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Europe's Changing Energy Relations

Horst Mendershausen

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In considering Western Europe's changing energy relations, this report projects likely changes and examines current developments in the energy structures of OECD-Europe and the United States, and discusses international political, economic, and security issues related to these developments and to possible emergency disruptions of international oil supply. By 1985 OECD-Europe will probably use relatively less oil and coal, and relatively more nuclear electricity and natural gas. The United States will probably use relatively more coal and nuclear electricity, relatively less natural gas, and about the same proportion of oil. The two areas' degrees of dependence on imported oil appear to be converging--Europe's remaining, however, distinctly higher. Oil will remain by far the largest single source of energy in both areas, and the 'swing fuel.' Assuring an uninterrupted flow of oil by diplomatic and military means will become to a greater extent a matter of U.S. economic self-interest. (LC)

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Europe's Changing Energy Relations

Horst Mendershausen

A report prepared for

Office of the Assistant Secretary of Defense (International Security Affairs)

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PREFACE

This report documents a study of Western Europe's changing energy relations undertaken for the Office of the Assistant Secretary of Defense, International Security Affairs. It considers developments now under way, and developments that may be expected during the decade ahead, in the oil, natural gas, and nuclear energy economies of the area's principal countries. It also examines related political, economic, and security issues. The study should assist Department of Defense officials in understanding trends and problems in European energy politics and in dealing with related military policy issues.

The author is a consultant to The Rand Corporation. Together with Richard Nehring, he previously wrote *Protecting the U.S. Petroleum Market against Future Denials of Imports* (The Rand Corporation, R-1603-ARPA, October 1974).

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SUMMARY

In considering Western Europe's changing energy relations, this report (1) projects likely changes during the decade ahead in the energy structures of OECD-Europe and, for comparison, the United States; (2) examines current developments now under way in the oil, natural gas, and nuclear energy economies of the area's principal countries; and (3) discusses international political, economic, and security issues related to these developments and to possible emergency disruptions of international oil supply.

Section II outlines the likely supply (both production and import) patterns for the various types of energy in 1980 and 1985, compared with 1974, in OECD-Europe and the United States. Section III discusses the progress and reshaping of European programs to achieve oil independence, whereas Sec. IV analyzes related foreign and security policy issues. Finally, Sec. V considers problems in the relations among the industrial democracies during emergency disruptions of oil supply. It reviews the 1973/74 experience and discusses, within the framework of the International Energy Agency (IEA) agreement, difficulties that may appear in a future supply crisis.

Given the study's focus on the coming decade, the research concentrates on energy developments that have begun, plans that may or may not be carried out by the mid-eighties, and currently discernible political and security issues. It ignores the possible effects of revolutionary technological developments that may occur in the decade and influence energy policies, if not actual energy patterns, during this time span.

The principal findings of the report are summarized below. Although all of the findings should assist Defense Department officials in assessing European energy prospects and energy-related policy issues, the paragraphs marked by asterisks (*) bear directly on OSD business.

Energy Structures: Current energy developments make it likely that OECD-Europe will by 1985 draw lesser proportions of its total energy than in 1974 from oil and coal, and greater proportions from nuclear electricity and natural gas. The United States will probably draw

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lesser proportions of its total energy from natural gas, and greater proportions from coal and nuclear electricity, the share of oil remaining about the same. Actual events will, of course, depend on many circumstances that cannot be predicted with certainty. It is certain, however, that oil will remain by far the largest single source of energy in both areas, and the "swing fuel."

Oil Imports: The dependence of OECD-Europe as a whole on imported oil may rise in volume terms but is likely to decline proportionately from three-fifths to two-fifths of all primary energy. In the United States, the share of imported oil will probably rise from less to more than one-fifth of all primary energy. The two areas' degrees of dependence on imported oil thus appear to be converging--Europe's remaining, however, distinctly higher than that of the United States. Middle Eastern oil will remain predominant in European imports. It will also constitute a growing proportion of U.S. imports, albeit remaining smaller than Europe's.

Other Energy Imports: The prospective reduction of OECD-Europe's relative dependence on imported oil will be accompanied by a substantially greater dependence on imported natural gas and uranium, and, temporarily at least, uranium enrichment services. Measured in terms of total primary energy, the latter increases will be smaller than the prospective decrease in oil imports. Within the affected energy branches, however, they are significant--e.g., from 4 to 26 percent of the natural gas supply to the European Community as a whole. Foreign sources of natural gas will differ somewhat from those of oil, with the Soviet Union due to supply an important part of the former, less of the latter. For a short while, in the late 1970s, the USSR will also be Western Europe's principal supplier of uranium enrichment services. Western Europe is likely to import somewhat more coal and substantially (and lastingly) fewer uranium enrichment services from the United States. Combined oil, gas, and coal imports can be expected to amount to nearly one-half of Western Europe's total energy supply by 1985, down from nearly two-thirds in 1974.

Energy Policy Factors: The contrast between the American and European outlooks should not be attributed principally, if at all, to

more effective postcrisis energy policies in Europe. The better European picture is due more to fortune than virtue. In 1974, Europe was just beginning to profit from North Sea oil and gas developments initiated in the 1960s, which will become fully productive in the decade ahead. The United States was then facing depletion of domestic resources in the contiguous 48 states, unrelieved by timely action in Alaska and offshore. In any event, energy developments under way in Western Europe and the United States are not the result of concerted efforts to reduce oil import dependence and should not be judged by a single criterion. The developments should be seen as the net results of forces seeking secure, cheap, clean, convenient, technically manageable, and profitable energy--each of these laudable objectives being complex and ambivalent, and all being combined either deliberately in programs or randomly by the play of competing political and market factors. Although security of supply often dominates governmental rhetoric, even that consideration produces alternatives rather than an unambiguous course of action. For oil import policy, for example, the alternatives range from minimizing all imports; to minimizing those from particular sources and importing more from others, i.e., diversifying imports; to ensuring undiminished imports from whatever source by economic and political engagements and strategies to prevent disruptions. For these reasons, the degree of prudence, or future benefits and costs, cannot be measured simply by the extent to which oil imports are reduced over time. The advantages and disadvantages accruing to Western Europe and the United States through the energy trends described above depend on the unpredictable configuration of future political and economic events.

Diversity: Neither OECD-Europe nor the European Community is a unit with uniform conditions and policies. Energy structures of the individual countries vary, and are subject to different national policy orientations. Elements of cooperation and conflict operate within as well as between national policies.

Country Expectations: Except The Netherlands, all Western European countries expect to lower the contribution of extraregional oil to their total energy consumption in the decade ahead--Britain and Norway by

substituting North Sea oil and gas, the others by substituting natural gas (imported or domestic) and nuclear electricity, in different proportions. The Netherlands expects to compensate declining domestic gas supplies in the 1980s by increasing oil imports. For Britain in the 1990s, both domestic coal and imported oil may regain importance if offshore oil reserves fail to grow beyond what can now be safely expected.

Substitution Constraints: All of the expected substitutions face constraints that are now more evident than they were in 1974. The constraints range from limitations on oil development (physical, economic, and political) in the North Sea states to nuclear power difficulties, limits to electrification, and other impediments elsewhere. The economic depression of 1974/75 fortuitously lowered European oil imports. We cannot yet predict how future oil imports will be affected by more economical energy use, induced by higher prices, administrative measures, and changes in energy-using equipment.

Nuclear Power: Ambitious nuclear power projects are proceeding in France and West Germany; but, for a variety of reasons--not all of them specific to this risky industry or to the particular country--their pace is currently slackening. In Sweden, the United Kingdom, and Italy, growth in the nuclear power industry is also lagging behind earlier expectations. Neither actual nor prospective shortages of uranium and uranium enrichment facilities account for the slowdowns. The drastic reduction/retardation of nuclear power development in the United States should make nuclear materials even more readily available to European and other countries. By the early 1980s, Western European uranium enrichment capacities will furnish most enrichment services for European reactors, ending Europe's nearly complete dependence on the United States and--in the late 1970s at least--heavy dependence on the USSR.

Constraints on Cooperation: Aside from the constraints on substitutes for oil and other energy developments in individual European countries, constraints on international cooperation among them, and among industrial democracies in general, reduce the extent to which these countries can pursue their own developments and benefit from each others'. Prominent constraints are various phenomena of energy

mercantilism: restraining exports and avoiding long-term supply commitments for North Sea oil and fissionable materials; national company and siting preferences for oil and nuclear facilities; and competitive misallocations of capital to, for example, oil export refineries both in Europe and elsewhere. As in other fields of policy, governments pursue both independence and interdependence, unsteady in their methods of mixing the two and unsure of the meaning of each.

**Spectrum of Risks*: The remaining--in the case of the United States even increasing--dependence on imported oil, and the developing dependence on imports of other energy materials, constitute security risks for supplies. But these risks vary in severity according to the contingencies with which they are associated. The worst case, in which all external sources of energy supply (oil, gas, and uranium; Saudi, all-Arab, all-OPEC, and Soviet) are denied, is of course the least likely--but at the same time the one that would almost certainly lift the energy issue out of the peacetime context in which this study is written. The risks of supply denial to the exporters are also substantial and in many cases tend to grow. The importers can make these risks weigh more heavily on the exporters, if they have the will and the skill.

**Defense Policy Implications*: The probable increase in the dependence of the U.S. economy on imported oil, concurrent with Europe's decrease, introduces a significant new factor into U.S. foreign and military policies. Assuring an uninterrupted flow of oil by diplomatic and military means will become to a greater extent a matter of U.S. economic self-interest rather than merely a responsibility imposed by the economic needs of our allies. This circumstance should provide a stronger motivation for public opinion and Congress to support appropriations for suitable naval, air, and logistics capabilities, and for diplomatic efforts to secure access to critical source areas and transport points. If "energy independence" continues to elude us, the Department of Defense and other parts of the government will gain a new argument for attaining security in the face of dependence.

Middle East Control: Increasing oil import dependence also emphasizes the American interest in developing and maintaining control

over the Arab-Israeli conflict, and in separating militant Arabism from the oil policies of Saudi Arabia and other producers.

European Economic Approach: Lacking most of the diplomatic and military means available to the United States for deterring Middle Eastern political developments that could lead to an oil supply cutoff, European governments approach the region with the principal objective of engaging the interests and presumed interests of the oil powers. In 1973/74, the chief engagement effort was aimed at obtaining preferential access to oil. As oil supply difficulties waned, the economic activities focused on attracting oil money to European exports. The hoped-for linkage of these exports to price and supply preferences for oil imports, however, remains elusive.

Political Pleasing: The efforts to court oil producers by humoring their political moods, or those of allied coalitions, have shown themselves to be fraught with risks and dubious rewards. The French have accumulated the most experience in this regard. Since both moods and coalitions shift, the friends courted often turn out to be fickle--and humoring them tends to produce conflicts with other industrial democracies.

**Oil Producers' Dependence*: On the other hand, economic and military development projects that make oil-producing countries dependent on an uninterrupted supply of services, personnel, materials, spare parts, and training from specific sources in the industrial world--notably sources that are irreplaceable on short notice--are likely to generate new motivations for reliable oil supply. So are the financial assets that producer countries are building up in the industrial world. Industrial democracies should cultivate the producers' consciousness of their own dependence, just as they cultivate ours of our dependence on them.

North Sea Oil Issues: North Sea oil management creates regional foreign policy issues, e.g., British and Norwegian oil mercantilism and Norwegian oil development conservatism as opposed to continental and Scandinavian interests. The issues are significant in many regards, usually not very sharp, but in need of careful treatment and compromises. The same applies to the Norwegian/Soviet issues and related

Norwegian/Western Alliance issues arising in the context of oil exploration north of the 62nd parallel, especially in the Barents Sea.

**Defense of Offshore Oil*: Neither Britain nor Norway regards as useful measures specifically directed to the military defense of the offshore oil installations in case of war with the Soviet Union, or any military use of these facilities in peacetime. Both countries recognize, however, their inescapable responsibility to safeguard their sovereignty in the offshore areas against terrorism, harassment, and undue curiosity by Soviet vessels and aircraft, and to prevent pollution and other disasters. The required national surveillance, rescue, and "border control" capacities are still weak, however, and their strengthening should be supported without being contingent on NATO-wide integration and management. Peacetime policing capabilities of the North Sea states are bound to have some utility in military contingencies as well.

Nuclear Exports: Control of the nuclear weapon potential of the burgeoning nuclear equipment exports of France, Germany, and other allies promises to become an even greater foreign policy issue for the United States. European nuclear energy development entails production of nuclear equipment; this industry in turn looks beyond domestic markets to exports. No Western nuclear industry center favors weapon proliferation, but various third-world countries make reactor purchases contingent on the supply of reprocessing facilities and other technologies. Goaded by conflicts with their neighbors, they barely conceal their interest in weapon applications. Equipment producers are unwilling to forego reactor exports and other economic advantages by insisting on restrictions that would safely close all avenues to weapons. The pressure of the powerfully organized equipment industries for exports is likely to increase as domestic nuclear programs are reduced. A more effective resolution of this problem--a by-product of greater European independence from oil imports--remains a challenge to U.S. security policies.

**U.S. Enrichment Capacity*: To limit the decline of U.S. leverage on the uses of growing nuclear industry capacities abroad, our capacity to supply uranium enrichment services should be expanded. While awaiting

the long-delayed plant expansion, additional reactor-grade uranium might be produced from weapon-grade material if the current modernization of our weapon stockpile freed a sufficient stock of the latter. This course could benefit both our budget and our foreign policy. It hinges, however, on whether the weapon program will indeed release such a stock--or, on the contrary, demand additional quantities.

Embargo Experience: The industrial democracies managed the oil supply emergency of 1973/74 with hesitation, improvisation, and divisiveness--and without countermeasures. The principal oil companies maneuvered quite skillfully between producers' pressures and customers' requirements, attaining what was in the circumstances a rather fair allocation of supplies. Governments showed little gratitude for their efforts; and the companies will neither be able in the future, nor allowed, to do as much in a similar crisis. After the last event, the governments created the International Energy Agreement in order to meet the next supply crisis more effectively, cooperatively, equitably.

The IEA Answer: Creation of the International Energy Agency (IEA) in 1974 was an important affirmation of this resolve and a salutary message to producer countries, the Soviet Union, and those in Western Europe who were beguiled by the notion of a separatist European unity, divorced from the United States. But the new emergency management apparatus could easily malfunction, engendering discord among the industrial democracies even greater in the next emergency than in the last.

Possibilities of IEA Malfunctioning: Formalization and semiautomatization of the emergency management system do not preclude--and its bureaucratization perhaps enhances--possibilities of malfunction. The possibilities range from overt breaches (induced, for example, by governments' or companies' submission to producer blackmail, discontent with the management), to quiet sabotage, to altercations about fair allocation of scarce supplies. Precrisis performance of governments in building up true emergency stockpiles of oil and creating standby production facilities is poor owing to inadequate financing, deceptive criteria, and indecision.

**IEA Supplements:* Aside from efforts to remedy some of the system's

deficiencies, two supplements might importantly strengthen its deterrent and defense value: provisions for U.S. discretionary supply of oil to particular countries, and provisions for a full range of countermeasures against willful supply disrupters. These provisions should not be sought as amendments or enlargements of the IEA's bureaucratic structure, but as unilateral or confidentially bilateral or multilateral preparations. Provisions for discretionary supply could alleviate the system's internal difficulties and sustain nonmember allies (as does, for example, the 1975 oil supply commitment to Israel).

With regard to countermeasures, intensive studies should be undertaken to ascertain the existing and developing vulnerabilities of regimes in oil-producing countries, with a view to developing better deterrence postures and improving contingency plans. The industrial democracies' virtually unavoidable dependence on imported oil and gas--which is, in some cases, increasing--requires developing a better understanding of the countervailing dependence of the producers on imported goods and services, and its implications.

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I. INTRODUCTION

In considering Western Europe's changing energy relations, the present study (1) projects likely changes during the decade ahead in the energy structures of OECD-Europe and, for comparison, the United States; (2) examines current developments now under way in the oil, natural gas, coal, and nuclear energy situations of the principal Western European countries; and (3) discusses international political, economic, and security issues related to these developments and to possible emergency disruptions of international oil supply.

Section II outlines in quantitative terms the likely supply (both production and import) patterns for the various types of energy in 1980 and 1985, compared with 1974, in OECD-Europe and the United States. It also discusses political and economic implications of these supply patterns.

Section III discusses the progress and reshaping of European programs to achieve oil independence, notably the direction of oil policy and constraints on the development of substitutes; the growing importance of the natural gas sector and of natural gas imports; and the problems encountered with nuclear fission energy.

Section IV analyzes foreign and security policy issues related to these energy developments. It touches briefly on the issues that arose during the oil crisis of 1973/74, then turns to three sets of issues that have arisen in the conduct of energy affairs since that time--namely, how to gain the good will of oil producers and related third-world interests, how to govern North Sea oil, and how best to conduct international commerce in nuclear equipment. The foreign and security policy issues are partly intra-European; partly between European countries, the Soviet Union, and third-world countries; and partly between European countries and the United States.

Finally, Sec. V considers problems in the relations among the industrial democracies during emergency disruptions of oil supply. It reviews the 1973/74 experience and discusses, within the framework of the International Energy Agency (IEA), difficulties that may appear in a future supply crisis.

Given the study's focus on the coming decade, the research concentrates on energy developments that have begun, plans that may or may not be carried out by the mid-eighties, and currently discernible political and security issues. It ignores the possible effects of revolutionary technological developments that may occur in the decade and influence energy policies, if not actual energy patterns, during this time span. The present study uses forecasts of energy quantities produced, consumed, or traded around 1980 and 1985 that are based on generally conservative expectations regarding social and technical processes and government policies--in some instances, however, the expectations may not prove to be conservative enough, as discussed below. The forecasts used do not reflect the more radical patterns of energy resource development and conservation ("accelerated policy cases") that have been urged on governments and societies by official and private bodies. Nor do they reflect political shocks that may occur in this time frame and that might lead to the adoption of more radical innovations.

The study focuses on Western Europe, emphasizing developments within that region and relations between it and others. Developments in other parts of the world and energy-related worldwide economic and political/military problems therefore receive only limited attention, and only insofar as they bear on European affairs.

II. THE QUANTITATIVE OUTLOOK AND SOME IMPLICATIONS

The "oil shock" of 1973/74 gave rise to the idea that the industrial democracies must restructure their energy economies in order to safeguard their economic security and political autonomy. The idea of reform, expressed in the American-coined slogan "Project Independence," has inspired much declaratory, regulatory, legislative, and diplomatic activity in Western Europe, the United States, and elsewhere, by which governments are seeking to mobilize their business communities and entire populations, and to spur other governments to a faster pursuit of certain objectives. Over the decade ahead, the industrial democracies wish to reduce their dependence on oil imports from sources they no longer control--notably the Middle East, especially the Arab countries--which, in the circumstances of 1973/74, interrupted the flow of supplies and dictated massive price increases.

The industrial democracies also committed themselves to develop alternative, "more secure" sources of energy, to restrain the growth of energy consumption, and to stockpile oil. Their pronouncements often tended to create the impression that from now on energy policy meant the all-out pursuit of "oil independence," pure and simple. But with the passage of time, all countries found that energy developments and policies had to reflect a variety of other considerations and circumstances--political and economic, industrial and environmental--besides those that dominated in 1973/74.

THE PROJECTIONS

In late 1976, we cannot yet foretell what the governmental and economic undertakings of the last three years--superimposed as they were on much that had begun earlier, and then subject to stops, retakes, and new starts--will have brought about when the conventional target years, 1980 and 1985, arrive. The uncertainty is not due to lack of projections. Indeed, forecasts have flowed copiously from governments, business organizations (energy companies, banks, etc.), and individual scholars, describing larger or smaller sectors of the national, regional,

or worldwide energy economies, based on more or less explicit assumptions concerning this or that influential factor, and derived from calculations ranging in complexity from back-of-the-envelope to elaborate computer operations. The projections to the 1980s may disagree because of different judgments of probabilities or of the impact of professed policy directions on actual events (e.g., governmental and private projections of future U.S. oil imports, or of Norwegian North Sea oil output). Or they agree among themselves and yet may prove to be off the mark because of shared misjudgments about future developments (e.g., the pace of nuclear electricity expansion in continental Western Europe, or perhaps the performance of Alaskan oil logistics at a certain time). Or they are offered as a bundle of alternative projections under a variety of different assumptions, which leaves it to the reader to pick one for his use (e.g., the 10 alternative "cases" of U.S. energy patterns in 1985, presented in the Federal Energy Administration's (FEA) *National Energy Outlook, 1976*).*

The quantitative outlook presented in Tables 1 and 2 (pp. 7-8) was developed by the combined energy staff of OECD/IEA in early 1976. We cannot be certain this outlook will be proved correct by future developments. But several of its characteristics recommend it as a good candidate, and suitable for the purpose of this study:

First, although the outlook is based on member government prognostications submitted to the International Energy Agency, which undoubtedly reflect biases in favor of some government programs and hopes, it nevertheless benefited from some objective estimating procedures and from independent staff judgments that counteracted biases.† Independent

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*The FEA's alternative "cases" were offered in order "to submit for public consideration and debate a limited number of future energy scenarios which characterize expectations and outcomes under various sets of assumptions. . . . Each scenario is designed to assess the impacts of several major policy initiatives, none of which can be realistically assumed to dominate future energy policy to the exclusion of other countervailing initiatives" (*National Energy Outlook, 1976*, Washington D.C., 1976, pp. E1 and E2).

†The data were presented in a working paper of IEA's Policy Analysis and Forecasting Division, "Updated Energy Prospects to 1985," dated 11 February 1976. Estimating procedures were described there in general

judgment is particularly needed when, as in the United States until recently, the entire government is not committed to an explicit and consistent energy program. In place of such a program, this country now has only a set of diverse executive and legislative dispositions. Their implications can be expressed only in judgments.

Second, the principal calculating assumptions specified by the IEA staff--i.e., for GDP growth in the serveral countries to 1980 and 1985, and the level of international oil prices in those years--stipulate a relatively slow GDP growth and a price level (in 1975 dollars) as at present. These basic-case assumptions, which seem reasonable enough for our purpose, underlie the outlook shown in the tables.*

Third, the estimates are presented systematically for all sources of energy supply, and on a comparable basis for OECD-Europe and the United States (as well as for the European Community group (EC), Canada, Japan, Australia, and New Zealand, and the IEA membership as a whole). Such a presentation permits comparisons of source developments within each area as well as between areas.+

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terms. The informal document had not yet been reviewed by member governments. The Appendix (pp. 101-104 below) presents some revisions in these data incorporated in a later OECD/IEA paper, "Long-Term Energy Assessment," 6 August 1976.

*The footnotes to the tables specify the assumed GDP growth rates and prices. Aside from the basic case (called "status quo case" by the IEA staff), the document also summarizes total energy requirements and net oil imports for cases based on faster GDP growth or lower oil prices. In these cases, estimated energy requirements and net oil imports are higher throughout and the latter supply a greater proportion of requirements than in the basic case. Thus, for examples, U.S. net oil imports in 1985 are estimated at nearly 15 million barrels daily (MM b/d) in case of fast GDP growth and lower price, instead of nearly 11 MM b/d in the basic case; and OECD-Europe's net oil imports at 18 instead of 14 MM b/d. Should incomes grow more slowly or oil prices rise, estimated oil imports would probably be smaller than in the basic case.

+The broad coverage of this body of material, which is unrivalled by any other projection studies that have come to this writer's attention, does not mean, of course, that any particular number is "better" than its equivalent in any other national or sector-limited study. The analysis of national and regional energy balances, and the estimation of oil imports as a residual, could have been refined in many ways; but such refinements would not have made the estimates more certain. If they prove to be unrealistic it will more likely be due to unforeseen

For these reasons, the basic-case quantitative outlook presented in the OECD/IEA working paper offers the most useful data for describing the energy positions of Western Europe and, for comparison, the United States in 1980 and 1985, as far as now ascertainable. It is no less persuasive than any comprehensive set of estimates that have come to my attention--including the revised estimates offered by OECD in August 1976 after further studies and consultations with national government officials.* While most revisions pertaining to Tables 1 and 2 are minor, notably those for Europe, some of the more important pertaining to the United States are problematical. In any event, these revisions do not significantly affect the findings of the present study.

