuczynski, Pedro-Pablo. "The Effects of the Rise in Oil Prices on the Third World." Euromoney, May 1974, pp. 37-41.

Landsberg, Hans H. "Low-Cost, Abundant Energy: Paradise Lost?" Science, vol. 184, no. 4134 (19 April 1974), pp. 247-53.

Lessing, Lawrence. "Lasers Blast A Shortcut to the Ultimate Energy Solution." Fortune, vol. LXXXIX, no. 5, May 1974.

Levy, Walter J. "An Atlantic-Japanese Energy Policy." Foreign Policy, no. 11 (Summer 1973), pp. 159-90.

_____. "Oil Power." Foreign Affairs, no. 4 (July 1971), pp. 652-68.

Levy, Walter J. "World Oil Cooperation or International Chaos." Foreign Affairs, vol. 52, no. 4 (July 1974), pp. 690-713.

Lewis, Bernard. "Conflict in the Middle East." Survival, vol. XIII, no 6 (June 1971), pp. 192-98.

Lidsky, Lawrence M. "The Quest for Fusion Power." Technology Review, vol. 74, no. 3 (January 1972), pp. 10-21.

Lincoln, G. A. "Energy Conservation." Science, vol. 180, no. 4082 (13 April 1973), pp. 155-62.

Loomis, Carol J. "How to Think About Oil-Company Profits." Fortune, vol. LXXXIX, no. 4 (April 1974), pp. 98-103.

Mallakh, Ragaei el-. "The Challenge of Affluence: Abu Dhabi." The Middle East Journal, vol. 24, no. 2 (Spring 1970), pp. 135-46.

_____. "The Economics of Rapid Growth: Libya." The Middle East Journal, vol. 23, no. 3 (Summer 1969), pp. 308-320.

Mates, Leo. "Non-Alignment and the Great Powers." Foreign Affairs, vol. 48, no. 3 (April 1970), pp. 525-36.

Maugh, Thomas H. II. "Fuel from Wastes: A Minor Energy Source." Science, vol. 178, no. 4061 (10 November 1972), pp. 599-602.

_____. "Gasification: A Rediscovered Source of Clean Fuel." Science, vol. 178, no. 4056 (6 October 1972), pp. 44-45.

_____. "Hydrogen: Synthetic Fuel of the Future." Science, vol. 178, no. 4063 (24 November 1972), pp. 849-52.

Mayer, Lawrence A. "Oil, Trade and the Dollar." Fortune, vol. LXXXIX, no. 6 (June 1974), pp. 193-201.

McCarthy, John. "Energy and the Environment." Science, vol. 183, no. 4128 (8 March 1974), pp. 901-902.

Meadows, Dennis L. "Nuclear Energy and Growth." Science, vol. 179, no. 4076 (2 March 1973), pp. 855-56.

Meir, Golda. "Israel In Search of Lasting Peace." Foreign Affairs, vol. 51, no. 3 (April 1973), pp. 447-61.

Mendelsohn, M. S. "World Money - What Is Not Happening, And Why." Euromoney, May 1974, pp. 32-35.

Metz, William D. "Fusion: Princeton Tokamak Proves a Principle." Science, vol. 178, no. 4067 (22 December 1972), p. 1274B.

_____. "Helium Conservation Program: Casting It to the Winds." Science, vol. 183, no. 4120 (11 January 1974), pp. 59-63.

_____. "Laser Fusion: A New Approach to Thermonuclear Power." Science, vol. 177, no. 4055 (29 September 1972), pp. 1180-82.

_____. "Magnetic Containment Fusion: What Are the Prospects?" Science, vol. 178, no. 4058 (20 October 1972), pp. 291-93.

_____. "New Means of Transmitting Electricity: A Three-Way Race." Science, vol. 178, no. 4064 (1 December 1972), pp. 968-70.

