"PROGRAMME FOR STRATEGIC AND INTERNATIONAL SECURITY STUDIES"
The Graduate Institute of International Studies, Ginevra, 23-25/III/1983

(1) programma e lista dei partecipanti
(2) Bell,A.P.: "Options for European energy security"
(3) Fesharaki,Fereidun: "OPEC and Europe"
(4) Maull,Hanns W.: "Europe's energy situation"
(5) Scanlan,Antony: "The Soviet Union as an energy supplier to Europe"

PROGRAMME FOR STRATEGIC AND INTERNATIONAL SECURITY STUDIES
PROGRAMME D'ETUDES STRATEGIQUES ET DE SECURITE INTERNATIONALE

THE GRADUATE INSTITUTE OF INTERNATIONAL STUDIES
INSTITUT UNIVERSITAIRE DE HAUTES ETUDES INTERNATIONALES

CONFERENCE PROGRAMME: MARCH 23 - MARCH 25, 1983

Wed. 23: Morning - Arrivals : Registration at the Institute
1415 - 1700: SESSION I: "Europe's Energy Situation",
Speaker: Hanns Maull
Respondent: Peter Odell
Evening - Dinner at Restaurant LA PERLE DU LAC at 1930

Thu. 24: 0900 - 1200: SESSION II: "OPEC and Europe",
Speaker: F. Fesharaki
Respondent: Ferrouki/Gault
1415 - 1700: SESSION III: "The Soviet Union as an Energy Supplier to Europe",
Speaker: A. Scanlan
Respondent: J. Stern

Fri. 25: 0900 - 1200: SESSION IV: "Options for European Energy Security",
Speaker: A.P. Bell
Respondent: T. Stauffer
Conference disperses.

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PROGRAMME FOR STRATEGIC AND INTERNATIONAL SECURITY STUDIES
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THE GRADUATE INSTITUTE OF INTERNATIONAL STUDIES
INSTITUT UNIVERSITAIRE DE HAUTES ETUDES INTERNATIONALES

ENERGY WORKSHOP 1983

LIST OF PARTICIPANTS :

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D'Ermo, Vittorio	ENI, Rome
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PROGRAMME FOR STRATEGIC AND INTERNATIONAL SECURITY STUDIES
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THE GRADUATE INSTITUTE OF INTERNATIONAL STUDIES
INSTITUT UNIVERSITAIRE DE HAUTES ÉTUDES INTERNATIONALES

ENERGY WORKSHOP '83

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M. J. Gault	Senior Economist, International Energy Development Corporation, Geneva
M. B. Gehr	Executive Secretary, Petroleum Union, Zurich
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ENERGY WORKSHOP

OPTIONS FOR EUROPEAN ENERGY SECURITY

By

A.P.Bell

March 1983

Presentation by
A.P. Bell, Manager, Corporate Affairs Department,
Esso Europe Inc., London.

to

The 1983 Energy Workshop
The Graduate Institute of International Studies, Geneva.

March 25, 1983

OPTIONS FOR EUROPEAN ENERGY SECURITY

Introduction

It was an honour to be asked by Professor Gasteyger to prepare and present a paper this morning and I hope it provides some worthwhile perspectives for the workshop.

Because of the events and turmoil in world oil markets in the last few weeks, it was not possible to produce a complete text beforehand. For this, let me apologize now to the workshop organizers but more particularly to Mr. Stauffer who has been asked to respond.

The topic on the programme is "Options for European Energy Security" and, as you know, the perspective of the workshop was the next five years. I am going to take some liberties with both these guidelines. The major focus of the paper will be on 1990 with a few remarks on the decade from then to the turn of the century. Secondly, I am not comfortable with the word security. It might be appropriate at a meeting of psychologists but I prefer a simpler, less subjective approach to energy analysis; that is the extent to which Europe has to rely on imports and the extent to which the various sectors of its economy are vulnerable to import supply interruption. Europe is neither richly endowed with coal, gas and oil nor self-sufficient in nuclear fuel. However, the exporters of

these fuels are not self-sufficient in their strategic needs. In short, the countries and regions of the world rely on each other for essential goods and services. Hence, as long as international trade continues unimpeded, our dependence on energy imports in itself does not threaten national or regional security. The problems that can arise from dependence occur when political factors interfere in the flow of commerce. Perhaps the best security we can hope for is that the basic laws of supply and demand will work to the benefit of both importers and exporters.