PROSPECTIVE PATTERNS OF OIL IMPORT DEPENDENCE AND ENERGY USE

The OECD/IEA outlook for 1980 and 1985, from the perspective of 1976, sees Western Europe as reducing its dependence on oil imported from outside the region, chiefly the Middle East, from about 60 to about 40 percent of total energy supply, as shown by Table 1. It sees the United States as increasing its dependence on imported oil from 17 to about 22 percent of its total energy supply (or from 38 to 50 percent of its oil consumption), as shown by Table 2.

Western Europe's reliance on energy from oil will decline somewhat, while increasing oil production within the region is expected to

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combinations of circumstances than to now-ascertainable misjudgments of detail on either the supply or the demand side.

For technical and other reasons, the working paper does not break down the estimates for OECD-Europe country-by-country. Among the "other reasons," one must expect to find the nonparticipation of OECD-member France in the IEA's reporting system of national data. The OECD/IEA document combines French data with others so as to present estimates for OECD-Europe, but avoids country detail that would necessitate showing the French input explicitly. At this time, IEA's only comprehensive country-by-country estimates of energy production, consumption, and trade for Europe have been derived from member-government submissions. These data are used in Table 4 below (p. 22). The later OECD/IEA document, "Long-Term Energy Assessment," presents at least some domestic energy *production* data by country, including France.

*This revision does not appear to be the last. After further consultations with national authorities, OECD expects to publish a final version under the title *World Energy Outlook*. Tables reflecting the revised August 1976 estimates appear in Appendix A, which discusses differences with Tables 1 and 2.

Table 1

ENERGY SUPPLY PATTERNS, OECD-EUROPE: ACTUAL 1974
AND PROJECTED 1980 AND 1985

Energy Source	Million Tons of Oil Equivalent (Mtoe) Annually 1974	1980	1985	Percent Composition 1974	1980	1985
Coal, total	248[a]	281	283	22	19	16
Production	200	218	214	(3)	(4)	(4)
Net imports	36	62	69			
Oil and LNG, total	658[a]	759	903	57	52	51
Production	22	210	248			
Net imports	697	604	718	(61)	(41)	(40)
Bunkers	-36	-56	-64			
Gas, total	140[a]	231	271	12	16	15
Production	132	193	193			
Net imports	9	38	78	(1)	(3)	(4)
Nuclear electricity	19	92	202	2	6	11
Other sources	83	98	114	7	7	7
Total energy supply	1,149	1,461	1,772	100	100	100

SOURCE: International Energy Agency, Policy Analysis and Forecasting Division, "Updated Energy Prospects to 1985," Working Paper, 11 February 1976. Explicit assumptions underlying projections: (1) GDP growth rate 1974-1980, 3.7 percent annually; 1980-1985, 4.8 percent annually; (2) oil price (Arabian marker crude), $11.51 in 1975 dollars ("status quo case").

[a]After allowance for stock changes.

Table 2

ENERGY SUPPLY PATTERNS, UNITED STATES: ACTUAL 1974
AND PROJECTED 1980 AND 1985

Energy Source	Million Tons of Oil Equivalent (Mtoe) Annually 1974	1980	1985	Percent Composition 1974	1980	1985
Coal, total	328[a]	393	504	19	20	21
Production	357	439	554			
Net imports	-32	-46	-50			
Oil and LNG, total	762[a]	967	1,058	44	48	45
Production	498	540	565			
Net imports	290	454	524	(17)	(23)	(22)
Bunkers	-17	-27	-31			
Gas, total	518[a]	439	492	30	22	21
Production	499	416	436			
Net imports	20	23	57	(1)	(1)	(2)
Nuclear electricity	29	109	227	2	5	9
Other sources	76	88	86	4	4	4
Total energy supply	1,714[b]	1,999[b]	2,367[b]	100	100	100

SOURCE: International Energy Agency, Policy Analysis and Forecasting Division, "Updated Energy Prospects to 1985," Working Paper, 11 February 1976. Assumed GDP growth rates: 1974-1980, 3.1 percent annually; 1980-1985, 3.5 percent annually.

[a]After allowance for stock changes.

[b]Including imports of electricity of 1, 2, and 5 Mtoe, respectively, for the three years.

eventually satisfy about 27 percent of oil demand (1974, 3 percent). The United States' reliance on oil is expected to remain about the same, with domestic production eventually satisfying only about 53 percent of American oil demand (1974, 65 percent).

Briefly, the outlook shows Western Europe as making some headway toward "oil independence" while the United States loses ground; but Western Europe's energy supply in 1985 will still depend more on oil, imported and overall, than that of the United States--particularly Middle Eastern oil. The figure depicts the expected contrary development of Western Europe's and the United States' degree of dependence on oil imports.*

In the attendant restructuring of energy economies, nuclear electricity and natural gas are to "substitute" for oil and coal in Western Europe as a whole. In the United States, nuclear electricity and coal are to "substitute" for natural gas. (Substitution refers, of course, to changes in the total mixture of energy sources and certainly not to changes in all uses of energy; no one expects the "substitutes" to displace, for example, gasoline and diesel oil as fuels for transportation equipment.) In the course of this restructuring, Western Europe is to develop a greater dependence on imported gas and on imported natural uranium (but a lesser dependence on imported uranium enrichment services). Combined oil, gas, and coal imports from outside Western Europe should constitute only 49 percent of that area's total energy supply by 1985, in contrast to 65 percent in 1974.† Will the expected substitute sources of energy become available in time, and to the extent foreseen? One may be fairly confident of that for gas in

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*Like Tables 1 and 2, the figure reflects the assumptions of the IEA's "basic case." A dotted line in the chart reflects alternative assumptions of faster GDP growth (for Western Europe, 4.4 and 5.1 percent annually for 1974 through 1980 and 1980 through 1985, respectively; and, for the United States, 3.6 and 4.0 percent annually, respectively), under continued 1976 oil price levels.

†The development of the import element in nuclear electricity on account of natural uranium supplies and enrichment services is difficult to estimate. European requirements for imported uranium are bound to rise, but those for enrichment services, to diminish over the coming decade. See the discussion below, pp. 37ff.

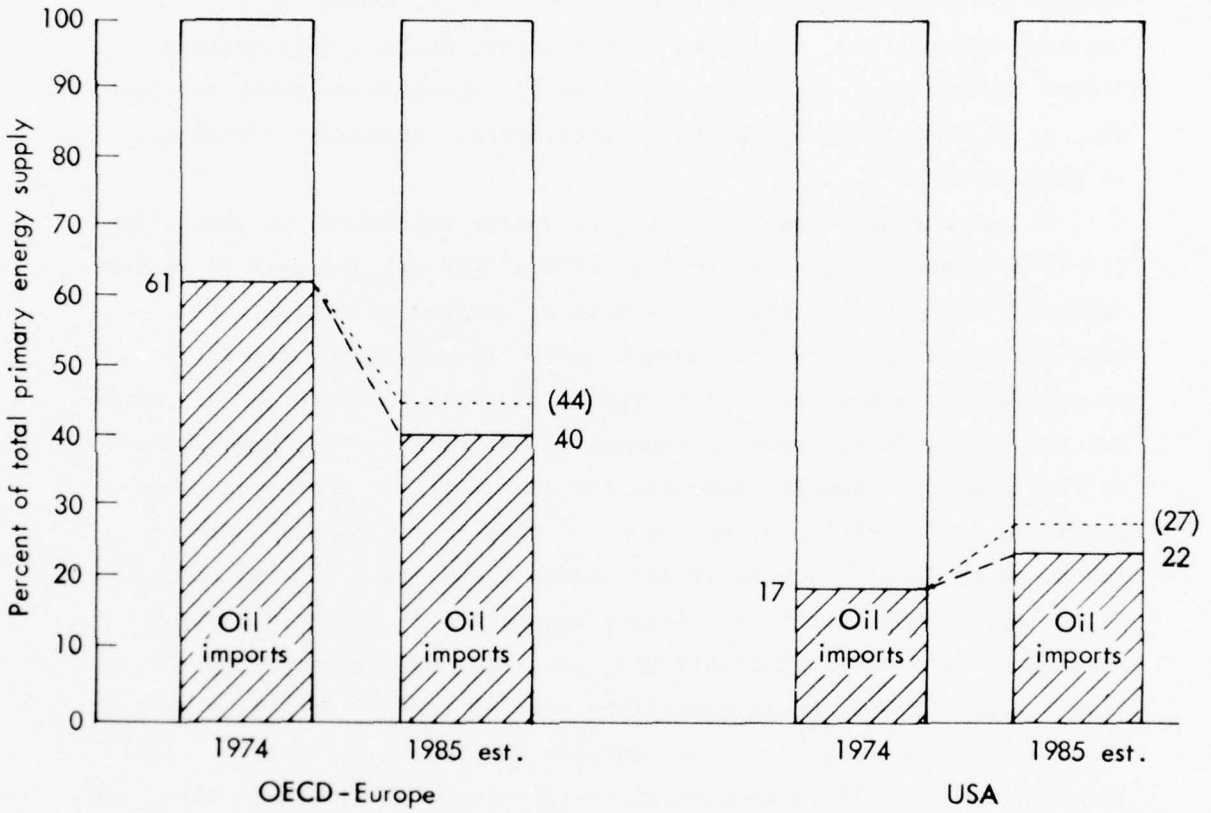

Figure — Net oil imports in total energy supply
OECD-Europe and USA
1974 and 1985 projection[a]

[a] Basic case: Slow GDP growth, present oil price.
Dotted line represents case of fast
GDP growth, present oil price.

Europe and for coal in the United States, but probably not for nuclear electricity in both places. These matters are treated more fully in Sec. III and IV.

Disregarding the significantly different shifts between oil and gas in the two areas and combining liquid and gaseous hydrocarbon energy sources, we can anticipate the principal move toward greater similarity in the European and U.S. energy compositions to occur in the contribution of this conglomerate to total energy. In 1974, it accounted for 69 percent of total energy in Western Europe, 74 percent in the United States. In 1985, it should constitute 66 percent in both. The principal move toward greater dissimilarity, on the other hand, should occur in coal, its contribution dropping from 22 to 16 percent in Europe and rising from 19 to 21 percent in the United States.

POLITICAL AND ECONOMIC IMPLICATIONS OF THE OUTLOOK

When considered in relation to the "Project Independence" professions of intent to reduce reliance on imported (Middle Eastern) oil, the energy outlook developed by the OECD/IEA analysis staff gives Europeans a cause for pride, Americans a cause for embarrassment. If events take this course, at least up to 1985, it will apparently have been the Europeans who followed through and the Americans who moved "backward." Indeed, in some contemporary discussions of international energy, notably within the framework of the IEA, pride and shame, praise and rebuke, tend to be so distributed. The divergence does not, however, principally reflect more vigorous European efforts, compared with the American, to find substitutes for Middle Eastern oil after the crisis of 1973/74. The Europeans' better prospects for reducing oil imports are due more to fortune than virtue--and the worse American prospects, to misfortune unrelieved by virtue. In the early 1970s, Western Europe was just beginning to profit from Dutch gas and North Sea oil and gas developments initiated in the 1960s, which will become fully productive in the decade ahead. The United States was then facing the depletion of traditional domestic resources, unrelieved by timely action in Alaska and offshore. The divergence, therefore, should not be attributed mainly, if at all, to more effective postcrisis energy policies in Europe.

But whatever its historical background, would a divergent development of this kind and scope matter, at least in the way people seem inclined to believe that it would matter? Would such a development make European governments less, or the U.S. government more, subject to the will of Middle Eastern (notably Arab) oil-producing countries and governments? Would it increase or diminish the ability of OPEC to raise oil prices, prevent declines, maintain price discipline? Would it damage or enhance "energy policy solidarity" among the industrial democracies? In all these regards, energy developments directed toward self-sufficiency have been expected to benefit the industrial democracies, or at least to stem dangerous tendencies. Would they? Would foreseeable developments be detrimental?

These questions appear to be unanswerable today--by no means settled in the way many took for granted in the recent past. In discussing them, we shall occasionally anticipate observations elaborated in later sections.

First, the *changes* foreshadowed in the quantitative outlook, although substantial, *may be too small to affect* the political behavior of the states. A Western Europe dependent on imported oil for 40 rather than 60 percent of its energy requirements may be no less inclined than it was in 1973 to "tilt" to the Arab side in, say, a substantial repetition of the scenario of Middle Eastern war, Arab oil embargo, high oil demand, and strong inflationary pressures; and a United States depending on oil imports for 22 rather than 17 percent of its energy, no more. Forty percent is still a large share of total energy, particularly since it involves a much higher percentage in some sectors, notably transportation; and 22 percent is much smaller than 40.

Second, in diplomatic conflicts similar to the 1973 scenario, *considerations other than those related to dependence on oil imports* could reinforce Western Europe's tendency to favor Arab countries, and pressure the United States as well. One consideration that might have this effect could be the greatly enhanced importance of Arab countries as markets for industrial-country exports and as financial partners, compared with which the commercial and financial links with Israel are small. Corporate and foreign-office strategists might be strongly

influenced by this factor. Generally, however, the motivations and forces pulling political leadership to any one posture in the Arab-Israeli conflict are so varied that a change in oil dependence alone might have little influence on government positions--probably less than the current constellation of political power and the composition of leadership.

Third, the *relevance of the 1973 scenario* for the future *may be doubted* and therefore also the relevance of the oil-dependence factor for future foreign policy decisions. The Arab alliance against Israel, notably the identification of some important Arab governments with Palestinian irredentism, may weaken--if not as a result of political settlements between the opponents of the October War then because of new and differently structured conflicts in the Middle East. Aggregate oil demand may grow more slowly than in the early 1970s. Alternative, and particularly reserve, supply capacities may become more important than then, as may protective devices of oil-importing countries (stockpiles, oil-sharing arrangements). In view of the growing dependence of oil-producing countries on the services of industrial countries, the latter, especially the United States, may find more effective ways to deter politically inspired restrictions on oil supply. These conditions cannot be safely taken for granted, but they appear today as distinct possibilities. Such developments, if persistent over some time, would make Saudi-Arabian or other Arab oil supplies seem less contingent on foreign-policy genuflections before militant Arabism than the European governments believed in 1973/74.

Fourth, and perhaps most important, entirely *different conflict situations* may arise, which may present, insofar as energy is concerned, challenges quite different from those produced by an Arab oil embargo. For example, local revolutions in or hostilities between oil-producing countries may pose issues of how to maintain open channels to willing and able suppliers, Arab or non-Arab, rather than how to meet a concerted suppliers' strike. To reduce oil imports from all in anticipation of such troubles would still be a reasonable precaution, but not so imperative as it would be in anticipation of a widespread suppliers' strike.

Conversely, potential conflicts of a different kind among industrial countries could increase the advantages of energy systems that depend rather more than less on oil supplies from whatever source. From the point of view of the cost of energy, such dependence could become attractive if the costs of alternatives to oil, or at least to imported oil, rose more rapidly than the cost of oil itself, in strictly economic or in broader terms. OPEC has been a great source of energy cost inflation, but it will not necessarily always be the greatest. Indeed, the current experience with cost escalation in "secure oil" and nuclear energy offers food for thought.

In any of these eventualities, occurring or perceived as impending, a progressive reduction of reliance on Arab, Middle Eastern, or OPEC oil would no longer be the prime objective of an industrial country's energy policy, which it became in 1973. It might become a secondary, conditional objective--or even cease to be an objective once reduction reaches a certain point--and its limited realization might even seem more an advantage than an outright failure. From this perspective, the probable U.S. energy development suggested by the quantitative outlook would perhaps not seem so unfortunate, and that of Western Europe perhaps not quite so advantageous, as they appear by the policy criteria of "Project Independence."

Fifth, cooperation or *solidarity* of the industrial democracies in matters pertaining to energy *should not be regarded as simply a matter of everyone moving in unison* toward lesser reliance on imported oil or energy. Although this has been the prime objective assigned to international energy cooperation within the framework of the IEA, it should be regarded as neither the sole rationale for creating the agency, nor a sufficient definition of cooperation. The main rationale was to organize the industrial democracies for concerted action in energy management, and to prevent political/economic problems in this field from destroying their alliances, which are predominantly aimed at Soviet political/military challenges.

As for a sufficient definition of cooperation, it is simply impossible to give one, especially one valid for all times. Cooperation or solidarity could easily fail widely while all countries or economic

regions are reducing oil imports as a result, say, of neglected crisis management prerequisities or domestic energy protectionism and beggar-thy-neighbor policies blossoming in conjunction with reductions in oil imports. On the other hand, cooperation in energy and other policies could just as easily continue, even improve, under such divergent developments as the quantitative outlook presented above suggests. For example, reducing the high dependence of Western Europe on imported oil is arguably more important than reducing the United States' relatively low dependence. Or (re)development of a U.S. reserve oil capacity (via initiation of new fields, or stockpiles, or administrative mechanisms) may be more important than a progressive year-to-year reduction of U.S. oil imports. Or diversification of import sources may be more important than import reduction. We should therefore not assume that the disparate outlook for U.S. and Western European aggregate oil imports, by itself, must weaken the bonds that hold the industrial democracies together.

Finally, Western Europe's prospective move toward a somewhat lesser, concurrent with the U.S. move toward a somewhat greater, dependence on oil supplies from the Middle East introduces a significant new factor into U.S. foreign and military policies. *Assuring an uninterrupted flow of that oil* by diplomatic and military means will become to a greater extent a matter of *U.S. economic self-interest* rather than merely a responsibility imposed on the United States by the economic needs of its allies. This circumstance may provide a stronger motivation for public opinion and Congress to support appropriations for suitable naval, air, and logistics capabilities, and for diplomatic and military assistance efforts to secure access to critical source areas and transport points. Greater U.S. dependence on imported oil may counteract U.S. reluctance to undertake the risks and costs attending such efforts to project power into distant areas, and reduce the opposition to some basic political and military requirements that has often hobbled such efforts in the past.

In sum, energy developments to 1985 of the kind suggested by the present quantitative outlook give the industrial democracies opportunities as well as difficulties. If the opportunities are well used,

deliberate (less than all-out) European progress toward "independence from imported oil," and even a moderate U.S. tendency in the opposite sense, need not be regarded as disastrous.

The following sections will examine more closely the progress and reshaping of European drives to achieve oil independence, the interplay of European energy and foreign affairs, and preparations for the management of future energy emergencies, in order to gain a fuller understanding of these countries' evolving security assets and liabilities related to energy.

III. PROGRESS AND RESHAPING OF EUROPEAN OIL INDEPENDENCE DRIVES

This section investigates how the Western European countries started down the road that may lead them to the energy patterns predicted for 1980 and 1985. This is a story of events, policy initiatives, responses to both events and policies, constraints, and reshaped policies. The story must be told with details specific to certain countries, for not only do the details vary considerably from country to country but the arenas in which energy developments are configured are essentially national. The diverse national arenas are in communication but are not governed by a consistent policy. The United States operates even more independently, but the present study will not deal with the American energy evolution.

Space permits the stories of only the principal countries of Western Europe. The discussions are organized according to topic rather than country, in order to highlight parallels and contrasts between the countries.

In 1976 it is, of course, too early to assess the outcomes of the drives for oil independence and other energy policies for the decade ahead on which countries embarked in 1973. We don't know what will be sustained, added, or subtracted, or what designs and investments will come to fruition amidst the events of the future.

AN EARLY START--THROUGH EXOGENOUS FACTORS

In 1974 and 1975, three important factors came to assist the European oil-independence drives. The first, entirely unrelated, was the general economic recession, which lowered energy demand, particularly by industrial users. The second, somewhat less exogenous, was the price increase for all European petroleum products following the large price increases for OPEC crude oil. The third was the increasing availability of energy materials from European sources, principally of Dutch and British natural gas supplies, which had begun to be tapped in the late 1960s. Largely due to these factors, the total oil demand of European countries declined significantly from 1973 to 1975, as shown

in Table 3. Warm winters assisted. Energy economy measures unrelated to these factors played but a small additional role.

Table 3

CONSUMPTION OF PETROLEUM PRODUCTS[a] IN EUROPEAN AND OTHER INDUSTRIAL COUNTRIES, 1973 AND 1975
(In million tons)

Country	1973	1975	Percent Change
West Germany	135	116	-14
France	111	96	-14
United Kingdom	99	82	-18
Italy	92	87	-6
Nine European Community countries	512	443	-14
United States	786	740	-6
Japan	245	226	-10

SOURCE: Union des Chambres Syndicales de l'industrie du pétrole, *L'industrie francaise du pétrole, 1975*, Paris, 1975, p. 7.

[a]Excluding bunkers.

We cannot determine precisely how much the decline in demand for oil was due to recession, how much to higher prices, and how much to the ongoing shift to natural gas. In comparison with the United States, European petroleum product prices rose quite strongly, about twice as fast. By early 1976, German, French, British, Italian consumers paid almost twice as much per barrel for their representative mixes of petroleum products, including taxes, as they had paid before the 1973 embargo; U.S. consumers, only about one-and-a-half as much.

It is noteworthy that petroleum taxes--levied more in proportion to costs in Europe than in the United States, and already high before 1973--contributed significantly to the increase in European consumer prices, much more than they did in the United States. But the net effect of the price increase on oil consumption may have been small because of the generally low sensitivity of energy use to energy price levels over short periods.

Developments in the consumption of different petroleum products suggest that factors other than price were more influential. German inland consumption of industrial fuel oil in 1975 dropped 9 percent from 1974, and 24 percent from 1973; while gasoline and diesel fuel consumption, subject to no lesser price increases, rose. Similarly, French industrial fuel oil consumption dropped 17 percent from 1974 (16 from 1973); while gasoline consumption was up by 4 and 1 percent, respectively, and that of diesel fuel likewise. In both Germany and France, consumption of heating oil in 1975 ran well below 1973 rates, largely owing to warm winter weather.* The economic recession probably accounted for part of the sharp drops in fuel oil consumption.

But part of the decline in consumption of fuel oil and, weather effects apart, in house heating oil must be ascribed to the substitution of natural gas for oil, which had already begun. The natural gas supply to European Community countries, primarily from intra-European sources, rose from 1121 billion kilocalories in 1972 to 1478 in 1974, and to 1659 in 1975, or by 48 percent, as shown in Table 5 (p. 34). From 1973 to 1975, the increase in natural gas supply corresponds to nearly one-half of the decline of those countries' oil consumption. In West Germany alone, the share of natural gas in total primary energy increased from 10 percent in 1973 to 14 percent in 1975.† Increasing availability of Western European natural gas resources in the recent past contrasted sharply with declining availabilities in the United States. Thus, Western Europe's oil-independence drive benefited from the timely fruition of natural gas projects started long before.

Insofar as the conversion from oil to natural gas accounted for the drop in oil imports, the reduction of Western Europe's dependence on imported oil has begun. But insofar as the drop in oil demand is due to the economic recession, it is bound to be reversed by greater economic activity. Indeed, in the first half of 1976, oil consumption and imports from traditional sources began to rise again with increasing

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*_Petroleum Intelligence Weekly_, 12 January 1976, p. 7; 1 March 1976, p. 9.

†Ruhrgas A.G., _Annual Reports_, 1974 and 1975.

economic activity, except in Britain, although they did not yet reach 1973 levels. Oil remains the principal "swing fuel."

The nearly complete dependence of the principal European countries' oil demand on imports (crude or products) did not change from 1973 to 1975 and, except for Britain, will not change in the future. The shares of imported oil traceable to OPEC and OAPEC sources declined somewhat from 1973 to 1975 in all of these countries,* but if one makes allowance for some inaccuracy in tracing the oil back to original sources, this reflects only some increase in imports of Soviet oil and a trickle of North Sea oil. By 1975, the four Western European principals still were basically as dependent on OPEC/OAPEC oil as in 1973. Pending further modifications in their domestic energy structures and increased North Sea oil and gas output, their lessened reliance on Middle Eastern/North African oil in 1975 must be regarded as largely fortuitous. Although a further increase of Soviet oil shipments to Western Europe during 1975/76† may have temporarily reduced this reliance a trifle more, the diversion of Soviet oil from Eastern to Western Europe on which this development appears to have been based is unlikely to be sustained. Even if Soviet oil-export capacity should expand in the coming decade more than has been assumed so far, Soviet oil is unlikely to replace much Middle Eastern oil in Western Europe.