_____. "Power Gas and Combined Cycles: Clean Power from Fossil Fuels." Science, vol. 179, no. 4068 (5 January 1973),

Meyers, R. A.; Hamersma, J. W.; Land, J. S.; Kraft, M L. "Desulfurization of Coal." Science, vol. 177, no. 4055 (29 September 1972), pp. 1187-88.

Mikdashi, Zuhayr. "Collusion Could Work." Foreign Policy, no. 14 (Spring 1974), pp. 57-67.

Mikolaj, Paul G. "Environmental Applications of the Weibull Distribution Function: Oil Pollution." Science, vol. 176, no. 4038 (2 June 1972), pp. 1019-21.

Miller, A. "The Energy Crisis as a Coal Miner Sees It." The Center Magazine, vol. VI, no. 6 (November/December 1973), pp. 35-45.

Mishan, E. J. "The Postwar Literature on Externalities: An Interpretive Essay." Journal of Economic Literature, vol. IX, no. 1 (March 1971), pp. 1-28.

Modesta, Jorg. "The Energy Crisis Facing the U. S." Middle East International, no. 20 (February 1973), pp. 13-17.

Moran, Theodore H. "Coups and Costs." Foreign Policy, no. 8 (Fall 1972), pp. 129-37.

_____. "New Deal or Raw Deal in Raw Materials?" Foreign Policy, no. 5 (Winter 1971-72), pp. 119-34.

Moyers, John C. and Hirst, Eric. "Efficiency of Energy Use in the United States." Science, vol. 179, no. 4080 (30 March 1973), pp. 1299-1304.

Murray, James R. et al. "Evolution of Public Response to the Energy Crisis." Science, vol. 184, no. 4134 (19 April 1974), pp. 257-63.

Naumann, Robert J. "Automotive Emission Standards and Fuel Economy." Science, vol. 183, no. 4125 (15 February 1974), p. 595.

Netschert, Bruce C. "The Energy Company: A Monopoly Trend in the E Energy Markets." Bulletin of the Atomic Scientists, vol. XXVII, no. 8 (October 1971), pp. 13-17.

Nuckolle, John; Emmett, John L.; Wood, Lowell. "Fusion Power by Laser Implosion." Scientific American, vol. 230, no. 6 (June 1974), pp. 24-37.

Oka, I. N.; Pimentel, David; Hurd, L. E.; Bellotti, A. C.; Forster, M. J.; Sholes, O. D.; Whitman, R. J. "Food Production and the Energy Crisis." Science, vol. 182, no. 4111 (2 Nov. 1973), pp. 443-49.

Okita, Saburo. "Natural Resource Dependency and Japanese Foreign Policy." Foreign Affairs, vol. 52, no. 4 (July 1974), pp. 714-24.

Othmer, Donald F. and Roels, Oswald A. "Power, Fresh Water and Food from Cold, Deep Sea Water." Science, vol. 182, no. 4108 (12 October 1973), pp. 121-25.

Pachter, Henry M. "Imperialism in Reverse." Harper's, vol. 248, no. 1489 (June 1974), pp. 62-68.

Penrose, Edith. "Vertical Integration with Joint Control of Raw Material Production: Crude Oil in the Middle East." The Journal of Development Studies, vol. 1, no. 3 (April 1965), pp. 251-68.

Pimentel, David; Hurd, L. E.; Bellotti, A. C.; Forster, M. J.; Oka I. N.; Sholes, O. D.; Whitman, R. J. "Food Production and the Energy Crisis." Science, vol. 182, no. 4111 (2 November 1973), pp. 443-49.

Pollack, Gerald A. "The Economic Consequences of the Energy Crisis." Foreign Affairs, vol. 52, no. 3 (April 1974), pp. 452-71.

Potter, Stephen P. "Energy Supply." Science, vol. 180, no. 4085 (4 May 1973), p. 446 (Letters).

Quandt, William B. "'Algeria: Yes.' Part I of 'Can We Do Business With Radical Nationalists?'" Foreign Policy, no. 7 (Summer 1972), pp. 108-131.

Rand, Christopher T. "The Arabian Fantasy." Harper's, vol. 248, no. 1484 (January 1974), pp. 42-54.