OIL POLICY DIRECTIONS AND SUBSTITUTES FOR OIL

Fortuitous circumstances, good or bad, of the future cannot be predicted, and those of the recent past matter only insofar as the effects of the 1974/75 recession induce planners/extrapolators to reduce certain forecasts of energy consumption for specific future years.

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*See Central Intelligence Agency, Office of Economic Research, *International Oil Developments, Statistical Survey*, various 1976 issues.

†Soviet sales of crude oil to European Community countries are reported to have increased from about 3 million tons in the first half of 1975 to about 7 million tons in the first half of 1976. See B. A. Rahmer, "Threat to East Europe's Oil," *Petroleum Economist*, December 1976, p. 453. The article suggests that acute Soviet hard-currency needs and speculation about an impending substantial OPEC price increase may have accounted for the development of Soviet oil exports.

The forecasts of total primary energy requirements in 1985, shown in Table 4, do not yet reflect such reductions fully, because the national program submissions on which they are based date from early 1975, before the impact of the recession was digested. Only in the case of France, where the data stem directly from more recent calculations by national planners, is this factor traceable. Taking account of the 1975 experience, the French planners reduced the expected level of 1985 total primary energy consumption from 240 Mtoe (their July 1975 estimate) to 232 Mtoe.* West German energy planners appear ready to make an even larger reduction, perhaps 10 percent from their November 1974 estimate of total primary energy consumption for 1985--i.e., 370 Mtoe--when they issue a new energy program statement in early 1977.†

Generally speaking, the 1985 figures on total energy requirements and oil imports in Table 4 should be read as indicating tendencies. Any exploration of national background material soon discloses multiple estimates of varying amounts, or a reluctance to make any estimates.‡ But for the present study, this ambiguity is unimportant. The object of the tabulation is to give an overview of the directions of energy policy in the several countries, and of difficulties and second thoughts encountered along the way.

All countries on the list but The Netherlands expect to reduce their dependence on imported oil during the decade ending in 1985. Indeed, the two beneficiaries of North Sea oil hope to replace theirs by a net export surplus. The expectations expressed in these national estimates are more sanguine than those held by the OECD/IEA secretariat in its "basic case," i.e., for an overall OECD-European import percentage of only 33, compared with the secretariat's 40 percent (see Table 1, p. 7). The lower estimate probably reflects the early enthusiasm for the new policy course. But in at least one case--Norway's--the

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*_Rapport de la Commission de l'énergie du VII^e plan_, Paris, 26 March 1976, p. 30. The report suggests that the new estimate may turn out to be too low, calls it "hard core," and speculates that it may be exceeded by, say, 13 Mtoe, which is named "adjustable supplement."

†Interview information. See also below, pp. 50-51.

‡See footnotes on the United Kingdom, Norway, The Netherlands, and Sweden in Table 4.

Table 4

ENERGY POLICY DIRECTIONS AND CONSTRAINTS IN WESTERN EUROPE

Country	Total Primary Energy Requirement[a] (Mtoe) 1974	1985 est.	Net Oil Imports in Percent of Total Primary Energy Requirements[a] 1974	1985 est.	Principal Substitutes Envisaged for Imported Oil[b] (see Key)	Constraints on Substitute Development (see Key)	Constraints on International Cooperation in Energy Development (see Key)
United Kingdom	215	252	51	- 6[c]	A, B, C	7	I, III
Norway	19	24	28	-50[d]	A	6	I, III
West Germany	260	388	51	43	E, C, D	1, 3, 4, 5	II, IV
France	176	232	64	42	E, C, F	4, 2, 1, 3	III, IV, II
Italy	132	212	77	54	E, C, B	1, 8	IV, II, III
Belgium	46	70	56	40	E, C	1	II
The Netherlands	62	89	43	53[e]	X[f]	7, 1	I, II
Sweden	45	68	60[g]	46[g]	F, E	4, 1	II
Spain	61	119	64	38	E, C, A	1, 8	n.a.
OECD[h] Europe	1,118	1,637	57	33	A, B, E	--	--

[a] IEA compilation of June 1976, based mainly on national programs submitted; for France: *Rapport de la Commission de l'énergie du VII[e] plan*, Paris, 26 March 1976, pp. 5 and 30; "hard core" estimate for 1985.

[b] National energy programs, various national publications.

[c] Midpoint of range of estimated British net oil exports, 14 to 46 Mtoe, in percent of total primary energy.

[d] Using Norwegian estimate of net oil exports for 1980. No Norwegian estimate available for 1985, according to note in source.

[e] Percentage derived from data presented in a memorandum of The Netherlands General Energy Administration, 28 June 1976, updating the *Energienota* cited in footnote *f*. IEA material shows a figure of 46 percent.

[f] Ministry of Economic Affairs, *Energienota*, The Hague, 1974, pp. 188-190.

[g] Employing similar oil import figures, but calculating total energy requirements on a kilowatt-hour basis, the Swedish national source arrives at 73 and 60 percent, respectively, for 1973 and 1985 (*Energy Planning in Sweden*, 1975 parliamentary resolution, published by the Swedish Ministry of Industry, 1975).

[h] Computed as IEA-Europe plus France.

Key to Table 4

Substitutes for Imported Oil	Constraints on Substitute Development[a]	Constraints on International Cooperation
A. Domestic oil	1. Nuclear power obstacles (safety costs and concerns, uranium costs, funding, industrial bottlenecks)	I. Export restraints (notably on crude oil) and avoidance of long-term supply commitments
B. Natural gas (domestic)	2. Costs of converting home heating to electricity	II. Import uncertainties (e.g., for U.S. coal and uranium enrichment, Norwegian oil) and related constraints on investments in foreign energy industries
C. Natural gas (imports)	3. Attraction of traditional oil systems (idle refineries, fuel oil surplus, lagging development of crackers, stabilization or decline of crude oil prices)	III. National company ("chosen instrument") and siting preferences in oil and nuclear facilities
D. Coal (maintained)	4. Lowered energy demand expectations	IV. Longing for preferred ("secure") access to OPEC oil
E. Nuclear electricity	5. High cost of domestic coal	
F. Energy economy drive	6. Political concepts of "sufficient" and "socially digestible" oil development	
X. No substitute for imported oil. National source and IEA submission foreshadow increased dependence on imported oil, with domestic gas output beginning to decline in the 1980s.	7. Limitation of domestic oil or gas resources	
	8. Uncertainty of Algerian LNG supply	

[a]Listed tentatively in order of importance for the country.

impending change is almost certainly understated. If that country produces 50 million tons of oil (90 Mtoe of hydrocarbons) from known North Sea fields by the early 1980s, as the government expects, it will have a net export surplus of more than 100 percent of its own total energy requirements. Natural gas supplies from currently known reserves in The Netherlands are not expected to keep up with energy consumption in the 1980s;* moreover, the government is unwilling to have nuclear power stations built.

The principal expected substitutes for imported oil are domestic oil in Britain and Norway, nuclear electricity in all the others but Holland. In Germany, France, Italy, Belgium, and Spain, imports of natural gas also figure as important substitutes for oil imports (as discussed below, pp. 32ff); and in Germany and the United Kingdom, efforts to maintain coal production play a part.† In the United Kingdom, in fact, coal is seen by some, e.g., the British Coal Board, as an increasingly important oil substitute for the time (the 1990s?) when the British North Sea oil fields may begin to yield declining output. In West Germany, however, coal can be expected to fight only a rearguard action. German steam coal in early 1976 was a good deal more expensive than heavy fuel oil, and much more expensive than natural gas. It can compete for the supply of power plants only with the help of large government subsidies.

All countries, especially those on the continent, want to assist the substitution process by various energy-saving measures. Some,

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*On the basis of proven reserves of almost 2 trillion cubic meters of gas, three-fourths of it in the onshore Groningen field, the official Dutch gas-marketing plan of 1975 foresees that sales to domestic power stations and large factories will begin to be phased out after 1978, and that gas exports will begin to decline at the same time, fall off rapidly after 1985, and virtually cease by 1994 (*Petroleum Economist*, July 1956, p. 256). There are hopes, however, that new reserves will be found meanwhile in the conveniently located Dutch offshore fields, which would somewhat prolong a higher level of deliveries. As of 1 January 1976, proven and probable gas reserves in Dutch offshore fields were estimated at 322 billion m^3 (proven 94 billion). Ibid., p. 257.

†In 1976, the British government decided to proceed with the development of a large new coal field at Selby in Yorkshire. It is expected to lead to the world's largest subterranean coal mine with a production of 10 million tons of coal annually by 1985. Production is expected to begin in 1981/82.

notably France, seek to implement this policy with significant administrative and fiscal efforts.* Even in Europe, where relatively higher energy prices and taxation have traditionally induced higher standards of energy economy than in the United States, numerous opportunities remain for a more frugal use of energy.†

CONSTRAINTS ON THE DEVELOPMENT OF SUBSTITUTES

Since the inception of policies to reduce oil imports, various constraints and second thoughts have been encountered, which cause slowdowns of existing programs and more or less important revisions. In all countries that have stepped up their nuclear electrification programs since 1973, obstacles to the timely execution of these programs have arisen. These obstacles are a mix, varying from country to country, of (1) local, sometimes widespread, opposition to nuclear site selections and delays encountered in overcoming or by-passing such opposition; (2) tightening of reactor safety rules and consequent delays

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*The French government established the Agency for Energy Economies to propagandize and subsidize energy-saving processes and installations in industry and household consumption. Under the VIIth Plan, the agency is expected to spend about 11 billion French francs (more than $2 billion) on premium payments, investment aids, and demonstration projects designed to promote energy economies in industry (*Rapport de la Commission . . .* , pp. 36, 42, 48, 49). In addition, consumption economies are to be furthered by regulations (concerning, for example, insulation of buildings, maximum heating rules, restriction of heating oil purchases, price penalties for increased consumption of industrial fuel oil). The Planning Commission has set a target of energy economies equivalent to 45 Mtoe by 1985, for want of which it believes the actual 1985 consumption level might be 285, instead of the forecast 232 to 245 Mtoe (Ibid., p. 31). These economies are to be made on top of savings of about 12 Mtoe, which are said to have already been made by economy measures, chiefly in residential and tertiary consumption, between 1973 and 1975, and which the commission hopes will be "consolidated," i.e., not reversed in the future (Ibid., pp. 4 and 34).

Energy-saving campaigns, including financial inducements, are also reported from Sweden and other countries.

†For a discussion of this subject and energy policy alternatives in general, see the valuable article by Amory B. Lovins, "Energy Strategy: The Road Not Taken?" *Foreign Affairs*, October 1976, pp. 65ff.

and cost increases in completing construction projects;* (3) uncertain funding (especially in Italy and Spain) and apprehensions about future uranium supplies (and their prices) as well as enrichment services for later reactor projects; and (4) industrial bottlenecks.†

In addition to these nuclear-specific obstacles, the relative underutilization of domestic oil refineries, the conundrum of heavy fuel oil surpluses accompanying a relative undersupply of light products, and the difficulties of resolving the latter problem by investments in cracking facilities, invite some temporizing in the oil-substitution programs of these countries. The traditional oil-refining capacities are in place; capital (in France, government capital) is tied up in them; oil is flowing freely. Moreover, the costs of substitute resources (coal and uranium, but not natural gas) and substitute-energy utilization patterns (converting home heating to electricity) are high--in some instances, rising more rapidly than oil prices--and governmental and corporate treasuries face other demands. So why not stick a little longer with good/bad old oil?

Some obstacles and second thoughts may prove transitory, but they are already retarding nuclear power programs and the retreat from oil. In some countries (France, Sweden, and probably soon West Germany also), governments' reduced estimates of future energy requirements furnish a good, albeit only partial, rationale for these slowdowns. Nuclear electricity will probably contribute a smaller portion of Western Europe's total energy supply than the OECD estimates predicted, which are shown by Table 1 (p. 7) and Appendix Table A-1 (p. 102).

In the North Sea oil-producing countries, the constraints are of another nature. In Norway, the constraint consists in the governmental concept of making haste slowly in developing the continental shelf oil

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*Regulations and court decisions based on environmental considerations are not only leading to a fuller reflection of social costs in business cost calculations of nuclear power plants--and thus to upward revisions of estimates of initial costs, expensive retrofits, and delays of these projects--but they affect likewise the construction of coal-fired power plants, e.g., in Germany. See *Frankfurter Allgemeine Zeitung*, 12 July 1976, p. 9.

†For further discussion of nuclear energy ambitions and difficulties, see below, pp. 37ff.

fields. The concept derives partially from social conservatism and protectionism (in favor of traditional patterns of settlement and employment), and partially from environmental and political apprehensions about oil exploration in the physically difficult and politically sensitive northern Norwegian and Barents Sea areas.* In Britain, the constraint consists in the desire to conserve limited, by now nearly fully explored, oil resources in the British sector.† But in neither the Norwegian nor the British case do these constraints impinge significantly on near-term prospects for oil production. For all practical purposes, North Sea production on both sides is currently developing as fast as could be hoped for, and it may well continue to do so until the mid-1980s. Norway's go-slow policy affects additional oil exploration, but hardly the rhythm of pumping from currently known fields; and Britain's proposed oil conservation (slowing down pumping to make reserves last longer) may never become policy--Britain needs the oil revenue so badly. Therefore the constraints noted in Table 5 (p. 34) and, at least in the Norwegian case, so often referred to in public discussions will have only a negligible effect on the North Sea output picture through 1985.‡

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*Discussed more fully below, pp. 66ff.

†Oil company estimates of ultimate recoverable oil reserves in the British North Sea sector, including those expected in fields yet to be discovered there, range between 20 and 25 billion barrels. Total proved and probable oil reserves in the discoveries made so far amount to about 19 billion barrels.

‡In the view of Professor Peter Odell of The Netherlands, the currently expected rate of North Sea oil exploitation falls far short of what would be possible if operating companies gave it preference over their oil acquisitions in the Middle East, and if the relevant European governments induced and obligated the companies to do so. He believes that such policies might have made it possible to reduce Western Europe's oil imports to as little as 20 percent of primary energy requirements by 1985 (paper read at RFF/NSF Workshop on the FEA's National Energy Outlook, Washington, D.C., 15 August 1976). Whereas Odell believes that companies are somewhat neglecting North Sea oil development despite its profitability, Professor M. A. Adelman of MIT thinks that British and Norwegian taxation and other policies have discouraged both exploration and development (*Resources*, Resources for the Future, Washington, D.C., Summer 1976, p. 10). Both critics are correct in regarding North Sea activity, vigorous as it has been, as falling short of

The most widely feared obstacle to the currently foreseen exploitation of North Sea oil, a profit squeeze, has failed to materialize and probably will not in the foreseeable future. The prices of OPEC oil have weathered the recent recession with no break and, in view of Saudi Arabia's and some other producers' capacity to throttle output as well as the operating companies' interest and expertise in maintaining "orderly markets," no significant break in prices should be anticipated. Should it happen nevertheless, the commitments of IEA members to safeguarding a "floor price" would provide a second barrier, albeit untested. Despite the much higher cost of oil extraction (before government rakeoffs) in the North Sea than in the Middle East, current oil prices yield the operating companies much greater profits from the fields chosen for exploitation than the companies can realize, barrel for barrel, from Middle Eastern oil, simply because the Western governments' "take" is less immodest.* The fear that Norway and Britain would tax, nationalize, or "participate" operating companies out of the market has proven largely invalid, and no present evidence suggests that these governments would do so in the future.† They are more likely to sacrifice revenue than permit production to fall significantly short of currently accepted schedules. This attitude also provides a cushion for unexpected general cost increases. Nor should one exclude subsidization of the new state companies if they were to take over some responsibilities from disappointed private operators. Thus, operators'

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an all-out effort. See in this connection the papers and critical comments of the Tønsberg Conference organized by the Norwegian Institute of International Affairs and Chatham House: M. Saeter and I. Smart, eds., *The Political Implications of North Sea Oil and Gas*, PIC Science and Technology Press, Guildford, England, 1975 (henceforth cited as the Tønsberg Conference Report).

*This is not to say that it does not amount to huge sums of money. British government revenue (from royalties, petroleum revenue tax, and corporate income tax) is expected to grow from $12 million in 1975 to at least $8800 million in 1980, and Norwegian government revenue (from royalties and corporate, capital, and special North Sea taxes), from $93 million in 1975 to $8347 million in 1980, with the steep escalation beginning in 1978 (*Petroleum Intelligence Weekly*, 21 June 1976, p. 5).

†The low-price policy of British gas, however, appears to have effectively discouraged the development of important natural gas finds in the southern part of the British North Sea sector, as well as the search for new ones (*Petroleum Economist*, November 1976, p. 411).

unwillingness to proceed with present exploitation plans should not constrain North Sea oil and gas output. If one company moves out, another will move in. (If future OPEC prices rise more or less in step with general price inflation, however, few will move out.)

CONSTRAINTS ON ENERGY COOPERATION AMONG INDUSTRIAL DEMOCRACIES

From the beginning of the International Energy Program in 1974, governments have assigned an important role to international cooperation. Evidently countries have much to gain from such cooperation in pursuing the restructuring of their energy economies, and the range of cooperative measures is wide--from cooperation in research and development to joint or compatible actions in matters of company access, investments, and trade. Just as evidently, the professions of cooperative attitudes by any one national government are often no more than invitations to others to do what it is unwilling to do for itself. As in many other undertakings of international cooperation, the parties tend to develop, at least rhetorically, an ideal image of cooperation, in which everybody's business would be managed as if it were the business of all; and as usual they are finding that nobody, at least not "the others," is living up to this ideal.* To be sure, much useful information and many proposals are being exchanged among the governments and companies of the OECD/IEA and EC countries, foreign-based companies are nowhere rigorously excluded, joint developments are under way, and trade in energy materials and technologies is accepted and to some extent encouraged. But not only are all of these cooperative activities subject to national limitations, indeed the very framework of energy policy remains national.

One important consequence is that North Sea oil is not being developed as a common OECD or European resource, but as a national

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*In the course of interviews with energy and political people in Europe, the author found this image developed most explicitly by a representative of the Italian state company ENI. He talked of "a family" and criticized other Europeans and Americans for not behaving toward Italy like family members.

British and Norwegian recource.* That is, development plans are drawn up and bargained out in the national political and economic framework; within each country the national, in particular the new state-owned oil companies (Statoil, Norsk Olje, BNOC), receive important preferences and privileges relative to other companies; long-term oil supply commitments to OECD as well as other countries are shunned (with few exceptions); and certain national-mercantilistic preferences apply (notably the preference for domestic refining and processing over exportation of crude oil).† These constraints on cooperation are noted in the last column of Table 5 (p. 34). Correspondingly, oil import uncertainties are noted for the oil-importing countries. These uncertainties serve as one justification, among others, for those countries' national-preference measures or other refusals to cooperate; and they reinforce in some countries, notably France, but also Italy and Germany, a longing for preferred access to Arab or other OPEC oil and corresponding national initiatives in those directions.‡

Similar export restraints or import uncertainties are said to affect the prospects of the flow of U.S. coal and uranium enrichment services to European countries and, in conjunction, European investments in these American industries.** Moreover, certain limitations on international cooperation within OECD result from France's traditional national oil *dirigisme*; national pipeline siting preferences (Norway's

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*In the United Kingdom, some even debate whether part of it should be managed as Scotland's own resource.

†It would lead too far to discuss and document here the ways of national energy planning, the privileges given to the "chosen instrument" companies, the refusal of long-term oil supply commitments by the North Sea oil countries, and the mercantilistic industrial policies of all. Some details are given in Sec. IV.

‡See also below, pp. 57ff. Note that this longing is shared by various oil companies based in other countries, notably the United States, and that the initiatives of these companies tend to sustain, even develop, the reliance of industrial countries on OPEC oil quite apart from what the companies may do to develop alternative energy sources.

**Contrary to European fears, expressed in some interviews with the author, that the United States might limit future coal exports to Europe, it should be noted that restrictions on such exports neither exist nor are likely. In the past, U.S. coal exports to Europe have, however, been limited by European--e.g., German--import restrictions. The problems of uranium enrichment and exports are discussed below, pp. 39ff.

desire to pipe Statfjord oil to its own coast despite the economies of loading it on tankers at sea for shipment to suitable refineries anywhere); R&D facility siting preferences (e.g., the tug of war over the location of a European fusion research or JET center); and unrestrained construction of petroleum export refineries here and there in the world while nearly everyone wishes to import crude oil rather than products. In short, advances toward oil or energy independence are more wasteful and less promising when pursued as a national rather than a group objective, i.e., in the form of national autarky and competitive advantage.

One should not assume, however, that the noted limitations on substitute energy developments and related international cooperation will halt the drive to reduce oil imports. Some of the limitations are delaying it now, but may become less effective with time. Others will not affect the drive until the end of the period under consideration, and then there are the unpredictable factors of future national income, general price level, energy price developments, and world politics that can either offset or reinforce the constraints. It would be very difficult to estimate by how much the noted constraints will diminish the oil import reductions foreseen by 1985 for particular countries. But taken in conjunction, and other things being equal, they may well leave OECD-Europe dependent on imported oil for more than 40 percent of its total energy in 1985. Certainly, the constraints can be observed today, and they have begun to modify energy programs in several countries.

NATURAL GAS

The sources of Western Europe's rapidly rising supply of natural gas (see above, Table 1) are more easily predicted than those of its more slowly rising oil supply. Most natural gas supplies are delivered by pipeline, under contracts firmly established for years ahead and in close correlation with pipeline capacities in existence or under construction, while oil supplies typically are not governed by firm long-term contracts today. North Sea oil will of course greatly reduce Norwegian and British imports of other oil, and eventually eliminate net oil imports altogether. One may also assume that most exported North

Sea oil will go to Western European destinations, but no one can predict today how much or where. Company and government decisions will be involved. The Norwegian government emphasizes that it will sell whatever oil it controls to anyone who pays the price. That could also be someone in Eastern Europe or outside Europe.

With natural gas, it is a different story. Governments and the government-controlled major national gas companies, such as Gaz de France and Ruhrgas A.G., have already negotiated with domestic and foreign sources, setting prices, quantities, and pipeline arrangements for 10 years or more ahead. In some cases, arrangements are not yet final--for example, Italy expects large imports from Algeria after 1980, but the laying of the trans-Mediterranean gas pipeline is still uncertain* --or a party may have second thoughts about a contract, engage in litigation, etc. But most existing pipeline-bound commitments to sell and to buy are firm and, short of political warfare, reliable. Contracts for shipments of liquefied natural gas (LNG) are perhaps less certain. LNG systems, from liquefication to regasification facilities, are more complicated than pipeline systems and, as experience with Algeria has shown, more liable to breakdowns; and the routes of transportation are not fixed, as with pipelines. But although LNG tankers can steam to any destination, they cannot, in contrast to oil tankers, find a large number of ports that can handle their cargo. They can unload only at a regasification plant, thus limiting the possibilities of redirecting shipments in case of contract failure, at least compared with oil.

Table 5 shows for the principal European countries the actual supplies of natural gas,† domestic and imported, in 1972, 1974, and 1975, and the flows currently contracted for 1980 and 1985. Future contracts could produce additional supplies in these years; but where governments have set aggregate target figures, as France and Italy have for 1985,

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*For a discussion of this pipeline project, from Hassi R'Mel over Tunisia and Sicily to the Italian mainland, see *Petroleum Economist*, June 1976, pp. 226-228.

†The statistics do not cover coking gas, which is a junior partner of natural gas in the total gas supply of the United Kingdom and West Germany.

and West Germany for 1980, they usually leave little room for additions.* The table also provides separate (British) estimates for the European Community countries.

West Germany and France expect declining domestic supplies; but Italy and, particularly, the United Kingdom expect substantially increasing ones. Thanks to growing supplies from the North Sea and--for the time being--from The Netherlands, all of these countries and the European Community as a whole expect larger supplies from Western European sources. Except for the United Kingdom, however, they will all increasingly rely on imports from non-European sources. The percentage share of the latter in total supplies is due to rise to 20 percent in Germany, 44 percent in France, 46 percent in Italy, and, according to the British estimate, 26 percent for the European Community as a whole. For natural gas, therefore, Western Europe's import dependence should increase substantially through 1980/85. Unless new sources are found in the North Sea fields, it will probably increase further after 1985.

In judging the political security significance of this growing dependence, Europeans point out that they will not depend, in the main, on the same countries that supply their oil. Indeed, of the Arab oil suppliers only Algeria and Libya appear in this equation. If, in the course of another Arab oil embargo, these two countries decided to turn off the valves to their European customers, Britain and Germany would not be directly affected at all, France for less than one-fourth, and even Italy for only one-third of its supply. Belgium, which recently concluded through its Distrigaz company a contract with Algeria's Sonatrach to obtain 3.5 to 5 billion m^3 of LNG beginning in 1979, would also be affected. These supplies might amount to about 30 percent of its consumption.

The Soviet Union would be the other foreign supplier, under bilateral and--together with Iran--trilateral arrangements. The Soviet Union became a net exporter of natural gas in 1974 and is expected by

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*See footnotes *d*, *h*, and *o* to Table 5. The German target (1974 vintage) for 1985, some 800 billion kcal, appears high in relation to the volume currently contracted for 1985, i.e., about 650 billion kcal; but the target is likely to be lowered. Negotiations with Algeria for additional supplies to West Germany have not yet led to a contract.

Table 5

NATURAL GAS SUPPLY OF WESTERN EUROPE, 1972 THROUGH 1975, AND ESTIMATES FOR 1980 AND 1985

(In billion kilocalories, ~ 100 million cubic meters)[a]

Country	Year	Domestic Supply	Imports		Total Western European Sources	Imports				Total non-Western European Sources	Grand Total	Percent non-Western European Sources
			Netherlands	Norway		Algeria	Libya	USSR	Iran			
West Germany	1972	149[b]	88[b]	--[c]	237	--	--	--	--	0[b]	238	0
	1974	175[b]	178[b]	--	353	--	--	n.a.	--	8[b]	361	2
	1975	159[c]	193[c]	--	352	--	--	26[c]	--	26[c]	378[c]	7
	1980 est.	n.a.	n.a.	60[d]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	1985 est.	169[c]	234[c]	117[c]	520	--	--	84[c]	46[e,e]	130	650	20
France	1972	69[b]	54[b]	--	123	n.a.	--	--	--	7[b]	130	5
	1974	68[b]	82[b]	--	150	20[f]	--	--	--	20	170	12
	1975	68[g]	n.a.	--	n.a.	n.a.	--	--	--	n.a.	n.a.	n.a.
	1980 est.	70[f]	90[f]	30[f]	190	40[f]	--	36[f]	--	76	266[h]	29
	1985 est.	55[f]	92[f]	32[f]	179	73[f]	--	36[f]	33[e,f]	142	321[h]	44
United Kingdom	1972	246[i]	--	8[i,j]	254	--	--	--	--	--	254	0
	1974	324[i]	--	6[i,j]	330	--	--	--	--	--	330	0
	1975	337[i]	--	8[i,j]	345	--	--	--	--	--	345	0
	1980 est.	475[k]	--	95[j]	570[l]	--	--	--	--	--	570	0
	1985 est.	n.a.[l]	--	n.a.	n.a.[l]	--	--	--	--	--	n.a.	0
Italy	1972	130[b]	n.a.	--	n.a.	--	n.a.	--	--	13[b]	143	9
	1974	137[b]	15[b]	--	152	--	n.a.	--	--	23[b]	175	13
	1975	130[c]	n.a.	--	n.a.	--	n.a.	--	--	n.a.	n.a.	n.a.
	1980 est.	140[m]	60[m]	--	200	--	30[m]	60[m]	--	90	290[o]	31
	1985 est.	173[m]	60[m]	--	233	110[n]	30[m]	60[m]	--	200	433[o]	46
Nine EC countries combined	1972	n.a.	n.a.	n.a.	1,089[p]	n.a.	n.a.	n.a.	--	28[p]	1,121	2
	1974	n.a.	n.a.	n.a.	1,422[p]	n.a.	n.a.	n.a.	--	58[p]	1,478	4
	1975	n.a.	n.a.	n.a.	1,513[p]	n.a.	n.a.	n.a.	--	146[p,q]	1,659	9
	1980 est.	n.a.	n.a.	n.a.	2,225[p]	n.a.	n.a.	n.a.	--	320[p,q]	2,545	13
	1985 est.	n.a.	n.a.	n.a.	2,492[p]	n.a.	n.a.	n.a.	n.a.	894[p,q]	3,386	26

[a]Quantities of natural gas are measured in caloric units in some statistics, in volume units in others. There is no uniform relationship across gas fields between caloric values and volumes. Where the source gave measurements in volume units only, we have equated 1 billion kcal with 100 million m^3 of gas, which is only approximately correct.

[b]*Petroleum Economist*, April 1975, p. 144. European Community statistical data.

[c]Ruhrgas A.G., *Annual Report*, 1975, p. 11. Total supply estimated at 630 to 684 billion kcal. Detail, based on concluded agreements, is given as approximate.

[d]Bundesministerium für Wirtschaft (Ministry of Economics), *Erste Fortschreibung des Energieprogramms der Bundesregierung*, Bonn, November 1974. The program postulated a 1985 target of some 800 billion kcal.

[e]Via pipeline from USSR.

[f]Gaz de France, interview information.

[g]*Petroleum Intelligence Weekly*, 8 March 1976, p. 8.

[h]Government's target set at 370 billion kcal.

[i]*Digest of United Kingdom Energy Statistics, 1975*, p. 95; and Department of Energy, *Energy Trends*, February 1976.

[j]Origin of imports not shown; all imports assigned here to Norway.

[k]Energy Minister Eric Varley's statement to Parliament, Department of Energy Press Notice, 11 April 1975.

[l]Expected to exceed 1980 volumes.

[m]ENI estimates, interview information.

[n]Dependent on trans-Mediterranean pipeline construction.

[o]Italian government's target set at about 450 billion kcal (*Piano Energetico Nazionale*, 29 July 1975).

[p]*Petroleum Economist*, December 1975, p. 448. A British expert estimate.

[q]Supply by pipeline and LNG.

n.a. Not available from sources at hand.

1980 to export about 23 billion cubic meters to Western Europe and more than 28 billion m^3 to communist Eastern Europe.* The Iranian role in supplying gas to Germany and France (and Austria as well) is to compensate Soviet supplies with Iranian deliveries into the Soviet pipeline network. Additional Iranian supplies to Europe in the form of LNG have been discussed but not yet agreed on.†

Germany's *Ruhrgas A.G.* is the leading party (operator) of a tripartite Western consortium with *Gaz de France* and Austria's *Oesterreichische Mineralölverwaltung*, which has contracted with the *National Iranian Gas Company* for the flow of about 125 billion kilocalories (approximately 13 billion m^3) of Iranian gas to the Soviet frontier station of Astara on the Caspian Sea; and with the Soviet Union (*Soyuzgazexport*) for the transit of about 106 billion kcal to the German-Czechoslovakian (and Austrian-Czechoslovakian) border, with the Soviet Union keeping 19 billion kcal of gas as "fuel gas" for the transit. Deliveries are due to begin in early 1981, to reach the indicated level after three years, and to be maintained until the end of 2003. About 53 billion kcal of the gas will be for Germany, in addition to Soviet gas reaching the country under earlier bilateral pipe-for-gas deals with the Soviets. About 35 billion kcal of gas under the Iranian deal (as well as additional Soviet gas bought by France directly from the Soviet Union) will then flow through Germany to the French border. The balance of about 18 billion kcal will be Austria's share.‡

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*Soviet gas imports from Iran and Afghanistan in that year, i.e., prior to the activation of the trilateral deal with Western Europe in 1981, are expected to amount to about 15 billion m^3, resulting in a Soviet gas export surplus of about 37 billion m^3 (*Petroleum Economist*, August 1976, p. 305).

†Beyond 1985, LNG gas supplies from the Middle East and North Africa could play a considerably larger role. Large gas resources in Iran, Algeria, and the Arab gulf countries still go unused. Their entry into trade presupposes the development of liquefication plants and other elements of transport logistics.

‡Ruhrgas A.G., *Annual Report*, 1975, p. 17. The indicated amounts of Iranian gas imports into Germany and France do not agree exactly with the estimates for 1985 in Table 5, which are derived from other tabulations for Germany in the same source and from Gaz de France information for France.

If the Soviet Union unilaterally decided to block deliveries to Western Europe it could, by present estimates for 1985, block 20 percent of West Germany's and France's natural gas supply, and 14 percent of Italy's. If this blockage coincided with an Algerian/Libyan embargo, France's supply would be cut by an additional 23 percent, Italy's by an additional 32 percent. Although the European gas distribution grid, including the new line from the North Sea collection system to Emden in northern Germany, would permit some compensation for such losses, the risk remains a weighty one. The concern about the rapidly growing dependence of continental Western Europe on extra-European natural gas supplies is mitigated less by diversification of sources, as European observers are wont to stress, than by the hope that the USSR will be a reliable supplier, and that it would in any event refrain from coordinating an interruption of its supplies with a possible Arab embargo. Although the latter assumption has at least the precedent of the Arab oil embargo of 1973, which the USSR did not join, the former is based on little more than faith. Economic interests in imports from the West and the realization of ongoing industrial and technological projects will of course keep Soviet supplies flowing in ordinary circumstances, but in a future crisis these interests might be overridden by political considerations of the Soviet government. "Diversification" and North Sea development notwithstanding, continental Western Europe is about to substantially increase its dependence on Soviet and Arab natural gas just as it reduces its dependence on Middle East oil.

The United States, as Table 2 shows, must also expect to draw more than heretofore on imported natural gas, probably in the form of LNG from Algeria; but in relation to total domestic supplies, these imports should remain small.

NUCLEAR ENERGY: AMBITIONS, DEPENDENCE ON IMPORTS, AND SECOND THOUGHTS

For OECD-Europe as a whole, nuclear power is, by current expectations, the most rapidly expanding energy source during the decade ahead, as Table 1 shows. In the principal countries, the anticipated and more or less firmly planned increases are drastic, as Table 6 shows; several small countries, however--Norway, The Netherlands, Denmark, Greece, and

Table 6

ESTIMATED NUCLEAR POWER GROWTH, WESTERN EUROPEAN COUNTRIES AND UNITED STATES

(In billion watts, GW)

Country	1975	1980	1985	1990
West Germany	3	19	45	77
France	2	20	56	90
Italy	1	1	26	62
United Kingdom	5	11	15	31
Spain	1	9	24	42
Sweden	3	7	11	16
United States	40	82	205	385

SOURCE: OECD Nuclear Energy Agency and International Atomic Energy Agency, *Uranium: Resources, Production, and Demand*, OECD, Paris, 1976. Estimates as of spring 1975.

Turkey--are not participating in the race. Nuclear power development was, of course, well under way before 1973, but the oil crisis increased its momentum. Nuclear electricity was then chosen as one of the main substitutes, if not the main, for insecure imported oil.

Nuclear power in Europe entails its own import dependencies, however. Except France, no Western European country has so far found and developed uranium deposits on its own territory adequate for fueling a significant number of reactors; and so far none is capable of providing uranium enrichment services for the fuel supply of civilian power stations. For natural uranium, most countries have depended and will continue to depend on supplies from non-European mines; for enrichment for civilian use, all have depended on the services of U.S. and Canadian plants. In the context of the oil crisis, this dependency has been entirely unproblematical for the Europeans. The Middle East neither has played nor is about to play a role as a source of raw material for nuclear power. The supply has been as secure politically as good relations with the United States, first and foremost, and with South Africa and a few central African countries secondarily.

But security of supply of nuclear raw material has been an important factor in Western European thinking precisely vis-à-vis the United States, with the principal accent on possible economic rather than political conflicts. Since the 1960s, the French, the Germans, and others have feared that, without alternatives to the U.S. monopoloy of enrichment services, the development of their nuclear power and nuclear equipment industries would be stifled by insufficient and capricious supplies of enriched uranium; that the monopoly would be used to favor both U.S. utilities and the U.S. nuclear equipment industry that is competing with the Europeans for exports; and that to continue relying on U.S. services would too drastically magnify Europe's economic, technological, and political subordination to the United States. Consequently, at the beginning of the 1970s, the groundwork was laid for the development of alternative enrichment facilities.

In 1970, the Anglo-Dutch-German centrifuge enrichment project got under way which eventually led to URENCO. Its principal plants are now being constructed in Britain (Capenhurst) and The Netherlands (Amelo).* In 1972, *French*, *Italian*, and *Belgian* companies, together with British, Dutch, and German (and later joined by Swedish and *Spanish*), formed an interest group to study a gaseous diffusion plant project (EURODIF). By the end of 1973, all but the italicized partners had withdrawn. The remaining French-led group decided to build a diffusion plant in France (Tricastin).† U.S. efforts to obviate the need for those facilities by a timely expansion of U.S. enrichment facilities, with or without European capital investment, or by joint

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*Owing to Dutch reluctance to expand the capacity of the Amelo plant to accommodate expected demand, a project to build a centrifuge enrichment plant in Germany is now being proposed by Uranit, the German partner in the tripartite venture (*ATW News*, December 1976).

†Sweden dropped out in 1974 only, and in 1975 Iran concluded an arrangement with France (SOFIDIF) through which it became an additional partner. Ownership shares in EURODIF are currently as follows: France (CEA/COGEMA), 27 percent directly, and another 15 percent through SOFIDIF; Italy (AGIP Nucleare and CNEN), 25 percent; Belgium (SOBEN), 11 percent; Spain (ENUSA), 11 percent; and Iran (OEAI, via SOFIDIF), 11 percent. France votes the Iranian share in EURODIF and thus controls 53 percent. A second EURODIF plant (EURODIF 2) is under consideration.

U.S./European undertakings in Europe, came to naught. Finally, beginning in 1970, the USSR offered to supply enrichment services to Western Europe, and soon concluded supply contracts with France, West Germany, Britain, Belgium, and Italy. As a result of these developments, Western Europe will indeed depend far less on U.S. uranium enrichment in future years than heretofore, as shown by Tables 8 and 9 (pp. 43-44).

Looking ahead toward future natural uranium supplies and enrichment capacities, we do not have the data to calculate both supplies (by source) and requirements for Western Europe as a whole. We shall, instead, present data first, for the Free World and then for West Germany and France. (Some aspects can be covered in only one of these frameworks of presentation, however.)

Uranium production capacities existing in 1974 were more than sufficient to cover Free World requirements, as Table 7 shows. Whether they will be so by 1980 and 1985 depends on a number of circumstances. Assuming rising prices of uranium, from the mid-1975 level of about $20/lb for uranium oxide (U_3O_8) to $30 or more,* OECD expects production capacities to more than double by 1980 (from 25,000 to 60,000 tons of uranium content), and to increase further to 1985. This estimate includes slightly greater capacities in Western Europe, as well as substantial expansions in central Africa, South Africa, Australia, and the United States (which should nevertheless remain the principal uranium-mining country of the Free World). It does not include capacities that may result from explorations in many other countries.

Whether these capacities will cover "requirements" depends on the development of the reactor industries and on technology. Assuming the worldwide growth of the demand to proceed according to early 1975 expectations, and no plutonium recycling, OECD predicts fairly easy coverage by 1980 but a tight supply by 1985. Four factors aside from technology† may, however, work to ease worldwide uranium supply

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*At 1 January 1975 dollar exchange rates, but not purchasing power.

†Plutonium reprocessing and recycling on an industrial scale probably will not become significant before 1985, if then. Currently, it is quite uneconomical. With relatively ample uranium and enrichment

Table 7

URANIUM PRODUCTION CAPACITIES AND WORLD URANIUM REQUIREMENTS, 1974 THROUGH 1985

(In thousand tons uranium/year)

Country	1974 (existing)	1980 (projected)	1985 (attainable)[a]
France	1.8	3.0	3-3.5
Spain and Portugal	0.2	0.8	1.0
Sweden	--	--	1.3
Other Western Europe[b]	0.2	0.4	1.4-1.9
Gabon and Niger	2.0	5.2	7.2
South Africa	2.7	11.2	13.8
Australia	--	3.3	>5.0
United States	13.5	25.0	40.0
Total production capacity, estimated[c]	25.1	60.0	87.0
Free World uranium requirements, estimated[d]	18.0	48-53	88-101

SOURCE: OECD Nuclear Energy Agency and International Atomic Energy Agency, *Uranium: Resources, Production, and Demand*, OECD, Paris, 1976, pp. 25 and 32.

[a] Market conditions permitting.

[b] Denmark, West Germany, Italy.

[c] Above listed countries plus Argentina, Canada, Japan, Mexico, Yugoslavia.

[d] Without plutonium recycling.

during this period of reactor buildup. First, reactor construction is usually started only when uranium supplies have been contracted over some time ahead; second, substantial uranium stocks are being accumulated in several countries;* third, delays in reactor activation

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capacity--and consequently less upward price pressure--the economics of plutonium recycling may well remain unfavorable. See Albert Wohlstetter, et al., *Moving toward Life in a Nuclear Armed Crowd?*, Pan Heuristics, Los Angeles, PH76-04-389-14, April 1976, p. 97.

*OECD/IEA reports German government stocks of 1370 tU in the form of enriched uranium (*Uranium: Resources, Production, and Demand*, Paris, 1976, p. 26). According to *Le Monde* (18 December 1974), France expects to accumulate such stocks of 4000 tsw by 1980.

are likely to leave some stocks intact longer than expected; fourth, uranium prices of $40/lb or more would probably call forth even larger supplies than currently expected. The balance of supply and demand after 1985 is anybody's guess.

The prospect of sufficient nuclear fuel availability in the Free World, at least through 1980 and probably through 1985 as well, is also supported by the schedule of uranium enrichment capacities, as Table 8 shows. Projected capacities for 1980 clearly exceed envisioned requirements even without counting the existing Soviet supply contracts with Western European countries and Japan,* and even assuming that the URENCO output will be delayed, as seems possible. For 1985, supply would fall clearly short of requirements only if the latter increased as fast as foreseen--which appears unlikely--and if neither new U.S. plant construction nor the output of European plants met expectations. (Even then, Soviet supplies and a draw-down of stocks might strike the balance temporarily.) It should be noted here that the need for new U.S. enrichment plant capacity might be obviated for some time by deriving reactor-grade material from an excess of weapons-grade enriched uranium that might result from a modernization of the weapon stockpile.†

What the Free World picture would signify for Europe depends largely on U.S. developments. The slowdown of the large U.S. reactor installation program, now in process, may free substantial quantities of uranium for other users.‡ On the other hand, further delays in U.S. generation of reactor-grade enriched uranium could nullify this effect.

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*Current Soviet output of enriched uranium has been estimated as approaching 10,000 tons of separative work (*New York Times*, 6 July 1975).

†Harold M. Agnew, director of Los Alamos Scientific Laboratories, has advocated such a transfer on technical and budgetary grounds (*Scientific American*, September 1976, pp. 66 and 68). It appears very doubtful, however, that the weapon program will indeed set material free for conversion.

‡Forecasts of U.S. nuclear power capacity for 1985 have been scaled down repeatedly since the early 1970s. The U.S. Atomic Energy Commission's *Nuclear Power Growth, 1974-2000*, of February 1974 shows the development up to 1974 (p. 17). The 1976 IEA estimate for 1985--227 Mtoe (Table 2)--is again much more modest than the AEC's last (February 1974) estimate (317-377 Mtoe). Current Federal Energy Administration projections expect 170 nuclear power plants to operate

Table 8

EXISTING AND PROJECTED URANIUM ENRICHMENT CAPACITIES AND FREE WORLD SEPARATIVE WORK REQUIREMENTS, 1974 THROUGH 1985

(In thousand tons separative work/year)

Enricher	1975	1980	1985
EURODIF 1	--	6.5	10.8
EURODIF 2	--	--	6.0
URENCO	--	1.0	10.0
United Kingdom	0.4	0.4	0.4
United States, existing plant	18.2	27.7	27.7
United States, new plant	--	--	17.2
Total capacity of which, committed[a]	18.6 18.6	35.6 35.6	72.1 41.6
Total Free World requirements, estimated[b]	10.0	28-31	57-65

SOURCE: OECD Nuclear Energy Agency and International Atomic Energy Agency, *Uranium: Resources, Production, and Demand*, OECD, Paris, 1976, pp. 66, 69.

[a]Excluding the still-tentative 1985 capacities listed under "United States, new plant" and "EURODIF 2," and the still-not-formally-committed increases in URENCO capacity.

[b]Assuming 0.25 percent tails assay, 70 percent load factor, no plutonium recycling.

Western Europe's prospective dependence on imported nuclear fuel can best be observed for Germany and France (Table 9), at least for enrichment services. In terms of contracts currently concluded, the United States now already supplies less than half of France's civilian enrichment work but still most of Germany's. In 1980, these shares will have fallen to 11 percent for France, 53 percent for Germany; in 1985, to 9 percent for France and 38 percent for Germany. European enrichment services will by 1980 cover, via EURODIF, more than half of

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in the United States by 1985 (instead of the 202 still anticipated a year ago). Currently, 58 plants are on line (*Los Angeles Times*, 6 August 1976). One may wonder whether the lowering of expectations has reached its end.

Table 9

EXISTING AND PROJECTED SUPPLIES OF NATURAL URANIUM AND ENRICHMENT SERVICES, WEST GERMANY AND FRANCE, 1975 THROUGH 1990

Item	West Germany[a]				France[b]		
	1976	1980	1985	1990	1975	1980	1985
Natural uranium							
Requirements, 1000 tU	1.89	4.83	10.71	15.12	2.4	7.0	10.0
Contracted	1.89	3.15	0.68	0.00	4.0	7.0	13.0
Open	--	1.68	10.08	15.12	-1.6	0.0	-3.0
Separative work requirements (civilian), 1000 tsw	0.65	2.47	5.14	7.94	0.8	4.0	7.0
Contracted							
U.S.-ERDA	0.52	1.30	1.30	0.91	0.6[c]	0.6[c]	0.5[c]
URENCO	--	0.39	1.30	1.17	--	--	--
EURODIF	--	--	0.13	--	--[d]	3.5[d]	4.5
USSR	0.13	0.78	0.65	0.46	1.0[d]	1.4[d]	n.a.
Total contracted	0.65	2.47	3.38	2.54	1.6	5.5	5.7
Open	--	--	1.76	5.40	-0.8	-1.5	1.3

[a]Federal Ministry of Science and Technology, interview material.

[b]Commissariat à l'énergie atomique, *Rapport Annuel 1974*, Paris, pp. 20-21, and interview material.

[c]ERDA, *U.S. Nuclear Power Export Activities, Final Environmental Statement*, April 1976, Vol. 1, pp. 3-66. Derived from 5-year totals. Some of the deliveries for 1980 and 1985 appear not to be firmly arranged.

[d]*Le Monde*, 18 December 1974. The 1975 figure is for 1976; the 1980 figure is enough of the 5-year contract reported for the years 1979 to 1983 (3.5 million t) to add up to the total contracted for 1980, according to CEA.

France's supply now contracted; and by 1985, 42 percent of Germany's via URENCO and EURODIF. During the interval, Soviet enrichment should cover fairly substantial portions of both countries' supply.* For the European Community as a whole, the Soviet Union should become, at least temporarily, the most important single source of uranium enrichment services. According to EURATOM data of 1976, it will supply more than half in 1977, and more than two-fifths in the two following years, before Western Europe's own supplies take up the slack of rapidly diminishing U.S. supplies, as Table 10 shows.

Table 10

SUPPLY OF URANIUM ENRICHMENT UNDER CONTRACT TO USERS IN EUROPEAN COMMUNITY

Year	Total Quantity (tsw)	Percentage Share of Sources			
		U.S.	USSR	EURODIF	URENCO
1976	2,374	74	26	0	0
1977	4,357	45	55	0	0
1978	6,217	45	46	5	4
1979	8,809	33	42	24	1
1980	12,467	27	28	35	10

SOURCE: Commission of the European Communities, private communication.