Ravenal, Earl C. "The Case for Strategic Disengagement." Foreign Affairs, vol. 51, no. 3 (April 1973), pp. 505-521.

Reed, T. B. and Lerner, R. M. "Methanol: A Versatile Fuel for Immediate Use." Science, vol. 182, no. 4119 (28 December 1973), pp. 1299-1304.

Rembo, Oded and Sinai, Anne. "The Energy Problem and the Middle East: An Introduction." Middle East Information Series, vol. XXIII (May 1973), pp. 2-7.

Richardson, John P. "America's Middle East Policy." Middle East International, No. 16 (October 1972), pp. 13-14.

Rinehart, John S. "18.6-Year Earth Tide Regulates Geyser Activity." Science, vol. 177, no. 4046 (28 July 1972), pp. 346-47.

Robson, Geoffrey R. "Geothermal Electricity Production." Science, vol. 184, no. 4134 (19 April 1974), pp. 371-75.

Roels, Oswald A. and Othmer, Donald F. "Power, Fresh Water and Food from Cold, Deep Sea Water." Science, vol. 182, no. 4108 (12 October 1973), pp. 121-25.

Rose, David J. "Controlled Nuclear Fusion: Status and Outlook." Science, vol. 172, no. 3985 (21 May 1971), pp. 797-808.

_____. "Nuclear Electric Power." Science, vol. 184, no. 4134 (19 April 1974), pp. 351-59.

_____ and Kubo, Arthur S. "Disposal of Nuclear Wastes." Science, vol. 182, no. 4118 (21 December 1973), pp. 1205-1211.

Rose, Sanford. "Our Vast, Hidden Oil Resources." Fortune, Vol. LXXXIX, no. 4 (April 1974), pp. 104-7.

Rothschild Intercontinental Bank. "Coping with the Oil Deficit." Euromoney, May 1974, pp. 115-18.

Rouleau, Eric. "Egypt from Nasser to Sadat." Survival, vol. XIV, no. 6 (November/December 1972), pp. 284-86.

Ruggie, John Gerard. "Collective Goods and Future International Collaboration." American Political Science Review, vol. LXVI, no. 3, pp. 874-93.

_____. "The Structure of International Organization: Contingency, Complexity, and Post-Modern Form." Peace Research Society, Papers, XVIII, The London Conference (1971), pp. 73-91.

Sadat, Anwar el-. "Where Egypt Stands." Foreign Affairs, vol. 51, no. 1 (October 1972), pp. 114-23.

Safran, Nader. "Arab-Israeli Conflict." Foreign Affairs, vol. 52, no. 2 (January 1974), pp. 215-37.

Sagan, L. A. "Human Costs of Nuclear Power." Science, vol. 177, no. 4048 (11 August 1972), pp. 487-93.

Sanisaka, Masao, "World Energy Problems and Japan's International Role." Energy Policy, vol. 1, no. 2 (September 1973), pp. 100-106.

Salzano, F. J.; Winsche, W. E.; Hoffman, K. C. "Hydrogen: Its Future Role in the Nation;s Energy Economy." Science, vol. 180, no. 4093 (29 June 1973), pp. 1325-32.

Sass, Jeremy and Blumer, Max. "Oil Pollution: Persistence and Degredation of Spilled Fuel Oil." Science, vol. 176, no. 4039 (9 June 1972), pp. 1120-22.

Schmidt, Helmut. "The Struggle for the World Product." Foreign Affairs, vol. 52, no. 3 (April 1974), pp. 437-51.

Schoenbaum, David. "'...Or Lucky?' Part II of 'Jordan: The Forgotten Crisis.'" Foreign Policy, no. 10 (Spring 1973), pp. 171-181.

Seaborg, Glenn T. "For a U. S. Energy Agency." Science, vol. 176, no. 4040 (16 June 1972), p. 1189.

Seif, Michael. "Fusion Power: Progress and Problems." Science, vol. 173, no. 2999 (27 August 1971), pp. 802-3.