Of course, the prospective displacement of the United States as the principal supplier of enrichment services to these countries is due to a failure of U.S. enrichment capacity to stay ahead of projected domestic requirements rather than to the customers' refusal to avail themselves of U.S. offers of firm contracts. Although the two European group developments now creating alternative sources of supply were motiviated by European desires to free themselves of the U.S. enrichment monopoly, they might not have begun if the U.S. supply capacity had remained reliable. The inadequacy of U.S. supply, and the resulting

*Soviet enrichment services have also been committed to Italy and Spain for the late 1970s and the 1980s.

uncertainty of obtaining enriched uranium from the United States for reactors coming on stream in the years ahead, became fully evident when in 1974 the AEC retroactively classified as "conditional" existing enrichment contracts for numerous foreign reactors and suspended the signing of new contracts.* Since then, considerable delays in winning U.S. export licenses for contracted materials have caused much irritation among European customers.

No adequate data are available to assess Europe's dependence on imported natural uranium. France's imports have come, and are likely to continue to come, mainly from the former French colonial areas of Gabon and Niger. Germany's imports have come from South Africa, Canada, the United States, and Australia; future suppliers may be scattered over an even wider range of countries.†

As pointed out repeatedly, demand and supply of raw material for nuclear power in future years will depend on the pace of reactor construction and activation in this country and elsewhere. On both sides of the Atlantic, this pace is turning out to be slower than many anticipated a few years ago.

The main source of hesitation and uncertainty is apprehension about the dangers of the industry, in its present state of technology, to the human environment. The dangers result from the radiological and chemical toxicity of materials and residues, and the possibility of accidents in the production, transportation, and storage phases of the industry--such as explosions or contamination of the environment. Evaluations of these dangers differ greatly. They range from insouciance and irresponsible neglect to emotional or willful exaggeration that associates the difficulties of the industrial processes with the horrors of nuclear warfare. The range between the two extremes is filled with studies and proposals recommending or refuting various

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*"As a result, European overtures to the Russians have been greeted with tacit approval by United States authorities. This spring, Washington even permitted shipments of American uranium to the Soviet Union for processing into nuclear fuel destined for West German power plants" (*New York Times*, 6 July 1975).

†West German firms are currently prospecting for uranium in Brazil (as part of the German-Brazilian nuclear cooperation program of 1975), Egypt, Indonesia, Niger (together with French and Japanese firms), Namibia, Australia, several European countries, Canada, and the United States.

safety provisions. The performance of the industry and any mishaps in it are searched for evidence in support of various positions. Fears of the diversion of nuclear energy activities to nuclear arms fabrication (proliferation) and terrorism add to the excitement.

The impact of these concerns on nuclear reactor and ancillary programs is manifold. Events in the industry, popular agitation, and political, administrative, and judicial measures affect the siting of reactors and other nuclear facilities, the execution of construction projects, and the use of existing plants. They lead to changes in safety and other regulations, requiring revisions of plans and modifications of existing plants. They often cause cost increases that, sometimes in interaction with other financial factors, may make undertakings unprofitable and jeopardize appropriations. Citizens' initiatives and demonstrations, educational campaigns, political conflicts, decisions, and reversals of decisions pull the development now in one direction, now in another.

The present study does not attempt to describe the individual countries' struggles with these problems. One can observe similar phenomena in all countries, but each faces different manifestations of the particular issues, and each handles the problems differently. A description of events in the several countries would reveal a good deal of international interaction, with debate and events in one country affecting the affairs of others. It would also reveal in particular the sensitivity of Europeans to developments in the United States. We shall limit ourselves here to noting some current indications of a slowdown and uncertainty in the nuclear programs of France, West Germany, Italy, Sweden, and Britain, where authorities are, or have been, strongly committed to such programs. We shall refrain from analyzing, in each case, the particular mix of considerations, endogenous and exogenous to the industry, that have led to slowdowns and increased uncertainty about the programs.

In *France*, the energy commission of the VIIth Plan published in March 1976 a new projection for 1985,* which initiated government

**Rapport de la Commission . . .*, p. 30. The last preceding projection appeared in *Rapport de la Commission de l'énergie sur les orientations de la politique énergétique*, Les Dossiers de l'énergie 7, Paris, July 1975, p. 142.

decisions to slow the pace of the ambitious nuclear electricity program. The revised projection, presented under the title "hard core" (*noyau dur*) showed a lesser absolute, and slightly lesser relative, contribution of nuclear electricity to prospective French energy consumption in 1985 than was the case in the commission's energy report of July 1975, as Table 11 shows. As a measure of the uncertainty experienced by the planners, the projection also included an "adjustable supplement" in case total energy consumption in 1985 exceeds the 232 Mtoe postulated in the "hard core." But this supplement was not broken down by source of energy.

Table 11

FRENCH ENERGY CONSUMPTION, 1974 AND 1975 ACTUAL AND 1985 PROJECTIONS
(In million tons oil equivalent)

Source of Energy	1974 (actual)	1975 (actual)	Projections for 1985		
				Projected in March 1976	
			Projected in July 1975	"Hard Core"	"Adjustable Supplement"
Coal	32	28	30	25	
Gas	16	17	37	37	
Oil	112	102	96	98	13
Nuclear electricity	3	4	60	55	
Hydroelectric	13	13	14	14	
New energies	--	--	3	3	
Total	176	164	240	232	245

SOURCE: *Rapport de la Commission de l'énergie du VII^e plan*, Paris, 26 March 1976, pp. 5 and 30.

Inquiries by the author during a field trip to Paris in the spring of 1976 revealed that petroleum authorities in the French government believed that any supplement would have to come from oil (whose share, as the reader will see, was already raised in the new projection), whereas planning office staff believed that it would come from both oil and nuclear sources ("if energy needs run higher, we still have time to start new reactor projects"). In accordance with the new

projection, the government decided to omit one of the six reactor construction starts (each of 1000 MW) planned for the year 1978.* The newspaper *Le Figaro* commented on the development in these romantic terms: "The government is no longer madly in love with nuclear energy. From now on this is no more than a small passion. And oil is coming out of the dog house."†

Late in 1976, the French government's endeavor to reduce its contribution to the financing of the nuclear program and to avoid electricity rate increases appeared likely to lead to a trimming of the nuclear construction plans of Electricité de France for the following years as well. The country's nuclear-electric capacity appeared to be approaching 35,000 MW by 1985, rather than the 50,000 MW previously programmed.

The *Swedish* story is similar. In the late 1960s, the Social-Democratic government decided to build 11 nuclear power plants (capacity of about 6000 MW) by 1982. During the oil crisis, it raised its sights to 24 plants by 1990, with construction of the 13 additional plants due to begin in the 1980s. In 1975, however, it elected to make firm commitments on only two of the 13 additional plants, thus reducing to 13 (capacity of 7200 MW) the total number of plants due to be operational by 1985. These were expected to supply 12 percent of the total energy (40 percent of electricity) consumption in that year. Prime Minister Palme explained that energy conservation in homes and industry would or should reduce the annual growth rate of the country's total energy consumption from the previous 4.5 percent level to 2 percent by 1985 and to zero in the 1990s, and that this decrease would permit a reduced pace of nuclear power development.‡ The specific difficulties

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*Actual reactor construction starts totaled 2000 MW in 1973, 4000 in 1974, and 6000 each in 1975 and 1976. For 1977, starts on another 6000 are planned; and for 1978, another 5000 (instead of 6000). A normal period of five years from construction start to plant inauguration is assumed.

†*Le Figaro*, 16 April 1976.

‡Swedish Ministry of Industry, *Energy Planning in Sweden* (pamphlet), December 1975. See also *Christian Science Monitor*, 31 December 1975.

with the "nuclear option" were acknowledged but given only a subordinate place among the reasons for the slowdown.

By 1975, Sweden had five nuclear plants in operation, with a combined capacity of about 3200 MW, and one plant about ready to start. Then came the elections of September 1976, which removed the Social-Democratic party from power. The Center (farmers) party that had campaigned for stopping all nuclear electricity generation in Sweden on environmental grounds also lost votes, but in coalition with the Liberals and Conservatives--both supporters of the previous government's nuclear program and the only gainers in the elections--the Center was able to lead the new government. The coalition apparently compromised by continuing the operation of the five existing plants and starting up the sixth, but delaying the activation of two others from 1977 to 1978, and stopping construction of the three remaining plants until a review by a royal commission (and possibly a referendum) confirms the program. These decisions are bound to postpone the nuclear electricity buildup well beyond 1985--even if economic and financial considerations should keep the government from canceling the last three projects altogether--and to jeopardize the country's objective of managing in 1985 with oil imports only slightly increased over the 1973 level (28 instead of 27 million tons).

In *West Germany*, no revision of the latest governmental program* has yet been published, but officials interviewed in the spring of 1976 anticipated that a forthcoming revision would lower the nuclear energy target for 1985 from 45 to 50,000 MW to perhaps 35,000 MW. The target for total primary energy consumption in 1985 was also expected to come down from its earlier level of 370 Mtoe, but by a lesser percentage, i.e., about 10 percent. Meanwhile, local demonstrators had halted two large reactor construction projects (at Wyhl on the Rhine and at Brokdorf on the Elbe). Delays for various reasons were being experienced with others. Selection of a site for nuclear waste disposal, a critical requirement for the industry's future, was running into strong

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*Bundesministerium für Wirtschaft, *Erste Fortschreibung des Energieprogramms der bundesregierung*, Bonn, November 1974, pp. 18 and 42.

opposition. And one of the two principal German electric companies, AEG-Telefunken, was brought to the edge of bankruptcy by losses on retrofits of a completed reactor project. At the end of 1976, the common front of political and industrial leaders that had pushed the German nuclear program showed signs of breaking up, with Chancellor Schmidt's Social-Democratic party beginning to bend before the inchoate opposition to nuclear development. It became distinctly possible that the 45 to 50 gigawatt program for 1985, which government officials had still presented as quite solid a year before, would end up producing even fewer than 30 gigawatts by 1985, and that German oil imports at that future time would be correspondingly higher than expected.

In *Italy*, the government's national energy plan also posits a large expansion of nuclear electricity, assigning it a target share of 13 percent of total primary energy in 1985--more than Sweden's target of 12 percent and only a little less than West Germany's target of 15 percent, but much less than France's 24 percent.* In contrast to France, Germany, and Sweden, however, Italy has not yet really initiated its ambitious program. Obstacles, compounded by the country's governmental and financial instability, have hampered it from the start, so the programmed capacity is unlikely to be even nearly achieved by 1985.

The present status of the nuclear power program of Italy's national electric energy board, ENEL, appears to be as indicated in Table 12. Between the nuclear electricity capacity in service at the end of 1974 (550 MW) and that hoped for by 1986 (16,000 to 24,000 MW) lies a difference of at least 16,000 MW, of which only 850 MW are now being constructed. The remainder consists of projects that still are more or less indefinite. Under the circumstances, even present estimates by the Italian petroleum industry placing nuclear electricity's share at about half the level proposed in the government's plan for 1985 may be overoptimistic; and the planned reduction of petroleum's share in total national energy consumption to 56 percent by that time (down from 73 percent in 1974) appears unrealistic.

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*Comitato Nazionale Energia Nucleare, *Programma Energetico Nazionale*, Rome, September 1975, p. 8.

Table 12

STATUS OF ITALY'S NUCLEAR CAPACITY PROGRAM, SPRING 1976

Status of Projects		Electric Capacity (MW)
In service, end of 1974	550	
Under construction, 1976	850	
Ordered for completion by 1983 but not yet sited	3,000	
Not yet ordered but hoped for completion by 1983	2,000	
Subtotal, hoped to be in service by 1983		6,400
Ordered for completion by 1986 but not yet sited	1,000	
To be ordered for completion by 1986	9,000 - 17,000	
Total, hoped to be in service by 1986		16,400 - 24,400

SOURCE: ENEL, interview information, May 1976.

Finally, *Britain's* relatively sedate nuclear electricity program is suffering from continued troubles with reactor design. A pioneer in nuclear power generation, Britain had 14 power plants in operation by the end of 1974, with a gross capacity of about 6000 MW, of which about 3900 MW were effectively exploited in that year. According to British submissions to OECD in 1975, this capacity was to be at least doubled by 1985. Attainment of that objective is doubtful, however, because of difficulties with the two British-designed advanced gas-cooled reactors that have been commissioned, as well as substantial delays in the construction of three others of the same type. The government's commitment to another British design, the steam-generating heavy water reactor, has been strongly challenged by the Atomic Energy Authority on economic grounds.* In September 1976, moreover, a royal commission on environmental pollution startled the public with a report urging postponement of all further expansion of nuclear energy in Britain until its environmental and other effects had been thoroughly studied.†

*_The Economist_, 7 August 1975, p. 67.

†_New York Times_, 23 September 1976.

As a result of the slackening of nuclear-electric development in *Europe as a whole*, the European Community was compelled in September 1976 to pare the more than 160,000 MW anticipated for member countries in 1985 to some 125,000 MW* (of which it noted that about 35,000 MW were still depending on decisions to be made). Correspondingly, the expected contribution of nuclear electricity to total primary energy in 1985 declined from 13 percent or more to 9 to 12 percent. For OECD-Europe, the OECD staff lowered its expectations of that contribution from 11 to 10 percent between February and August 1976, as shown by Tables 1 and A-1 (pp. 7 and 102, respectively).

The planned reduction of the Western European countries' dependence on Middle Eastern oil is thus being hastened by certain new factors and retarded by others. It is proceeding, albeit unevenly, and for some countries at least through the development of new dependencies on energy-material imports from outside the region. Except for coal, where at least some of the increased imports are likely to come from the United States, these new dependencies will be on various third-world and communist countries. Aggregate imports of natural gas from Arab countries and the Soviet Union should furnish nearly half of France's and Italy's gas supply by 1985, one-fifth of Germany's. For a short period at least, in the late 1970s, the USSR may be Western Europe's principal supplier of uranium enrichment services.

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*The higher figure represented the minimum objective set by the Council of Ministers in December 1974 (Commission of the European Communities, *Community Energy Policy, Communication to the Council*, 30 September 1976, Annex 1).

IV. FOREIGN AND SECURITY POLICY ISSUES

The revolutionary break in the economic and political continuities of the Western world's energy system was bound to produce a host of new foreign policy and security issues. The first taste of discontinuity in the early 1970s, when the supply and price of oil no longer obeyed the political and company authorities that had governed them since World War II, stirred up a series of defensive reactions. The industrial nations were seeking to ward off the immediate threats coming from new powers, variably identified as oil producers (OPEC) or as Arab states--which had come to form overlapping coalitions. Efforts to purchase security from them or create security against them preoccupied the diplomats of the industrial democracies and overlaid their other concerns in world politics. The new foreign policy issues were how to gain favor with the new powers, but at the same time how (in what coalition, with what strategies) to counteract them. The policy moves of all the industrial democracies mixed and vacillated between alternative approaches of "cooperation" and "confrontation," with political rhetoric, particularly European and Japanese rhetoric, favoring the former.

While the European states and Japan focused their chief economic approaches on the oil producers, and their political rhetoric on the Arabs, the United States combined its oil-diplomatic moves with a major effort to attenuate and arbitrate the conflict between the belligerents of the Yom Kippur War. Being the only Western power capable of such an effort, the United States pursued it to good effect--diverting the military and financial dependence of some of the Arab belligerents from the Soviet Union to itself, restraining Israel while supporting it, eroding at least for awhile the fatal link between the oil problem and virulent Arab irredentism, and thus diminishing the threat of another Arab oil embargo. In retrospect, the American effort was the main diplomatic success for the industrial democracies in coping with the oil revolution of 1973/74. It bought them time to resolve their energy problem. Meanwhile, the economic recession removed another prerequisite for a serious oil embargo threat in the near term--excess demand.

The oil crisis issues linger on, but for now they are less acute. Intra-European and transatlantic debate over whether oil producers should be "cooperated with" or "confronted" has died down, as has the debate over participation in and the scope of the International Energy Agency. The amount of security provided the industrial democracies by this effort in cooperation is questionable, but so is the availability at a given time of the "oil weapon" with which Arab oil producers threaten them.* "Recycling" oil revenues is no longer a public worry--rightly so because it was never a real problem of international finance; but wrongly so because many of the investments and arms purchases through which these vast amounts of money are being recycled are highly problematical. Some of the issues that may become acute again in the future are discussed in the following section.

The present section is devoted to three sets of foreign policy and security issues that have arisen in the course of the adaptation of the Western European industrial systems to the disappearance of cheap, international-company-managed, Middle Eastern oil. These issues are posed partly by the new aspects of managing the international energy business with its traditional geographic and technological features, and partly by novel geographic and technological features of that same business: (1) engaging third-world interests, (2) how to govern North Sea oil, and (3) nuclear commerce.

ENGAGING THIRD-WORLD INTERESTS

Present diplomatic efforts of the European states do not focus on warding off or gaining favors under another Arab oil embargo. They

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*A skeptical British observer has commented on the IEA that "in itself, it is almost nothing. As an international agency, in the proper sense, it hardly exists. To suppose that a mere handful of dedicated officials in Paris can plan, initiate, or manage, even to the extent that agencies such as the European Commission may do, is unreasonable. The IEA in its present form is essentially a symbolic repository for the expression of a political will by its member governments. If that will should break under stress, the IEA will, no doubt, serve as a symbolic scapegoat for their political failure" (Ian Smart, Tønsberg Conference Report, p. 149). Regarding the conditions of the threat, see Hanns Maull, *Oil and Influence, The Oil Weapon Examined*, Adelphi Paper 117, IISS, London, 1975. For a discussion of emergency management under IEA, see Sec. V below.

rather seek to profit from the oil wealth that is being accumulated, channel export projects into national industries, pursue preferential oil-import deals in conjunction with such export projects where possible, create a climate of cooperation conducive to such deals, and, to this end, humor the political interests and alliances of the newly powerful by appropriate maneuvers in various contexts. These appear to be lasting tendencies, not very closely related to the current degree of European dependence on Middle Eastern oil imports. European observers with whom the author discussed the relationship between oil dependence and foreign policy postures tended to agree that the linkage between the two was quite loose, and that foreign policies were unlikely to change if, or because, dependence on imported oil were indeed to diminish to the extent now foreseen. To what extent the policies would have the desired effects, to what extent they might lead the Europeans into new troubles, remained open questions.

Economic Projects

From 1973 to the end of 1975, the total monetary reserves of the OPEC countries had increased from 8 to 25 percent of world monetary reserves,* and they are likely to rise higher. The concomitant enormous increase in buying power attracts the sales efforts of European, American, and Japanese industries, and is giving OPEC countries a rapidly expanding share in their exports. In West Germany, for example, 7 percent of all exports went to OPEC countries in the first quarter of 1976, up from 3 percent in 1973. Enterprises and foreign offices of the industrial countries compete in attracting or generating the demands of the oil-producing countries for a great variety of products, including arms, industrial and other development projects, and all kinds of services--as well as the similar demands of certain non-oil producers who are the beneficiaries of oil-money loans and grants (e.g., Egypt). As for arms, France and Britain are the chief European competitors of the United States. West Germany has remained in the background, following a policy of no arms exports to "areas of tension"; but it

*International Monetary Fund, *International Financial Statistics*, various recent issues.

participates in such exports through the transactions of other European countries involving military goods produced in cooperation with German firms. Except in the matter of nuclear equipment exports, this competition has not yet caused significant frictions between industrial country governments, but it well may.

In 1973/74, most export initiatives of the large industrial countries were tied directly to endeavors to obtain preferential supplies of oil. This was the case with the French, British, and German drives into Iran, French and German drives into Saudi Arabia. As a rule, the attempted linkage did not work; export orders were often obtained but oil preferences were not.* But with at least some kinds of oil ceasing to enjoy a seller's market for awhile, some prospects for linkage seem to have improved. Iran has dangled special oil deals before France and others, negotiated with Italian and British interests about participation in downstream activities, and concluded a joint oil tanker operating venture with BP.† In August 1976, an Iranian official announced that his government was negotiating with Britain to procure antiaircraft missiles, tanks, and other weapons in connection with oil shipments. In November 1976, British sources reported from Teheran that Iran would buy $660 million worth of Rapier missiles from British Aircraft Corporation, paying in crude oil that the Shell Oil Company would market on behalf of BAC.‡

French efforts to engage Saudi Arabia in a combination of industrial cooperation ventures and a long-term oil supply deal were unsuccessful in 1974, but continue to be revived from time to time.** France

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*See Horst Mendershausen, *Coping with the Oil Crisis, French and German Experiences*, Johns Hopkins Press, Baltimore and London, 1976, pp. 71ff.

†*Wall Street Journal*, 9 March 1976. A similar venture was started earlier between Saudi interests and the Mobil Oil Corporation.

‡*New York Times*, 11 August and 19 November 1976. The negotiations with the British are evidently playing a role in conjunction with Iranian procurement of arms in the United States. However, very large arms purchases in the United States have so far not been accompanied by steadily rising U.S. imports of Iranian oil, and no formal linkage is apparent.

**_New York Times_, 23 July 1975.

is selling Mirage aircraft to Egypt for Saudi money, but so far no arms to Saudi Arabia directly. The French have been trying assiduously to obtain Saudi oil for CFP and ELF-Aquitaine on no worse terms than for the ARAMCO partners, but without success. Still, in November 1976, the two French companies renewed for another two years the nonpreferential three-year contract with Petromin--first concluded during the panic of 1973--apparently to maintain direct relations with the Saudi oil agency rather than reverting to sole reliance on the ARAMCO partners for Saudi oil. With Iraq, on the other hand, where the French oil companies do enjoy some preferences, the French government has agreed to "privileged cooperation" in nuclear research and reactor construction, computers, and television equipment, as well as personnel training programs in all three fields.*

The business of Saudi Arabia, which alone holds about half of the OPEC countries' monetary reserves, is of course the most dazzling prize. West Germany has not made as conspicuous an entry there as in Iran, but its exports to Saudi Arabia are rising rapidly and now rank third, behind those of the United States and Japan, having overtaken Britain's. Interestingly, the half-government-owned German oil concern VEBA, whose export refinery initiative in Iran came to naught, now appears to be the driving force behind the substantial German participation in the industrial and infrastructure development of Yanbu al Bar on the Red Sea, in which the Saudis are interested. The German "chosen instrument" company is involving itself in project planning and consortium organization that go far beyond its normal field of business, probably hoping to obtain favorable access to crude oil and perhaps a Saudi capital participation as well. The company's chairman has been arguing for some time that Germany needs systematic economic cooperation with a major oil-producing country.

VEBA's role resembles that of the "chosen instrument" companies of other European oil-importing countries, e.g., ELF in France and ENI in Italy. In order to expand their relatively narrow crude oil basis, they are all seeking preferential oil deals in producer countries in

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*_Le Monde_, 21 November 1975.

competition with the Majors and are trying to bind such deals to consortia with export interests in their countries. These companies have also found other common interests that tend to oppose them to some or all of the Majors. They have therefore formed an informal grouping to coordinate policy and articulate their joint views.*

Whether or not oil supply deals can be arranged in conjunction, Western industrial and arms suppliers are attracted to the massive purchasing power derived by OPEC countries from oil revenues. Financially, such business makes good sense; but politically it carries great risks for all concerned. The pace of investments; the feverish rate at which advanced technologies of industry and warfare are being demanded and offered, and often dumped in the midst of primitive economies; the rivalries among suppliers for orders and among buyers for the latest types of plants and weapons--these factors put all participants on a kind of cultural roller-coaster whose path and destination are beyond anyone's control.

Political Humoring

While export interests motivate efforts to attract particular third-world countries--oil producers from which supplies may be obtained

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*In September 1976, VEBA, ENI, Belgium's Petrofina, and France's CFP and ELF-Aquitaine issued a joint memorandum to the European Common Market Commission requesting a variety of measures designed to strengthen their competitive position vis-à-vis the Anglo-American Majors in the European markets and to create an infrastructure of market regulation within the framework of the European Community resembling French national oil *dirigisme*. The "Five" share, in varying degrees, a mainly European and downstream scope of operations, and are evidently seeking to appear as representatives of "a European interest" in matters concerning the oil industry. Although their initiative struck some sympathetic cords in the commission, it ran into the opposition of forces favoring market self-regulation (transnational companies, independent operators, and the West German and some other governments) and defending the competitive advantages flowing from worldwide operation as well as from European producing assets (e.g., possession of relatively low-cost German crude oil by subsidiaries of Anglo-American Majors--but not by Germany's national VEBA). The initiative toward a European system of oil protectionism may well fail. Moreover, it remains to be seen whether common or divisive interests will prevail in the group of Five. See *The Economist*, 25 September 1976, and *Petroleum Economist*, October 1976, pp. 370-371.

or other countries that can provide oil money--political gestures to assist these endeavors are often addressed to less clearly defined audiences. European foreign offices try to engage the newly powerful by addressing certain coalitions--e.g., the Arab League, the "underdeveloped South," a coalition of raw material producers--in which some or all of the oil countries have involved themselves as influential backers. Such courtship may momentarily please the oil producers and oil-money spenders, but its economic effects are dubious. Discussing France's policy of "all-azimuth friendship" with the Arab world, Flora Lewis reported from Paris that "French officials do not pretend that they have done better in oil supplies, or prices, or on big profitable sales to the Arabs, because of their policy."* Indeed, the French share in total OECD exports to OPEC countries declined from 1971/73 to 1975, fell relative to the shares of Japan, Germany, Italy, and the United States, and rose relative only to Britain's share.† Moreover, such pandering to third-world political moods increases the risks of strengthening forces that oppose all industrial countries, causing frictions with other industrial countries, and running afoul of the conflicts of interest within the Third World.

Largely on French initiative, the European Community states have engaged in a "Euro-Arab dialog" with the Arab League to explore mutual interests. From its inception, this dialog has been marred by disagreements between the two sides on the content of these interests, with the Europeans seeking economic preferences and compatible development projects (e.g., restraint in the development of Arab export refineries in favor of crude oil exports to Europe), and the Arabs seeking European political commitments against Israel and the United States. In reply to European proposals for exchanges of views on economic cooperation, spokesmen of the Arab League have dwelled on demands for European recognition of the Palestine Liberation Organization and endorsement of Arab belligerency.‡ The talks appear to have been barren so far--and perhaps

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*_New York Times_, 20 June 1976.

†_Petroleum Intelligence Weekly_, 2 August 1976, p. 7.

‡For a collection of statements made at a "Euro-Arab dialog" meeting in May 1976, see _Europe Archiv_, 25 September 1976, pp. D 473ff.

only in this way could they fail to produce serious friction with the United States, which has observed the dialog with suspicion from the start.

As long as the Arab governments seemed united in their espousal of Palestinian irredentist claims on Israel, the West German, French, and other European governments found it convenient to humor them by favoring this irredentism. In the United Nations, they endorsed Palestinian territorial and political "rights," allowing to Israel only a vague "right to exist." In January 1976, the German foreign office found it useful to explain that it favored a settlement by which Israel would relinquish *all* the territories it took in the 1967 war, including Jerusalem--thus departing from the American interpretation of Security Council resolution 242--and the creation of a Palestinian state in some of these territories.* Moreover, when Palestinian guerrillas hijacked a French airliner in July 1976, taking the aircraft and a large number of Israeli passengers to Uganda, French authorities did not denounce the terrorist act and Uganda's connivance; rather, they denounced the daring Israeli rescue of the hostages from Entebbe as "an infringement of Uganda's sovereignty."+

The aggravation of some inter-Arab conflicts has reminded European foreign policy makers that pro-Arab, notably pro-Palestinian, rhetoric at the expense of Israel is no passkey to the oil treasuries, let alone to enhanced political prestige in the Middle East. The inter-Arab war in Lebanon has drawn domestic factions, "peacemaking" intervention forces of several Arab states, and Palestinian gunmen allied to one or the other of them, into a vortex of bloodshed that leaves little room for illusions about a Middle East peace based on unilateral Israeli concessions. The recurring hostilities between Arab states, the interactions between Arab and European terrorism, and other conflicts that may break into the open within the region make European efforts to gain economic advantage in the region by the espousal of "Arab interests"

**Frankfurter Allgemeine Zeitung*, 24 January 1976.

+*Le Monde*, 9 July 1976.

quite unpromising. France's president found that even an offer of mediation in Lebanon, and of French troops to help with peacemaking there, was rejected by nearly all parties and led them to reward the fervent pro-Arabism of his government with accusations of anti-Arab imperialism.

Courting oil wealth with conciliatory support of the third-world agitation for a "new world economic order" and a redistribution of wealth "between North and South" appears to be an equally unrewarding course. It does help wealthy oil countries to posture as defenders of the poor, although OPEC price increases have made the most important recent contribution to their impoverishment; but it hardly produces rewards from the oil countries to the industrial democracies. The oil producers tend to champion the claims addressed to the industrial democracies for an indexation or upward "stabilization" of prices of other raw materials, and for outright grants to "developing countries." They also like to make the industrial countries believe that such largesse would be rewarded with smaller price increases for OPEC oil. European governments that have been most tolerant of this agitation, such as the French and the Dutch at the Nairobi North/South conference, have irritated more reluctant Western governments, such as the American and West German, without gaining measurable benefits.* Western European governments can hardly keep pace with the Soviet Union in supporting and stimulating the incongruous coalition of oil-rich Arab and poor Afro-Asians in its drive on the resources of the West.

Engaging the oil wealth of the Middle East through gestures and deferences to its associated political movements is a course fraught with risks and yielding dubious rewards. When the meeting of "nonaligned nations" at Colombo in August 1976 appealed to the oil producers to impose an immediate oil embargo on France (and Israel) in retribution for their arms sales and (French) reactor sales to South Africa, representatives of all the Arab oil countries voted for the resolution. The Arab

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*In a somewhat converse situation, an industrial country may pick up a profitable deal only at the cost of a political affront to third-world parties it is courting. Thus the French decision to sell nuclear reactors to the Union of South Africa embarrassed French diplomats in various countries of black Africa. German competitors who lost the reactor sale to France showed some *Schadenfreude* over the anti-French outbursts in Africa. See *Der Spiegel*, 7 June 1976.

governments did not think for a moment of heeding that resolution, but their participation in the hostile move demonstrated once more how little reciprocity Paris can expect for its pro-Arab gestures, and how little Arab support for French interests in return for French nonparticipation in the "confrontationist" IEA. The persistence of this line of French foreign policy can only be ascribed to domestic complications --e.g., the anti-Atlanticism shared by the Gaullists and the Left--and not to the success of the policy itself.

The growing dependence of the oil-producing countries on the continuity of the development services and the industrial and arms exports of the industrial democracies holds out more promise as an effective lever on the oil producers than do political genuflections. The infrastructure of complex industrial and even more complex armament development in the countries benefiting from oil wealth will depend for many years on a continued infusion of skilled manpower, spare parts, new machinery, training, planning, and trouble-shooting capacities from the industrial democracies. This dependence will undoubtedly make it harder for the recipients than it was in 1973 to withhold oil exports to the industrial world, *provided* the latter puts itself in a position to threaten an interruption of its greatly augmented services. This proviso is of course essential. If the industrial democracies cannot cut exports, recall experts, block accounts, etc., in the face of a threatened oil embargo, if they are fearful even to intimate such actions for reasons of domestic employment, international competition, or their opponents' bluster, then blackmail may win out over deterrence. But it need not. The more deeply and specifically any industrial country becomes involved in complex development projects with an oil supplier, the greater should be its leverage on the latter's behavior notably in time-limited crisis situations.

HOW TO GOVERN NORTH SEA OIL

The pursuit of North Sea oil and gas development under the laws and administrative controls of Britain and Norway has created numerous regional foreign policy issues, which are in turn linked to domestic

issues in these countries.* The international issues are chiefly between Britain and the continental members of the European Community, notably France; between Norway and its continental and Scandinavian neighbors as well as the Soviet Union. Relations between Britain and Norway concerning North Sea oil affairs happily appear to be smooth. The United States is hardly involved, except in matters pertaining to Norwegian developments in the north, which also involve the Soviet Union. American oil companies do participate prominently in ongoing operations in both the British and Norwegian sectors; but the problems these companies have with the two countries' compulsory state participation policies--problems they share with other private companies--have not yet generated significant diplomatic issues.

The foreign policy issues around North Sea oil are considered under three classifications: (1) British issues, (2) Norwegian issues, and (3) national sovereignty and defense issues related to oil developments.

British Issues

Oil and gas development in the British sector of the North Sea is the primary hope for rescuing the British economy. Government revenue from it is expected to ease British public finances. The involvement of the new state-controlled British National Oil Company (BNOC) is valued, at least by the present Labor government, as an agent for increasing government control over the economy.+ Above all, the ailing balance of payments will get a welcome boost. A British Treasury study of oil's role in the balance of payments is interesting. From the 1973 pattern, when North Sea oil operations were a net drain on the current balance

*No significant oil and gas fields have been discovered so far in the German and Danish North Sea sectors; but the Dutch sector has yielded significant new gas fields (current proven reserves, about 100 billion m^3, equivalent to about 13 percent of those in the Norwegian sector), most near the coast and therefore easy to exploit. By current estimates, about 60 percent of proven oil and gas reserves combined are in the British sector, a little over 30 percent in the Norwegian, and less than 10 percent in all others.

+Through participation agreements and royalty receipts in the form of oil, BNOC may control more than one-fourth of the oil produced in the British North Sea in the early 1980s.

and caused some international borrowing by Britain, the situation has progressed to a 1976 pattern where these operations have a small positive effect on the current balance, but induce heavy international borrowing. By 1985 they should make a large positive contribution to the current balance accompanied by little borrowing, as Table 13 shows.

Table 13

NORTH SEA OIL'S ESTIMATED IMPACT ON BRITISH BALANCE OF PAYMENTS
(In £ millions at 1976 prices)

Balance of Payments Items	1973 (actual)	1976 (estimated)	1980 (estimated)	1985 (estimated)
Imports for development	-175	-1,130	-800	-1,300
Oil exports and imports saved	0	-1,090	6,600	14,300
Imports displaced	55	270	450	1,200
Interest and profits paid abroad	-5	-200	-1,750	-2,600
Interest on extra reserves	-5	60	900	4,300
Net effect on current balance	-130	90	5,400	15,900
Net capital borrowed	90	1,060	400	100
Net effect on total balance of payments	-40	1,150	5,800	16,000

SOURCE: *The Economist*, 17 July 1976, based on Treasury Economic Progress Report 76, July 1976, Table 1. Britain's overall current account deficit totaled £ 1700 million in 1975. By 1980, the overseas debt accumulated in connection with oil development, net of repayments, is expected to amount to £ 5.25 billion.

British hopes for financial benefits from North Sea oil developments are undoubtedly legitimate, although their realization will depend on OPEC maintaining high oil prices and other factors. But whether these benefits will stimulate the British economy as a whole, rather than serve as a soporific, remains to be seen.

Western Europe, especially the other European Community countries, has little reason to begrudge Britain's impending oil bonanza, except for the mercantilistic methods by which the British government seeks to maximize it. The government has decreed that all oil produced in

the British sector be landed in Britain--which for tankers loading in the field means the imposition of transshipment charges in British ports on export shipments. Furthermore, the government has voiced the "expectation" that two-thirds of North Sea oil will be refined in the United Kingdom, which the companies appear to regard as a directive; and it favors a substantial expansion of British refining capacity for petroleum-product exports at a time when European refining capacity is more than ample and oil-country refining capacity is growing.* Exports of crude oil from Britain are evidently to be restrained, in favor of exporting products with higher value-added. That policy is the basis for continental complaints about contraventions of Common Market rules and "unequal access," complaints that visiting President Giscard d'Estaing delivered in person during a press conference in London in June 1976.† The issue is perhaps not grave. It may be compromised in view of similar sins on the part of others, but it may also encourage other beggar-thy-neighbor policies.

Norwegian Issues

On the Norwegian side, the issues are different and weightier. A penchant for oil mercantilism has appeared there, too, in that country's insistence on supplying Norwegian-refined products to the Swedish petrochemical industry under a long-term contract, instead of the crude the Swedes wanted. Norway's refinery expansion program also goes beyond the requirements of the domestic market, but its domestic market is so small relative to the prospective oil output of known fields in the

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*At the beginning of 1976, British oil-refining capacity was reported to be 2.9 million b/d. Current construction projects may carry it to 4.4 million b/d by 1981 (*Oil and Gas Journal*, 29 December 1975; see also *Petroleum Economist*, September 1976, pp. 340ff).

†*Le Monde*, 26 June 1976. French demands for "equal access" to the resources of other EC countries accompany French policies that grant to others somewhat less than equal access to French resources, as well as French proposals in the European Community to create unequal conditions of access between member-country oil companies and others, notably American. One French objection to the oil "floor price" support policy is that it stands to benefit all companies. The French would prefer European Community investment guarantees to member-country companies only.

Norwegian sector that a large part of the crude output will soon be available for export. Some will undoubtedly go to the United States, as will some of the British crude--benefiting from a possible slight freight advantage over West African oil--and some may go to Eastern Europe. That Norway is unwilling to earmark its exports for the Western European market and rather wants to sell them without preferences causes some talk among Europeans about possible unfriendly acts against other Norwegian economic interests, but is hardly going to become a big issue. Most of the oil exports from Norwegian fields will probably go to Western Europe anyway.

The big issue here is the speed of oil exploration and exploitation permitted by the Norwegian government. This is an issue between proponents of unlimited growth and environmental and social conservatism, capitalistic enterprise and state control, foreign (notably friendly foreign) and domestic interests and responsibilities, development and security interests. These are very real oppositions, in which domestic Norwegian and foreign viewpoints and interests form alliances on both sides of the issue, and some pass occasionally from one side to the other. Up to a point, however, the issue is academic, with the outcome depending more on developing economic and political circumstances than on policy principles, as we shall see.

The Norwegian Labor government's point of view was eloquently stated at the previously mentioned 1975 Tønsberg Conference:*

> The fact that Norway will become an oil-exporting nation probably implies the greatest transformation of economic, social, and political conditions ever seen in modern Norwegian history. . . .
>
> Because of the great impact of the oil industry on Norwegian society, shaping a policy on oil is not a process which can be carried out by the industry itself, or by the experts of the Ministry of Industry. . . . Highly political questions are involved. . . .
>
> The three most important principles set out by Parliament are:

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*Bjørn S. Aamo, Undersecretary of State, Ministry of Finance, "Norwegian Oil Policy: Basic Objectives," Tønsberg Conference Report, pp. 81ff.

- A moderate scale of production . . . ,
- A slow introduction of the use of the revenues in domestic consumption,
- Government majority control of future exploration, production, and, to a large extent, also of refining and the petrochemical industry, as well as of distribution.

> The first two principles were unanimously adopted by Parliament [and the moderate scale of exploitation defined by the government as an annual level of 50 million tons of oil and 40 million tons of oil equivalent of gas in the early 1980s].
>
> Norway has no physical need for a higher level of production. Given the available hydroelectric power, there is no greater need for oil and gas as sources of energy. . . . The total revenue from oil and gas production is likely, for a long time, to exceed . . . the absorption capacity of the Norwegian economy. . . . For this reason, many Norwegians feel that the level of production proposed is already too high.

Implementation of the "moderate growth" policy has been placed in the Ministry of Industry; it is being carried out chiefly through the dosing of exploration licenses and production permits. The policy has been attacked variously as "nationalistic" or "isolationist"--i.e., as disregarding general European and OECD interests in maximum replacement of Middle Eastern oil. Even Norway's political alignment with the West has been questioned, and its policy labeled "socialistic" (overemphasizing state control and shackling private oil companies, domestic and foreign) and "illiberal" (reflecting too much protection of social structures and traditional, less-profitable economic activities, such as forestry and fishing).

Diverse attacks have come from the Continent, experts, the press, and, confidentially at least, government and European Community officials. But they have also appeared as pressure from domestic oil and offshore equipment industry interests for less restraint and from foreign companies for more licenses. On the other hand, the strong opposition to further development has emphasized the danger of even greater inflationary stimuli than Norway's full-employment economy is already experiencing, disturbance of the fishing grounds off northern Norway, and other threats to the quality of life and the traditions of the country.

So far, the Norwegian government has resisted the pressure to go faster, and it may well continue to do so, although various people, even in the state oil company, continue to speculate that the 1985 output "ceiling" will be lifted in order to make up for lesser earnings from shipbuilding or for other reasons. Norwegian foreign policy spokesmen have steadfastly rejected allusions to the country's lack of political solidarity with the West. But while admitting that a more expansionist oil policy might net Norway a marginal increment of political good will in Western Europe, some of them have expressed doubt that this would in any way increase Norway's security.*

The growth-rate issue is also somewhat academic insofar as the oil and gas production from the Norwegian continental shelf is still far below the ceiling of 90 Mtoe (1976: 17 Mtoe), and by the latest estimates of the Ministry of Industry (April 1976) should only reach 76 Mtoe in 1985 from currently known fields--if the North Sea produces no unpleasant surprises. The rate at which exploration permits are being granted *from now on* will probably affect production by that time very little. For later years--for which no official ceiling exists--it might of course affect production.

This brings us to the complex problem of the opening of oil exploration north of the 62nd parallel. In this area, only seismic studies have been made. Oil/gas fields are suspected, but the decision to permit exploratory drilling has been postponed since 1974. Until the spring of 1976, the government was expected to allow two exploratory drillings off the Troms coast in 1977. But after a confused debate within the Labor party, the government postponed that activity again by at least another year. Electoral considerations (concern with the votes of northern fisherman, whose loyalty to Labor has been questionable ever since the great Norwegian debate about joining the Common

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*"It is clear that we could create additional 'good will' in Western Europe and the USA by showing greater receptiveness to those countries' wishes [regarding oil output], and 'good will' can have nontrivial marginal significance. But there are harder realities than marginal 'goodwill' that determine whether one country goes to war for another" (Arne Olaf Brundtland, "Some Security Policy Aspects of Oil Activity" [Norwegian language], *Internasjonal Politikk*, No. 2B, Supplement, 1975, p. 388).

Market) appear to have played a big role. That the climate permits only summertime operations in these waters, and sea conditions require expensive precautions (reserve platforms, avoidance of fishing grounds), contributes to the hesitation. Another consideration is relations with the Soviet Union.

"Norway has strong motives," wrote Johan Holst, one of Norway's outstanding foreign policy thinkers and currently Undersecretary of Defense, "to refrain from measures and activities which would seem provocative to the Soviet Union from the point of view of threatening the ingress and egress of its Northern Fleet or its home bases. Traditionally, Norway has had to balance between considerations of deterrence and reassurance in her relations with the Soviet Union in the far north."* This consideration not only militates against defense measures involving some sort of permanent NATO presence in the Barents Sea, or the arming of oil and gas installations with weapon systems that could be construed as threatening the passage of Soviet ships--two prospective measures mentioned by Holst. It also supports Norwegian contentions that economic management of the northern shelf, especially off Finnmark and Svalbard, should be exclusively Norwegian (i.e., exclude foreign concessionnaires); and it intensifies hesitancy about any oil operations in the north, which may for technical reasons require some participation by U.S. and British-based oil companies.

Norway is now conducting difficult negotiations with the Soviet Union about the delimitation of their sovereignties in the Barents Sea† and probably wishes to avoid complicating them by starting substantial oil exploration in the vicinity. Much as it relies for deterrence on the virtual presence of allied powers, it is inclined to reassure the Soviets that these powers or their companies will have no permanent presence there. But the Soviets may protest even purely Norwegian rigs as

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*Johan Jørgen Holst, "The Strategic and Security Requirements of North Sea Oil and Gas," Tønsberg Conference Report, p. 136.

†See S. M. Olenicoff, *Territorial Waters in the Arctic: The Soviet Position*, The Rand Corporation, R-907-ARPA, July 1972; and John C. Ausland, "The Challenge of Oil to Norwegian Foreign Policy," *Cooperation and Conflict*, Fall 1975, pp. 189ff.

provocative. Thus foreign policy considerations regarding the USSR reinforce the domestic motives of Norway's go-slow policy for oil.

Meanwhile, the Soviet Union has conducted military demonstrations in the eastern part of the contested Barents area. In October 1976, the Soviets carried out their fourth of a series of rocketry tests despite Norwegian objections.* This Soviet behavior, which tends to bypass a delimitation agreement by creating military *faits accomplis*, may persuade the Norwegians that little can be gained by delaying oil development in northern coastal waters--unless it further intimidates Norwegian oil policy.

National Sovereignty and Defense Issues

Neither Britain nor Norway regards as useful measures specifically directed to the military defense of the offshore oil installations in case of war with the Soviet Union, or any military use of these facilities in peacetime. The arguments range from lack of necessity to infeasibility or low productivity.† Both countries recognize, however, their inescapable responsibility for safeguarding their sovereignty in the offshore areas against terrorism, harassment, and undue curiosity by Soviet vessels and aircraft, and for surveillance, pollution control, and rescue operations. It requires certain capacities for policing and "border control." Current capacities are rather weak.

For the present, the British Navy has borrowed from the Department of Agriculture and Fisheries an 892-ton fishery protection vessel and an ocean-going tug for patrol duties, and it has several Buccaneer fighters to make flights over the North Sea installations. Replacing these, in a year or so, will be five new 900-ton ships--top speed 16 kn with a 40 mm gun--four of which are to serve in the North Sea. The

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*_Neue Zürcher Zeitung_, 24/25 October 1976.

†"In the event of a major East-West war in Europe it seems unlikely that oil and gas installations in the North Sea would constitute priority targets. . . . Defense of the 'new' territory seems potentially viable (although that viability is, in my view, extremely weak) only in the South. In the North there is no escape from permanent vulnerability. . . . [Deployment of sonar and other antisubmarine capabilities on the installations is] associated with considerable disutilities" (Holst, pp. 137-140).

ships cannot carry helicopters. Four aircraft, probably Nimrods, will be assigned to air surveillance.* How much these forces can accomplish in the face of reportedly frequent infringements of the British-decreed 500-meter safety zones around installations by Soviet ships and overflights by Soviet aircraft, or even terrorist challenges, may be debatable. The British government has chosen not to procure special frigates.

In Norway, the Special Committee of Inquiry into the Need for National Services in Connection with Fisheries and Petroleum Activities recommended in June 1975 that a coast guard service be established within the Navy, under an Inspector of the Coast Guard. The service would be equipped with three modernized and seven new 2000-ton helicopter-carrying surveillance ships (the latter with speeds up to 27 kn), six new helicopters, three new patrol planes (Orions recommended), one special vessel, and a total personnel of 685 men.† According to the latest information available, the commission's organizational proposal will probably be adopted, but it has not yet been approved by Parliament. Establishment of the coast guard would elevate the surveillance effort to a higher status. As for the procurement proposals, new patrol planes may not be procured because available maritime patrol aircraft could be used for additional tasks. However, the proposed coast guard ships are already being planned, and some are likely to be procured.

With both countries--especially Norway--apparently intent on emphasizing the peacetime missions and national character of the surveillance forces, NATO involvement in the missions is problematical. A special NATO study group has studied joint defense plans and considered proposals for a multinational force of helicopters and high-speed patrol boats; but agreement among the relevant parties has not been

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*"Defending North Sea Rigs," *Petroleum Economist*, September 1975, pp. 339ff. See also Hugh Hanning, "NATO and North Sea Oil," *NATO Review*, October 1975, pp. 14ff.

†Norwegian Ministry of Defense, *Surveillance of Fisheries and Petroleum Activities*, Norwegian Official Report 1975:50, Chapter V, Oslo, 27 June 1975, pp. 15ff. In 1975, 195 men operated seven antiquated ships of the Naval Fisheries Surveillance Service.

obtained and will prove harder to reach than national decisions, perhaps supported by allies, to strengthen the national services. Bilateral cooperation between these services in surveillance, rescue, and antiterrorist missions should also be more feasible.* From NATO's point of view, greater national capabilities to fulfill the peacetime missions and some cooperation between the countries involved can only be welcomed, and early steps in these directions would be preferable to protracted and probably fruitless talks about an integrated defense of the oil installations while national efforts are delayed.