Shapley, Deborah. "Auto Catalyst to Stay for 1975." Science, vol. 182, no. 4114 (23 November 1973), p. 809.

_____. "EPA Severs Ties with Industry Research Group." Science, vol. 183, no. 4120 (11 January 1974), pp. 60-61.

_____. "Law of the Sea: Energy, Economy Spur Secret Review of U. S. Stance." Science, vol. 183, no. 4122 (25 January 1974), pp. 290-92.

Sholes, O. D.; Pimentel, David; Hurd, L. E.; Bellotti, A. C.; Forster, M. J.; Oka, I. N.; Whitman. R. J. "Food Production and the Energy Crisis." Science, vol. 182, no. 411 (2 November 1973), pp. 443-49.

Shourie, Arun. "Growth, Poverty and Inequalities." Foreign Affairs, vol. 51, no. 2 (January 1973), pp. 340-52.

Shulman, Marshall D. "Toward a Western Philosophy of Coexistence." Foreign Affairs, vol. 52, no. 1 (October 1973), p. 35.

Silbey, Franklin R. "Will Arab Oil Change the U. S. Middle East Stance?" Middle East Information Series, vol. XXIII (May 1973), pp. 40-52.

Sinai, Anne and Rembo, Oded. "The Energy Problem and the Middle East: An Introduction." Middle East Information Series, vol. XXIII (May 1973), pp. 2-7.

Squires, Arthur M. "Clean Fuels from Coal Gasification." Science, vol. 184, no. 4134 (19 April 1974), pp. 340-46.

Stabler, Charles and Vicker, Ray. "Liquid Assets - Middle East Oil Funds Play an Increasing Role in Monetary Turmoil." Middle East Information Series, vol. XXIII (May 1973), pp. 75-78.

Starr, Chauncey and Hammond, R. Phillip. "Nuclear Waste Storage." Science, vol. 177, no. 4051 (1 September 1972), pp. 744-45 (Letters).

Stauffer, Thomas R. "Impact of Middle East Petroleum Operations the U. S. and U. K. Balance of Payments." Middle East Economic Survey, vol. XII, no. 31 (30 May 1969), pp. 1-5.

_____. "Oil Money and World Money: Conflict or Confluence?" Science, vol. 184, no. 4134 (19 April 1974), pp. 321-25.

Steinhart, Carol E. and Steinhart, John S. "Energy Use in the U. S. Food System." Science, vol. 184, no. 4134 (19 April 1974), pp. 307-316.

Takeuchi, Kenji and Varon, Bension. "Developing Countries and Non-Fuel Minerals." Foreign Affairs, vol. 52, no. 3 (April 1974), pp. 497-510.

"A 30-Year Cycle of Energy Development." Technology Review, vol. 73, no. 8 (June 1971), p. 59.

Teman, A. "An Oil-Based Arab Currency." Euromoney. May 1974. p. 30.

Thompson, A. W.; Cooley, P. R.; Hooven, F. J. "Fuel Economy and Emission Controls." Science, vol. 184, no. 4136 (3 May 1974), pp. 520-22.

Tribe, Laurence H. "Technology Assessment and the Fourth Discontinuity: The Limits of Instrumental Rationality." Southern California Law Review, vol. 46, no. 3 (June 1973), pp. 617-60.

Turcotte, D. L. "Statistical Thermodynamic Model for the Distribution of Crustal Heat Sources." Science, vol. 176, no. 4038 (2 June 1972), pp. 1021-22.

Varon, Bension and Takeuchi, Kenji. "Developing Countries and Non-Fuel Minerals." Foreign Affairs, vol. 52, no. 3 (April 1974), pp. 497-510.

Venu, S. "Oil Prices and the Indian Economy." Euromoney, May 1974, pp. 105-107.

Vernon, Raymond. "The Multinational Enterprise: Power versus Sovereignity." Foreign Affairs, vol. 49, no. 4 (July 1971), pp. 736-51.