NUCLEAR COMMERCE

The expansion of nuclear electricity in Western Europe and related European nuclear equipment industries at present creates no direct foreign policy and security problems between the United States and the Western European states, much less among the latter. But the United States faces conflicts with the European producers of nuclear equipment, today principally Germany and France, over commercial/industrial transactions with countries in Asia, Latin America, and Africa. These conflicts result partly from the competition of American and European producers for export orders; but the principal issues come from the linkage of such transactions to the possible production of nuclear weapons in third-world countries, i.e., the danger of nuclear weapon proliferation through the spreading use of the "peaceful atom."

These problems are peripheral to the present study of European energy development. The danger of nuclear weapon proliferation, and how to cope with it, is not our subject. European nuclear energy development by itself poses no acute threat of weapon proliferation, particularly in West Germany. But insofar as energy development entails production of nuclear equipment, which in turn looks beyond the domestic

*"There will be a need for expanded search and rescue capabilities and this task may also provide a basis for increased cooperation among North Sea states" (Holst, pp. 140-141). The discussion of Holst's paper at the Tønsberg Conference noted that "some North Sea states . . . would be in favor of handing the responsibility for the defense of North Sea installations over to NATO, whereas Norway believed that calling NATO into the North Sea for that purpose would be deleterious to her own relationship with the Soviet Union" (Ibid., p. 143).

markets to exports, it creates new avenues for proliferation elsewhere. The resulting foreign policy problems are thus tied to European nuclear energy development.

The core of these problems is that there is no foolproof way of separating nuclear industrial processes from weapon production so that you can put the former under some state's sovereignty and the latter beyond its reach. If a country wants nuclear explosives, it will almost certainly find a way, sooner or later, to derive them from the industrial processes and the infusion of technology, notwithstanding the nonproliferation treaty, IAEA monitoring, bilateral controls established under supply contracts. None of these legal safeguards is foolproof; none blankets all relevant aspects of a country's industry and technology; the implementation of negotiated controls is or has often been slipshod; and the sanctions against contravention or evasion are uncertain. To the extent that the safeguards are capable of *delaying* weapon acquisition--perhaps their most important capability--they have been weakened by sloppy implementation.

Processing facilities for fissionable materials are particularly suspect. If a country acquires facilities to enrich uranium or reprocess spent reactor fuels, it can as a rule also produce weapon-grade uranium or plutonium for bombs. These are not the only ways to get nuclear explosives, but under present technology, e.g., pending the installation of breeder reactors, they are the principal ways of linking electric power and research reactors to weapon production. The high cost of domestic fuel-processing facilities and the relative diseconomies of reprocessing are economic deterrents, particularly in countries where power reactors are few and their requirements for fissionable material, small; but a number of third-world countries have or pretend to have economic (security-of-supply or export) reasons for seeking processing facilities, and several of them are suspected of having weapon applications in mind.

Only arrangements that would submit a country's entire nuclear establishment to the sovereign control of an external power--and reflect that power's determination to close all avenues to weapon use--could be trusted to keep the atom "peaceful" in that country. Soviet control

in Eastern European countries seems to virtually effect that. In particular, all spent fuel for Soviet-supplied reactors must be returned to the USSR. American, Canadian, and French controls of the fuel cycle in customer countries were never so tight; and it is less miraculous that India produced a bomb than that no other countries have done it so far, or at least acknowledged doing so.

No Western nuclear industry center favors weapon proliferation. Since 1975, the United States, the Soviet Union, Britain, France, West Germany, and others have cooperated in the Nuclear Suppliers Conference to develop rules of conduct that would restrain, or stop the exportation of fuel-processing technologies.* But Germany and France, especially, favor a maximum development of their nuclear equipment industries, and a strong contribution of these industries to their exports and their entrée as developers into third-world countries. Big sums of money are involved, with the prices of overseas projects usually double or triple those of domestic reactor projects because of infrastructure and ancillary features. For German industry, in particular, and the Bonn government, exports of nuclear equipment are a treasured means of demonstrating industrial prowess.

The U.S. government allows no exports of American reactors that are tied to exports of fuel-processing facilities. This restriction was an important factor in stopping Westinghouse reactor sales to Brazil, which then led to the multibillion dollar German-Brazilian package contract for reactors, processing facilities, and joint uranium mining ventures.† The German and French governments have been unwilling so far to forego export opportunities for their powerfully organized

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*For a brief description of the group's business, see the IISS's *Strategic Survey 1975*, pp. 11, 15, and 16.

†Other important factors were (1) the United States' incapacity to enter into firm enrichment commitments, discussed above; (2) Brazil's desire to gain "horizontal independence" from the United States, primarily to pursue its industrial-military rivalry with Argentina; and (3) West Germany's drive for a leading role in the nuclear business. See Norman Gale, "Atoms for Brazil, Dangers for All," *Foreign Policy*, Summer 1976.

nuclear industries* just because recipient countries that insist on reprocessing as part of the deal might find ways to slip through and around treaty or contractual safeguards against weapon development. The Germans and the French have been limiting their commitments to the partners in the suppliers conference to insistence on the less-than-foolproof IAEA and bilateral safeguards. The partners, notably the United States, have not consistently opposed that position.† German critics have charged the Bonn government, too, with looking the other way while nuclear industrialists, subsidized with large government research and exploration funds, prepare export deals that may assist weapon proliferation.‡ In France, the government, especially the semiautonomous Atomic Energy Commission, may play a more active role in the initiatives.

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*In West Germany, the Kraftwerk Union (KWU), a joint affiliate of Siemens and AEG-Telefunken is the centerpience of the nuclear equipment industry and the principal promoter of exports. Its relationships with other German corporations and government agencies were mapped out in *Der Spiegel*, 15 March 1976, p. 49. As a result of large losses suffered in the domestic reactor business (discussed above, p. 51), AEG-Telefunken has been seeking a buyer for at least part of its 50 percent share in KWU. In November 1976 it found one. Its partner, Siemens, acquired the entire AEG share and is now the full owner of KWU. See *Wall Street Journal*, 11 November 1976. In France, the engineering firm Framatome, now principally owned by the government's Atomic Energy Commision and largely purged of its connection with Westinghouse, occupies a corresponding position. Together with Alsthom and the Compagnie Electro-Mécanique, it forms the French industrial group that goes out for export orders. The German and French industry groups cooperate in some areas, e.g., the development and export planning for fast breeder reactors; but French efforts to buy into KWU have been rebuffed.

†In a speech to the National Press Club in Washington, D.C., German Chancellor Helmut Schmidt insisted that "we have brought the Brazilian government to undertake even greater duties toward nonproliferation than they would have to undertake if they were a partner to the nonproliferation treaty" (*Washington Post*, 16 July 1976). The chancellor did not speculate on how willing and able the Brazilian government would be to fulfill these duties, and what avenues to weaponry those duties left open. An interesting discussion of these questions appears in Juan E. Guglialmelli, "The Brazilian-German Nuclear Deal: A View from Argentina," *Survival*, July/August 1976. Earlier, on 26 February 1976, the IAEA in Vienna declared itself satisfied that sufficient safeguards to prevent the making of bombs were contained in both the German deal with Brazil, including a fuel enrichment plant, and the French deal with Pakistan for a plutonium reprocessing plant.

‡"The German government . . . is reluctant to interfere with the freedom of action of businessmen. . . . Self-imposed restrictions on

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The international disputes between the U.S. and the European nuclear exporters thus arise from indiscriminate export initiatives, a confusion of efforts to attach (or to be seen attaching) safeguards to these exports, international compromises about the safeguards and second thoughts about the compromises, U.S. efforts to stop the transactions at some stage, and European charges that the U.S. government is interfering with their business with third parties--allegedly because it wants its own companies to get the business. The German-Brazilian, French-South Korean, French-Pakistani, and other projects furnish illustrations. In some cases, the projects have been stopped through the exercise of U.S. pressure on the recipient country--notably the French-South Korean fuel reprocessing project and, at least for now, the Iranian demand for a German reprocessing plant as part of its purchase of two large power reactors.* The cost to the United States in arms supply obligations and diplomatic freedom has been considerable at times;† in other cases, U.S. leverage did not prove to be strong enough.

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weapon exports do not apply in trade with atomic plants: here, private industry has its own untouchable preserve and everything gets past even parliament. . . . Said Foreign Minister Hans-Dietrich Genscher: 'Every country that wants the bomb can also build it. It does not need our help for that.' . . . Here is the layout: the businessmen secretly prepare the deal; as in the case of Brazil, they present to the government agreements which are practically ready for signature and Bonn must then agree in the interest of providing jobs and to enable the economy to flourish" (*Der Spiegel*, 15 March 1976, pp. 65ff). In order to illustrate what it calls "atomic laissez-faire" the paper cites a Free Democratic official as saying, "They exert pressure and we like to be put under pressure"; and a Social-Democratic MP who said, "It seems best not to make any decisions on the highest level but rather to let industry and a couple of state secretaries go ahead and do what they can."

*See interview with Iran's atomic energy chief Akbar Etemad in *Le Monde*, 2 December 1975; *Christian Science Monitor*, 19 April 1976; and *New York Times*, 9 and 10 August 1976.

†The *New York Times*, 11 August 1976, commented: "State Department officials were very reluctant to acknowledge that there was any link between [U.S. guarantees of enriched uranium and a large arms supply commitment to Iran and Iran's agreement not to buy a reprocessing plant], but they did not deny it either. As one said, 'We're not about to put ourselves in a blackmail position where any country can get arms out of us by threatening to buy a reprocessing plant.'"

The struggle to stop or at least delay proliferation-prone nuclear equipment exports from other industrial countries, and the tensions resulting therefrom, are not at an end. On the contrary, one may well expect the situation to deteriorate. At present, German and French equipment makers still have large domestic reactor orders to meet, and their export capacities are correspondingly limited.

> Framatome currently has the capability to produce seven or eight nuclear steam supply systems per year. The domestic market . . . will probably absorb five per year, so that Framatome is trying to sell two or three NSSS's per year to foreign countries. . . . KWU currently has the capacity to deliver at least four systems per year which can easily be expanded to six or seven per year with the domestic market absorbing perhaps five. This leaves a short-run export possibility of two reactor systems per year.*

In the years ahead, the cutbacks and impending completion of the domestic nuclear programs will probably free much larger French and West German capacities for reactor exports, stimulate the competition for export orders, and increase the leverage of importers for controversial extras. Swedish, Japanese, British, [illegible] American suppliers of nuclear equipment, who are also facing limitations in their respective markets, are likely to participate in the competition. Employment interests will sharpen it. Sweden's nuclear equipment industries, for example, might have to discharge some 10,000 workers if the domestic program were drastically reduced and no equivalent export orders were obtained. In West Germany, a recent study by the Deutsches Institut für Wirtschaftsforschung reportedly pointed out that 39,000 man-years of employment (direct and indirect) are at stake in the construction of one 1000-MW nuclear power plant. Fast breeder reactors of Franco-German and British manufacture will broaden the palette of proliferation-prone equipment; and various regional conflicts are likely to raise the appetites for such equipment. The control of the weapon potential of the burgeoning nuclear equipment exports of U.S. allies thus promises

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*Paul L. Joskow, "The International Nuclear Industry Today," *Foreign Affairs*, July 1976, p. 793.

to be a significant foreign policy issue for the United States, one that may severely strain alliance relations. To find an effective resolution is a continuing challenge to U.S. security policy planners.

V. ENERGY RELATIONS IN SUPPLY EMERGENCIES

The preceding sections have considered evolutionary changes in European energy structures and import dependencies. The discussion brought out the absence of integrated energy policies and developments among the Europeans (and among the industrial democracies in general), and highlighted the concomitance of national efforts with certain competitive phenomena, both beneficial and deleterious.

The present section looks at the management of future oil supply crises. Since the timing, setting, and characteristics of such crises are unknowable, the discussion can only be conjectural. It will not attempt to forecast what will happen and only map out the uncertainties and the unfortunately strong possibilities of discord among the industrial democracies. Agreement on the International Energy Program (IEP) and installation of the management system of the IEA in OECD does not eliminate entirely, and to some extent even causes, these possibilities of discord.

THE 1973/74 PRECEDENT

The experience of 1973/74, which led to IEP and IEA, is the necessary benchmark. The following five points will briefly review that experience. First, when the Arab states ordered production cuts and embargoed oil shipments to the United States, The Netherlands, and some other destinations, they found the consuming countries not only materially unprepared but also unwilling to activate the rudimentary emergency management system that had been developed in OECD-Europe as a result of earlier oil crises. The OECD Oil Committee refrained from declaring an emergency.*

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*"During the embargo, the OECD oil-sharing committee tried to play down the crisis atmosphere and any evidence of controversy. At a meeting on October 25 and 26, just a week after the cutback was announced, Australia and Canada, supported by the United States and the United Kingdom, managed to block a statement to the press expressing 'hope' that an agreement on an OECD-wide oil-sharing scheme would be reached by the end of 1973. The committee agreed only to report monthly on oil

Second, most of the governments attempted to maximize oil imports into their respective countries. Industrial oil stocks were drawn down to some degree, as shown by Table 16 (p. 87). Reserve production capacities did not exist. Mutual aid between European governments was minimal at best.

Third, most of the oil companies shunted around as best they could the mix of uncut, unembargoed oil supplies and reduced, embargo-targeted supplies available to them, so as to "equalize pain" among their affiliates and customers.* The results were significant as Table 14 shows, but also controversial.

Table 14

INCIDENCE OF SUPPLY RESTRICTIONS DURING
ARAB EMBARGO OF 1973/74

Importing Country	Oil Supply by 5 U.S. Major Companies: Difference between Actual and Forecast as % of Forecast, Dec. 1973 through March 1974	Change in National Consumption of Petroleum Products from Forecast as % of Forecast	
		Petroleum Consumption	Total Energy Consumption
Japan	-11	-3	-2
United States	-27	-11	-5
United Kingdom	1	-12	-6
France	-3	-21	-15
West Germany	-18	-26	-15
The Netherlands	-41	-22	-12
Other importing countries	0	6	2

SOURCE: Robert B. Stobaugh, "The Oil Companies in the Crisis," *Daedalus*, Fall 1975, pp. 194 and 202.

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stock levels, and then they adjourned for one month" (Robert B. Stobaugh, "The Oil Companies in the Crisis," *Daedalus*, Fall 1975, p. 185).

*Professor Stobaugh's interesting study reported that "one major established guidelines [such that] (1) contractual obligations to provide crude and products to nonaffiliates were to be respected, although volumes were to be reduced where *force majeure* provisions of a contract

Fourth, governments and a chorus of publicists complained about inequities in the companies' allocations. The French and British governments, in particular, were incensed that the companies were depriving them of the supply preferences that the Arabs had granted them. "Prime Minister Heath called executives of British Petroleum to a meeting to ensure that the United Kingdom would receive preferential treatment because it was on the Arabs' 'priority' list. BP executives, undaunted, maintained that they intended to treat all nations--including Britain--equally. . . . Heath reportedly exploded. . . ."* Some governments threatened and started investigations of the companies.

Fifth, the European and U.S. governments took no economic, financial, or other countermeasures against the embargoers, characterizing such measures as impractical, even undesirable. But on U.S. initiative, they set about creating the IEP, grafting it onto the OECD. Most OECD members agreed to participate. In October 1974, half a year after the Arab restrictions were rescinded, the IEA was created. Its objective was to meet another such crisis more effectively, cooperatively, and equitably.

THE CLOUDY OUTLOOK

The big question is whether the international program and correlated national endeavors will attain this objective. Two-and-a-half years after the last emergency ended, we cannot confidently confirm the program's efficacy; in another two-and-a-half years, we still may not be able to. Compared with 1973, the international emergency management system has been formalized, legally semiautomated, and bureaucratized; but it remains uncertain whether the system would function as well as the informal, imperfect, and extralegal procedures of 1973, notwithstanding its competent staff rich in experience with companies and

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applied; (2) the remaining petroleum supplies were to be distributed on 'as fair a basis as possible' to affiliates, taking into account for each consuming country such factors as inventory position, indigenous supplies, and the outlook for industry supply and demand. Other companies used less formal systems" (Stobaugh, p. 187).

*Stobaugh, p. 189. See also Mendershausen, *Coping with the Oil Crisis*, pp. 84ff, on French and German reactions.

government. The following discussion will suggest possible weaknesses of the system and sources of discord among the industrial countries.

Will governments declare a supply emergency in a future contingency and *trigger the system* of supply rights and obligations that the agreement provides? The text (Chap. IV of the agreement) declares that member-countries shall impose consumption restrictions, make available and receive oil under allocations, etc., when staff units report to the governing board that individual countries, or the group as a whole, are sustaining certain percentage reductions of their daily rates of oil supplies, unless 45 out of 51 votes oppose it.* This provision makes action semiautomatic, theoretically.

Will it actually be automatic? An agreement between the IEA and Norway spells out the absence of automatism in one case. Norway is no member, but only "enjoys the rights of a participating country" for certain aspects of the IEA, excluding notably the emergency activation chapter.† Norwegian contributions to the latter will be at the discretion of the Norwegian government.

But this is only the visible tip of an iceberg. The legal text notwithstanding, any member government may declare in a contingency that higher considerations override the agreement, that it finds it impolitic to participate in the activation of emergency measures, some or all. The unfortunate precedent of 1973 could be followed by, say, a country that received promises of undiminished supplies from the embargoers, backed up by their state companies and tankers. The breach of the agreement would probably entail a sharp conflict with the country's allies; but that does not rule it out, the world being what it is.

But suppose that IEA solidarity prevails up to this point and that something like the contractually outlined *emergency management* goes into effect. How will it work? The companies will no longer allocate oil moving in international commerce by their own devices. They say they

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*Each of the 17 participating countries has three votes on the governing board for this purpose.

†Norway, often mistakenly called the eighteenth member of the IEA, maintains liaison with the IEA but is not represented on its governing board.

no longer can and the governments say they no longer should. So the companies are to advise and help national and international government officials to mobilize and redistribute all oil. Although some of this activity is being planned and gamed, it is anybody's guess how this system will perform in a real case. Because it is politicized, intergovernmental, shot through with legalisms and rules, it is liable to greater malfunctions than was informal intracompany management and helpful intercompany collusion. Will countries fudge relevant data? Attack the bureaucrats, especially those of another nationality, for bungling and bias? Demand their recall? Note advantages seized by other countries? Retaliate? Sabotage the system? Such a course would not require unprecedented wickedness. Domestic and international politics may not contain these troubles as easily as the company oligopoly did.

The IEA's very criterion of *fair allocation* may become the source of discord. It is to equalize cuts in oil consumption between participating countries, but no unequivocal criterion of fairness exists. Oil consumption is not the same proportion of total energy everywhere, as Table 15 shows. An equal percentage cut in oil consumption will cut Danish energy by twice as much as Canadian, Italian twice as much as Norwegian. Moreover, the significance of oil for various economic activities in the several countries is uneven. Will there not be heated arguments about the unfair incidence of the adopted allocation criterion on "essential" activities?

The agreement also imposes unequal emergency-reserve-stockage burdens on the participants by setting stockage obligations for the purpose of emergency oil sharing in proportion to the countries' oil imports (rather than consumption). Fair in one respect, this provision is unfair insofar as it imposes relatively higher stockage costs on consumer-importers than on consumer-producers. A more communitarian version might provide for a sharing of reserve stockage costs among participants. During a crisis, some participants are likely to protest this system, arguing that in any event they were unable to meet their emergency reserve obligations meaningfully.*

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*Insofar as the adopted IEA standards of fairness in oil redistribution tend to favor the United States, one may ask why those disfavored

Table 15

OIL CONSUMPTION AS PERCENTAGE OF TOTAL PRIMARY ENERGY, 1975: IEA GROUP AND FRANCE

Country	Percentage
Denmark	88
Japan	72
Ireland	71
Italy	69
Spain	66
France	62
Switzerland	59
Sweden	56
Belgium	54
West Germany	52
IEA Average	50
New Zealand	48
Austria	48
United Kingdom	46
United States	46
Canada	43
Netherlands	40
Norway	35

SOURCE: IEA compilation of June 1976, based mainly on national programs submitted; for France, *Rapport de la Commission de l'énergie du VII^e plan*, Paris, 26 March 1976, p. 5.

Will anyone order oil companies under his jurisdiction to penalize infractors of IEA rules? Those who are ready to doubt it may note that the IEA agreement (Article 11) promises nonparticipating countries that their shares of world oil supply will be safeguarded under the group's emergency management. If that is fair for nonparticipants (say, France), will the same privilege not be claimed by "nonparticipating participants"?

One should expect that the IEA would inspire better *oil stockpiles and standby production capacities*, but they are not yet in sight.

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did not insist on modifications in the system during the bargaining of 1974. One explanation is that the United States' agreement to commit its domestic production to the redistribution system overcame objections at the time. See Ann-Margaret Walton, "Atlantic Relations: Policy Co-ordination and Conflict; Atlantic Bargaining over Energy," *International Affairs*, April 1976, p. 192.

Standby production capacity might be made available in the North Sea, if anyone would pay to ready oil fields for production and then not pump them. As a rule, no one does; therefore, no standby capacity will be ready when a future crisis occurs, unless low demand at that time happens to have curtailed production.

The agreement obligates a country to reserve emergency oil equivalent to at least 60 days of its oil imports during the preceding year, and to augment the stocks soon to 90 days. Most Western European countries, including France, have imposed corresponding obligations on their oil refiners and importers, and IEA members regularly report to the agency the "days of supply" (DS) on hand. There are variations from country to country as to what is and is not included in these stocks and what is held in the form of crude and what in refined products, and which. Consumption (import) variations over time affect stock sufficiency as measured by DS in a curious way: last year's low imports will make unchanged stocks look more sufficient. But above all, there is no agreement--and in view of different industry structures, little chance for agreement--on what part of these stocks must be considered "minimum operating stocks" and what are true "emergency reserves."

The IEA's provisional rule of thumb is to regard 10 percent of a country's total reported stocks as minimum operating stocks, but some governments have claimed them to be as high as 60 percent, depending on the definition of "minimum operating requirements," and oil companies usually put the number even higher. For example, for the United States as of December 1974, the IEA allowance for minimum operating stocks would have been 209 MMB, yielding a presumed U.S. emergency reserve of 977 MMB as of that time. The National Petroleum Council, however, put the minimum operating inventory level of the U.S. industry at 934 MMB, leaving an emergency reserve base of only 140 MMB. The NPC observed that the IEA rule simply "does not recognize the need to keep the oil logistic system operating efficiently."* The meaning of the IEA data

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*National Petroleum Council, *Petroleum Storage for National Security*, Washington, D.C., August 1975, p. 110. According to the Bureau of Mines, the actual U.S. crude and refined stocks then totaled 1074 MMB, to which stocks held by utilities (112 MMB) had to be added for the IEA (but not the NPC) way of estimating minimum operating stocks.

on days of supply or of self-sufficiency is therefore opaque, and estimates of stock efficiency based on these data are apt to be greatly misleading.

Country oil stocks as assembled by the American Petroleum Institute also suffer from differences of definition and coverage among the various countries; but they show at least absolute levels. As Table 16 shows, recent levels of these stocks are nowhere significantly higher, and in several countries actually lower, than at the beginning of the 1973 oil crisis.

As for government-owned stocks, military stocks are usually not counted in the general statistics. Swedish and Swiss strategic stocks appear to be included, however. A West German stockpile of government-owned crude oil is being built up gradually, and Congress has authorized an American stockpile. The German government's crude oil reserve now

Table 16

OIL STOCKS OF SELECTED OECD COUNTRIES
(In million barrels, end of month)

Country	September 1973[a]	April 1974	Mid-1976[b]
United States	893	866	893
Belgium	34	25	42
Denmark	31	26	31
France	194	171	167
Ireland	6	6	7
Italy	n.a.	144	142
The Netherlands	23	22	18
Norway	8	9	11
Spain	44	47	44
Sweden	44	39	37
Switzerland	27	26	29
United Kingdom	153	135	135
West Germany	172	166	189

SOURCE: American Petroleum Institute estimates of crude oil and major products, as published in Central Intelligence Agency, *International Oil Developments, Statistical Survey*, 15 July and 4 November 1976, p. 19.

[a]Or earliest thereafter.

[b]June or latest available.

contains about 2.5 million tons (18 million barrels). It may reach 4 million tons by the end of 1977, but it is unlikely to hit an earlier target of 10 million tons by 1980, if ever. The U.S. strategic petroleum reserve is in the stage of storage facility preparations. Beginning of the fill, rate, modalities, financing of oil acquisition, and the final size of the stockpile are still subject to executive and congressional decisions. Whether and when it will reach the level of 70 million tons (500 million barrels) that has been talked about, remains to be seen.

Before leaving the subject of emergency stocks, let us note that no way of calculating a country's emergency stock levels can unambiguously gauge its government's staying power in the face of oil suppliers' blackmail. That power depends not only on the level of emergency stocks in relation to imports denied, but also on the government's readiness to cut into minimum operating stocks as well as reduce consumption, and on society's readiness to tolerate the cuts--i.e., on subjective factors.

What will the *next supply emergency* be like? Will restrictions be targeted (by embargoes of certain countries) or untargeted, deep or shallow, long-lasting or short? The IEA agreement theoretically covers the eventualities, but actuality may raise questions. Untargeted, shallow, and short restrictions are least problematical, but then they also are least likely to require much emergency management. In the cases of Saudi Arabia and Iran, single producer-country supply failures, say, as a result of war or revolution in these countries and not of embargo policies, would have a wide and deep impact. Each of the two supplied more than 7 percent of American, Canadian, Westen European, and Japanese total oil imports in 1975. Kuwait did the same for Germany and Italy only; Iraq for Italy, France, and Spain; and the Arab Emirates for Japan, Germany, and France. The politics of the supply adjustment might be relatively easy.

Targeted restrictions pose nastier problems. Will IEA members shun supply preferences proffered by the embargoers, or will some give in to blackmail and repudiate the IEA? Will oil companies obey producers' injunctions not to supply target countries (directly, or even

from other sources), or will they obey IEA orders to carry the oil to assigned designations, regardless? In 1973/74 the companies obeyed the embargoers, at least as far as the latters' oil was concerned, for fear that if they acted otherwise "all would be lost."* We know today that many a threat by the Arab producer governments to the companies was bluff, and that the companies lost much in those countries despite compliance. So the next time companies may be braver, and perhaps importing governments, too--who knows?

Will the United States unilaterally put oil supplies at the disposal of IEA or selected countries to meet special situations not covered by IEA obligations? As a forthcoming Adelphi paper+ will point out, such *discretionary supply undertakings* could help prevent divisiveness, and the ability to make them could be a valuable factor in U.S. leverage. In connection with the Israeli-Egyptian Sinai agreement of 1975--and outside the IEA framework--the United States has already undertaken to safeguard Israel's oil supply in emergencies.

The general prospects for the U.S. energy evolution described in Sec. I do not particularly favor the development of such "standby capacity"; but neither do they preclude it, for many other circumstances could arise during a supply emergency that might lead to such use of U.S.-controlled oil. In any event, IEA should not be counted on to manage allocation alone. An early and progressive buildup of the U.S. strategic oil reserve would probably help, as would faster-than-expected increases in U.S.-controlled oil flows.

Finally, will deliberate future supply restrictions be deterred by or fought with *countermeasures*? The IEA itself is a countermeasure; but the agreement understandably does not deal with the panoply of economic, financial, political, and military measures that might be taken the next time. What they might be, by whom they might be taken, etc.,

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*Horst Mendershausen and Richard Nehring, *Protecting the U.S. Petroleum Market against Future Denials of Imports*, The Rand Corporation, R-1603-ARPA, October 1974, pp. 8-9.

+Edward N. Krapels, "The Security Implications of Energy Import Dependence" (provisional title). Draft manuscript kindly made available to the present author.

will be largely a matter of circumstance. The unfortunate failure of 1973/74 might be repeated; this even appears to be the consensus of many European speculations.*

But as pointed out above, intervening developments have given the industrial countries new means of counterpressure against oil-rich states. The main problem is how to free these means from conceptual and political impediments. Their application, even their threat, might spare the United States and OECD-Europe many troubles inherent in sole reliance on the IEA, and their importance is enhanced by the continued or even growing dependence on oil imports and the poor performance of reserve stockage programs. To this end, the characteristics of the developing dependence of important oil-producing countries on the various supplies and services of industrial democracies should be studied closely, and the prerequisites for deterring oil price and supply manipulations be established. Countermeasure strategies should be considered as sequels to deterrence strategies.

Identifying possible troubles is not predicting that they will happen. The more innocuous future supply restrictions turn out to be, the less occasion for the troubles discussed above. But it would be foolish to trust that the emergency management apparatus that is being assembled under the IEA will protect us from these troubles better than the improvisations of 1973 did. It could do worse.

The description of risks under the agreement does not imply, however, that we would be better off if the industrial democracies had not arrived at such an agreement. Its conclusion in 1974 was an important affirmation of their desire for a united approach to the energy problems posed by the oil revolution. This was a salutary message not only to the producer countries, but also to the Soviet Union and to those in Western Europe who were, particularly at that time, beguiled by the idea of a separatist European unity in matters of energy and more generally. To cope with energy crises, most Europeans found they had to

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*See, for example, the disparaging comments of the IISS's *Strategic Survey 1974*, pp. 30-32, on the mere mention by high U.S. officials of military action in case of "strangulation of the industrial world."

band together with the United States and other industrial democracies. The European Community just was not a sufficient framework, but as things turned out, it acquired the task of coordinating the IEA-wide cooperation in Western Europe--e.g., providing a link with France, which had chosen to stay outside the IEA. The burden of the preceding discussion is that, having gotten together on this important agreement to plan and act jointly, the industrial democracies should understand the possibilities of its malfunctioning and, where possible, prepare to check them.

VI. FINDINGS

The study of Europe's changing energy relations leads to a number of findings regarding

- The outlook for European energy structures in the 1980s and the comparative U.S. outlook;
- The direction and constraints of the various European programs to gain oil independence, and the problem of new kinds of energy import dependencies;
- Foreign and security policy issues related to energy developments;
- International management of future oil supply emergencies.

OUTLOOK FOR EUROPEAN ENERGY STRUCTURES IN THE 1980s AND THE COMPARATIVE U.S. OUTLOOK

Current energy developments make it likely that OECD-Europe will by 1985 draw lesser proportions of its total energy than in 1974 from oil and coal, and greater proportions from nuclear electricity and natural gas. The United States will probably draw lesser proportions of its total energy from natural gas, and greater proportions from coal and nuclear electricity, the share of oil remaining about the same. Actual events will, of course, depend on many circumstances that cannot be predicted with certainty. It is certain, however, that oil will remain by far the largest single source of energy in both areas, and the "swing fuel."

The dependence of OECD-Europe as a whole on oil imported from outside the area may rise in volume terms but is likely to decline proportionately from three-fifths to two-fifths of all primary energy. In the United States, the share of imported oil will probably rise from less to more than one-fifth of all primary energy. The two areas' degrees of dependence on imported oil thus appear to be converging--Europe's remaining, however, distinctly higher than that of the United States. Middle Eastern oil will remain predominant in European imports.

It will also constitute a growing proportion of U.S. imports, albeit remaining smaller than Europe's.

The prospective reduction of OECD-Europe's relative dependence on imported oil will be accompanied by a substantially greater dependence on imported natural gas and uranium, and, temporarily at least, uranium enrichment services. Measured in terms of total primary energy, the latter increases will be smaller than the prospective decrease in oil imports. Within the affected energy branches, however, they are significant. Foreign sources of natural gas will differ somewhat from those of oil, with the Soviet Union due to supply an important part of the former but little of the latter unless Soviet oil export capacity should increase more than has been estimated hitherto. For a short while, in the late 1970s, the USSR will also be Western Europe's principal supplier of uranium enrichment services. Western Europe is likely to import somewhat more coal and substantially (and lastingly) fewer uranium enrichment services from the United States.

Energy developments in Western Europe and the United States do not result from single-minded efforts to reduce dependence on imported oil and should not be judged by a single criterion. The developments should be seen as the net results of forces seeking secure, cheap, clean, convenient, technically manageable, and profitable energy--each of these laudable objectives being complex and ambivalent, and all being combined either deliberately in programs or randomly by the play of competing political and market factors. Although security of supply often dominates governmental rhetoric, even that consideration produces alternatives rather than an unambiguous course of action. For oil import policy, for example, the alternatives range from minimizing all imports; to minimizing those from particular sources and importing more from others (wherein it remains to be determined which are to be minimized and which maximized); to ensuring undiminished imports from whatever source by economic and political engagements and strategies to prevent disruptions. For these reasons, the degree of economic and political prudence, or future benefits and costs, cannot be measured simply by the extent to which oil imports are reduced over time. No national energy policy, let alone an energy policy for the industrial democracies

as a group, has yet come close to a comprehensive and consistent ordering of objectives, or to a realistic choice of means for attaining the ordered objectives over time.

The advantages and disadvantages accruing to Western Europe and the United States through the energy trends described above will depend on the unpredictable configuration of future political and economic events. One should not assume that the dissimilar outlook for U.S. and Western European dependence on imported oil must by itself weaken the bonds that hold the industrial democracies together.

EUROPEAN PROGRAMS TO GAIN OIL INDEPENDENCE: DIRECTION AND CONSTRAINTS

Neither OECD-Europe nor the European Community is a unit with uniform conditions and policies. Energy structures of the individual countries vary, and are subject to different national policy orientations.

Except The Netherlands, all Western European countries expect to lower the contribution of extraregional oil to their total energy consumption--Britain and Norway by substituting North Sea oil and gas, the others by substituting natural gas (imported or domestic), nuclear electricity, and to some extent North Sea hydrocarbons, in different proportions. The Netherlands expects to compensate declining domestic gas supplies in the 1980s by increasing oil imports. For Britain in the 1990s, both domestic coal and imported oil may regain importance if offshore oil reserves fail to grow beyond what can now be safely expected.

All of the expected substitutions face constraints that are now more evident than they were in 1974. The constraints range from limitations on oil development (physical, economic, and political) in the North Sea states to nuclear power difficulties, limits to electrification, and other impediments elsewhere. Slower-than-expected growth of total energy demand can be translated relatively easily into lesser oil imports (e.g., compared with contractually fixed natural gas imports), but it also tends to discourage the movement away from imported oil through concern with underutilization of oil industry facilities. New spurts of total energy demand may tend in the same direction because the international oil-supply system has greater short-run flexibility than

alternative energy systems. The economic depression of 1974/75 fortuitously lowered European oil imports. We cannot yet predict how future oil imports will be affected by more economical energy use, induced by higher prices, administrative measures, and changes in energy-using equipment.

Ambitious nuclear power projects are proceeding in France and West Germany; but, for a variety of reasons--not all of them specific to the industry or to the particular country--their pace is currently slackening. In Sweden, the United Kingdom, and Italy, growth in the nuclear power industry is also lagging behind earlier expectations. Neither actual nor prospective shortages of uranium and uranium enrichment facilities account for the slowdowns. The drastic reduction/retardation of nuclear power development in the United States, the world's leading nuclear-electricity-generating country, should make nuclear materials even more readily available to European and other countries, provided the United States is willing to export. By the early 1980s, Western European uranium enrichment capacities will furnish most enrichment services for European reactors, ending Europe's nearly complete dependence on the United States and--in the late 1970s at least--heavy dependence on the USSR.

Aside from the constraints on substitutes for oil and other energy developments in individual European countries, constraints on international cooperation among them, and among industrial democracies in general, reduce the extent to which these countries can pursue their own developments and benefit from each others'. Prominent constraints are various phenomena of energy mercantilism: restraining exports and avoiding long-term supply commitments for North Sea oil; national company and siting preferences for oil and nuclear facilities; and competitive misallocations of capital to, for example, oil refineries both in Europe and elsewhere. As in many other fields of policy, governments pursue both independence and interdependence, unsteady in their methods of mixing the two, and unsure of the meaning of each.

FOREIGN AND SECURITY POLICY ISSUES RELATED TO ENERGY DEVELOPMENTS

The remaining--in the case of the United States even increasing--dependence on imported oil, and the developing dependence on imports

of other energy materials, constitute security risks for supplies. But these risks vary in severity according to the contingencies with which they are associated. The worst case, in which all external sources of energy supply (oil, gas, and uranium; Saudi, all-Arab, all-OPEC, and Soviet) are denied, is of course the least likely, and at the same time the one that would almost certainly lift the energy issue out of the peacetime context in which this study is written. The risks of supply denial to the exporters are also substantial and in many cases tend to grow. The importers can make these risks weigh more heavily on the exporters, if they have the will and the skill.

The probable increase in the dependence of the U.S. economy on oil imports, concurrent with Europe's decrease, introduces a significant new factor into U.S. foreign and military policies. Assuring an uninterrupted flow of oil by diplomatic and military means will become to a greater extent a matter of U.S. economic self-interest rather than merely a responsibility imposed by the economic needs of our allies. This circumstance should provide a stronger motivation for public opinion and Congress to support appropriations for suitable naval, air, and logistics capabilities, and for diplomatic efforts to secure access to critical source areas and transport points. If "energy independence" continues to elude us, the Department of Defense and other parts of the government will gain a new argument for attaining security in the face of dependence.

Increasing oil import dependence also emphasizes the American interest in developing and maintaining control over the Arab-Israeli conflict, and in separating militant Arabism from the oil policies of Saudi Arabia and other producers.

Lacking most of the diplomatic and military means available to the United States for deterring Middle Eastern political developments that could lead to an oil supply cutoff, European governments approach the region with the principal objective of engaging the interests and presumed interests of the oil powers. In 1973/74, the chief engagement effort was aimed at obtaining preferential access to oil. As oil supply difficulties waned, the economic activities focused on attracting oil money to European exports. The Germans have been most successful. The

hoped-for linkage of these exports to price and supply preferences for oil imports, however, remains elusive.

The efforts to court oil producers by humoring their political moods, or those of allied coalitions--e.g., Palestinian irredentism, third-world claims for a redistribution of wealth, etc.--have shown themselves to be fraught with risks and dubious rewards. The French have accumulated the most experience in this regard, but others have, too. Since both moods and coalitions shift, the friends courted often turn out to be fickle--and humoring them tends to produce conflicts with other industrial democracies.

On the other hand, economic and military development projects that make oil-producing countries dependent on an uninterrupted supply of services, personnel, materials, spare parts, and training from specific sources in the industrial world--notably sources that are irreplaceable on short notice--are likely to generate new motivations for reliable oil supply. So are the financial assets that producer countries are building up in the industrial world. Industrial democracies should cultivate the producers' consciousness of their own dependence, just as they cultivate ours of our dependence on them.

North Sea oil management creates regional foreign policy issues, e.g., British and Norwegian oil mercantilism and Norwegian oil development conservatism as opposed to continental and Scandinavian interests. The issues are significant in many regards, usually not very sharp, but in need of careful treatment and compromises. The same applies to the Norwegian/Soviet issues and related Norwegian/Western Alliance issues arising in the context of oil exploration north of the 62nd parallel.

Neither Britain nor Norway regards as useful measures specifically directed to the military defense of the offshore oil installations in case of war with the Soviet Union, or any military use of these facilities in peacetime. Both countries recognize, however, their responsibility to safeguard their sovereignty in the offshore areas against terrorism and undue curiosity by Soviet vessels and aircraft, and to prevent pollution and other disasters. The required national surveillance, rescue, and "border control" capacities are still weak, however, and their strengthening should be supported without being made

contingent on NATO-wide integration and management. Peacetime policing capabilities of the North Sea states are bound to have some utility in military contingencies as well.

Control of the nuclear weapon potential of the burgeoning nuclear equipment exports of France, Germany, and other allies promises to become an even greater foreign policy issue for the United States. European nuclear energy development entails production of nuclear equipment; this industry in turn looks beyond domestic markets to exports. No Western nuclear industry center favors weapon proliferation, but various third-world countries make reactor purchases dependent on the supply of reprocessing facilities and other technologies. Goaded by conflicts with their neighbors, they barely conceal their interest in weapon applications. Equipment producers are unwilling to forego reactor exports and other economic advantages by insisting on restrictions that would safely close all avenues to weapons. The pressure of the powerfully organized equipment industries for exports is likely to increase as domestic nuclear programs are reduced or completed. A more effective resolution of this problem--a by-product of greater European independence from oil imports--remains a challenge to U.S. security policies.

To limit the decline of U.S. leverage on the uses of growing nuclear industry capacities abroad, our capacity to supply uranium enrichment services should be expanded. While awaiting the long-delayed plant expansion, additional reactor-grade uranium might be produced from weapon-grade material if the current modernization of our weapon stockpile freed a sufficient stock of the latter. This course could benefit both our budget and our foreign policy. It hinges, however, on whether the weapon program will indeed release such a stock--or, on the contrary, demand additional quantities.

MANAGEMENT OF FUTURE OIL SUPPLY EMERGENCIES

The industrial democracies managed the oil supply emergency of 1973/74 with hesitation, improvisation, and divisiveness--and without countermeasures. The principal oil companies maneuvered quite skillfully between producers' pressures and customers' requirements, attaining what was in the circumstances a rather fair allocation of supplies.

Governments showed little gratitude for their efforts; and the companies will neither be able in the future, nor allowed, to do as much in a similar crisis. After the last event, the governments created the International Energy Agreement in order to meet the next supply crisis more effectively, cooperatively, equitably.

Creation of the IEA in 1974 was an important affirmation of this resolve and a salutary message to producer countries, the Soviet Union, and those in Western Europe who were beguiled by the notion of a separatist European unity, divorced from the United States. But the new emergency management apparatus could easily malfunction, engendering discord among the industrial democracies even greater in the next emergency than in the last.

Formalization and semiautomatization of the emergency management system do not preclude--and its bureaucratization perhaps enhances--possibilities of malfunction. The possibilities range from overt breaches (induced, for example, by governments' or companies' submission to producer blackmail), to quiet sabotage, to altercations about fair allocation of scarce supplies. Precrisis performance of governments in building up true emergency stockpiles of oil and creating standby production facilities is poor owing to inadequate financing, deceptive criteria, and indecision.

Aside from efforts to remedy some of the system's deficiencies, two supplements might importantly strengthen its deterrent and defense value: (1) provisions for U.S. discretionary supply of oil, and (2) provisions for a full range of countermeasures against willful supply disrupters. These provisions should not be sought as amendments or enlargements of the IEA's bureaucratic structure, but as unilateral or confidentially bilateral or multilateral preparations. Provisions for discretionary supply could alleviate the system's internal difficulties and sustain nonmember allies (as does, for example, the 1975 oil supply commitment to Israel.

With regard to countermeasures, intensive studies should be undertaken to ascertain the existing and developing vulnerabilities of regimes in oil-producing countries, with a view to improving contingency plans and developing better strategies to deter oil price and supply manipulations.

Appendix

REVISED OECD ENERGY SUPPLY ESTIMATES

As noted in the text (p. 6), OECD/IEA issued a working paper in August 1976 giving revisions of the earlier (February 1976) estimates on which Tables 1 and 2 (pp. 7-8) are based. The revised estimates are shown in Tables A-1 and A-2.

Comparing Table A-1 with Table 1, the reader will note that the later OECD estimates for OECD-Europe suggest chiefly a somewhat lesser growth of total energy demand than the earlier estimates, in the form of oil and nuclear energy in particular, from 1974 to 1980 and 1985. These revisions may well be realistic. They do not affect the findings of our study. The percent compositions of European energy supplies in the three years are virtually unchanged.

For the United States--comparing Tables A-2 and 2--the later OECD estimates also suggest a lesser total energy growth to 1980 (despite a more sanguine assumption of U.S. GDP growth: 4.4 instead of 3.1 percent annually). For 1985 they arrive at about the same level as the earlier estimates (2360 rather than 2367 Mtoe). The composition of the 1985 total, however, differs from the earlier estimates; it contains more domestic and less imported oil, more domestic and less imported natural gas, more nuclear electricity and less coal. The increase in oil imports' share of total energy from 1974 to 1985 is somewhat attenuated, i.e., from five to three percentage points.

The tendency of these revisions is debatable. While OECD's revised estimates for the U.S. oil supply in 1985 now nearly match those of the FEA's *National Energy Outlook* (1976) for what the FEA calls the "regulation case" (as Table A-3 shows), nongovernmental U.S. estimates (e.g., Walter Levy's) envisage substantially greater total U.S. energy, notably oil, consumption in 1985, and a share of oil imports in total energy of 22 percent, as in the early OECD/IEA estimate,* rather than 20 percent, as in the revision. Without going into the complex particulars

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*W. J. Levy Consultants, "An Assessment of U.S. Energy Policy," September 1976. Private document made available to the author.

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Table A-1

ENERGY SUPPLY PATTERNS, OECD-EUROPE, ACTUAL 1974 AND PROJECTED 1980 AND 1985

Energy Source	Million Tons of Oil Equivalent (Mtoe) Annually 1974	1980	1985	Percent Composition 1974	1980	1985
Coal, total	254[a]	273	284	22	19	17
Production	206	214	216			
Net imports	36	58	68	(3)	(4)	(4)
Oil and LNG, total	668[a]	734	856	58	52	50
Production	22	190	245			
Net imports	708	592	664	(61)	(42)	(39)
Bunkers	-36	-49	-53			
Gas, total	140[a]	218	271	12	16	16
Production	132	189	189			
Net imports	9	29	82	(1)	(2)	(5)
Nuclear electricity	20	87	194	2	6	11
Other sources	78	90	105	7	6	6
Total energy supply[b]	1,160[a]	1,402	1,709	100	100	100

SOURCE: OECD, Policy Analysis Division, Combined Energy Staff, *Long-Term Energy Assessment*, Working Paper, 6 August 1976. "Reference Case." Assumed ("medium") GDP growth rate for 1974-1980, 3.6 percent annually; for 1980-1985, 4.1 percent annually. Assumed oil price (Arabian marker crude), $11.51 ("constant in real terms").

[a] After allowance for stock changes.

[b] Details may not add to totals due to rounding.

Table A-2

ENERGY SUPPLY PATTERNS, UNITED STATES, ACTUAL 1974 AND PROJECTED 1980 AND 1985

Energy Source	Million Tons of Oil Equivalent (Mtoe) Annually 1974	1980	1985	Percent Composition 1974	1980	1985
Coal, total	328[a]	376	493	19	19	21
Production	357	417	532			
Net imports	-32	-42	-40			
Oil and LNG, total	762[a]	921	1,020	44	47	43
Production	498	540	582			
Net imports	290	404	466	(17)	(21)	(20)
Bunkers	-17	-24	-28			
Gas, total	518[a]	449	509	30	23	22
Production	499	418	459			
Net imports	20	31	50	(1)	(2)	(2)
Nuclear electricity	29	108	244	2	6	10
Other sources	77	86	94	4	4	4
Total energy supply[b]	1,714[a]	1,940	2,360	100	100	100

SOURCE: OECD, Policy Analysis Division, Combined Energy Staff, *Long-Term Energy Assessment*, Working Paper, 6 August 1976. "Reference Case." Assumed ("medium") GDP growth rate for 1974-1980, 4.4 percent annually; for 1980-1985, 3.5 percent annually.

[a] After allowance for stock changes.

[b] Details may not add to totals due to rounding.

Table A-3

OECD/IEA AND FEA ESTIMATES OF U.S. OIL SUPPLY IN 1985
(In million tons)

Item	OECD/IEA Estimates ("reference case")		FEA Estimates as of March 1976	
	As of February 1976[a]	As of August 1976[b]	"Regulation Case"[c]	"Reference Case"[d]
Domestic oil	565	582	575	700
Imported oil	524	466	470	295
Total supply[e]	1,089	1,048	1,045	995

[a] From Table 2.

[b] From Table A-2.

[c] FEA, *National Energy Outlook, 1976*, p. G-12. Imported oil price: $13/barrel. Domestic oil regulated at about $9/barrel wellhead price.

[d] Ibid., p. G-2. Same price of imported oil. Domestic oil price control dropped.

[e] Disregarding bunkers.

of the estimates for the United States, one may question whether the later OECD data for the United States, which bear on the main U.S.-Europe comparison in the present study, represent an intrinsic improvement over the earlier forecast, or whether they represent only a closer approximation of the international agency's outlook to what the FEA regards as "a realistic if slightly pessimistic projection" of future U.S. dependence on oil imports, which may yet turn out to be optimistic in the sense of "Project Independence".