Verrier, A. "Oil and Regional Development." Middle East International, no. 7 (October 1971), pp. 39-40.

Vicker, Ray. "Liquid Assets - Middle East Oil Funds Play an Increasing Role in Monetary Turmoil." Middle East Information Series, vol. XXIII (May 1973), pp. 75-78.

Wade, Nicholas. "Raw Materials: U. S. Grows More Vulnerable to Third World Cartels." Science, vol. 183, no. 4121 (18 January 1974), pp. 185-86.

Walsh, John. "Britain and Energy Policy: Problems of Interdependence." Science, vol. 180, no. 4092 (29 June 1973), pp. 1343-47.

_____. "Electric Power Research Institute: A New Formula for Industry R & D." Science, vol. 182, no. 4109 (19 October 1973), pp. 263-65.

_____. "Problems of Expanding Coal Production." Science, vol. 184, no. 4134 (19 April 1974), pp. 336-39.

_____. "West Virginia: Strip Mining Issue in Moore-Rockefeller Race." Science, vol. 178, no. 4060 (3 November 1972), pp. 484-86.

Weinberg, Alvin. M. "Nuclear Energy." Science, vol. 178, no. 4064 (1 December 1972), pp. 933-34.

_____. "Social Institutions and Nuclear Energy." Science, vol. 177, no. 4043 (7 July 1972), p. 27.

Weinhold, J. Frederick. "Nonnuclear Energy for Development." Science, vol. 180, no. 4083 (20 April 1973), p. 324.

Wilson, Carroll L. "A Plan for Energy Independence." Foreign Affairs, vol. 51, no. 4 (July 1973), pp. 657-75.

Wilson, Richard. "Tax the Integrated Pollution Exposure." Science, vol. 178, no. 4057 (13 October 1972), pp. 182-83.

Wohlstetter, Albert. "Japan's Security: Balancing After the Shocks." Foreign Policy, no. 9 (Winter 1972-73), pp. 171-190.

Wolf, Martin. "Solar Energy Utilization by Physical Methods." Science, vol. 184, no. 4134 (19 April 1974), pp. 382-86.

Wood, Lowell; Emmett, John L.; Nuckolle, John. "Fusion Power by Laser Implosion." Scientific American, vol. 230, no. 6 (June 1974), pp. 24-37.

Woodhouse, Edward J. "Revisioning the Future of the Third World: An Ecological Perspective on Development." World Politics, vol. XXV, no. 1 (October 1972), p. 1.

Woodwell, G. M. "Biotic Energy Flows." Science, vol. 183, no. 4123 (1 February 1974), p. 367.

Zakariya, Hasan. "Some Analytical Comments on OPEC's Declaratory Statement of Petroleum Policy." Middle East Economic Survey, 14 February 1969.

News Reports in Journals

"Belgium: 1968-72 Nuclear Programme." Science Policy News, vol. 1, no. 4 (January 1970), pp. 87-88. (News and Reports.)

"The Coal Industry Makes a Dramatic Comeback." Business Week, 4 November 1972, pp. 50-58.

"European Community - Energy Policy Situation." Science Policy News, vol. 3, no. 1 (July 1971), pp. 18-19.

"Expenditure on Nuclear Research 1956-68." Science Policy News, vol. 1, no. 1 (July 1969), p. 9. (News and Reports.)

"France - Electric Power to be Based on Enrich-Uranium Stations." Science Policy News, vol. 1, no. 4 (January 1970), p. 90. (News and Reports.)

"Nixon Outlines His Energy Plan, Proposes Opening Oil Shale Reserves." Science, vol. 172, no. 3988 (11 June 1971), pp. 1114-15.

"OPEC and the Diminishing Dollar." Middle East International, no. 10 (January 1972), pp. 18-19.

"U. K. Forecasting Model of the Electricity System." Science Policy News, vol. 2, no. 2 (September 1970), p. 22. (News and Reports.)

"Work of the European Nuclear Energy Agency." Science Policy News, vol. 2, no. 2 (September 1970), pp. 17-19.