Basic Theses

The basic theses of my paper are three:

1. That there are no realistic options for eliminating European energy imports by 1990.
2. That we require prompt decisive action if imports are to be significantly reduced during the 1990's.
3. That cutting our imports is not likely to be desirable if we pursue it without regard to the impact on the European and international economy.

My paper this morning is in three sections. First, an overview of European energy demand and supply through 1990 and possible variability around the base case. With these data we can establish a range of European import requirements.

Second. The scope for reducing the level of European imports by 1990 and an assessment of Europe's ability to withstand a short term major reduction in imported oil or gas supplies.

Finally, brief remarks on the potential for changing the situation during the 1990's.

All of the data I will discuss are for western Europe, that is excluding Turkey, Jugoslavia and the Comecon countries.

Vugraph 1: European Primary Energy Demand

This bar chart shows our recent forecast of primary energy demand. However, it should be emphasized that I am putting this case forward only as a base case against which to describe import requirements. It projects total demand growing from 1175 MTOE in 1982 to 1344 MTOE in 1990, an increase of 1.7% per year.

Experience in recent years has taught us to be very modest about our forecasting abilities and it is possible to envision a range of 500 MTOE between an extremely low and extremely high demand for energy in 1990. A very simple model we use indicates that demand could be about 1000 MTOE in 1990 with little or no economic growth and crude priced at $40 per barrel (1982 $).

At the other extreme, the model forecasts demand about 1500 MTOE if we have economic growth of 3.3% per annum through 1990 and a crude price of $25 per barrel (1982 $). Neither extreme is likely, but the wide range makes it clear that we are ill-advised to think of future energy issues within a narrow range of possibilities.

The main features of this base forecast are well known and common to most other forecasts of European energy demand.

Oil demand hit its peak at 728 MT in 1973, then began to decline. Since 1979 the decline has been particularly strong. Through the rest of the decade oil demand is forecast to carry on declining slightly due to the continued move away from fuel oil.

Natural gas demand continued to grow until 1979 to a peak of 181 MTOE but, unlike oil, growth is expected to resume this year and continue through 1990 and beyond due largely to its increasing use in the household and small consumer sector.

Coal demand is now stagnant and is apt to remain so for the next year or two. We do not expect real growth until the later 1980's and even then it is premised on a continued price advantage versus fuel oil and the existence of the necessary customer installations.

The small growth forecast in hydro and geothermal energy reflects a lack of economic opportunities.

Nuclear power is expected to provide the most dramatic growth and this forecast assumes the implementation of virtually all current committed programmes in this period. 42% of the capacity increase is in France, 14% in Germany, 16% in Spain and 9% in the U.K.

Vugraph 2: European Energy Supply

Taking the same demand numbers, we have broken the bars for the three years so that domestic and imported supplies are clearly differentiated. Import dependence has declined significantly - from 49% of energy supply in 1980 to 43% in 1982. For our base case, it is forecast to decline further to 41% in 1990. However, in volumetric terms, imports are now at minimum and we expect them to increase slowly in the rest of the decade because of the major increases forecast in gas and coal demand. The big increase in coal imports reflects the increasingly uncompetitive costs of European coal supplies.

Domestic energy production is forecast to increase nearly 20% by 1990 and contributes to a reduction of imports. The increases are expected to come

largely from nuclear power and oil, but as you will be aware, by 1990 domestic oil production is likely to be already declining from its peak of about 165 MT in the mid-1980's. Domestic production of gas has declined from 1980, partly because of the gradual depletion of fields such as the southern North Sea but mainly because domestic reserves have been shut in to some extent by imports. I will return to this subject later, but first let me expand on the various import requirements indicated.

Vugraph 3: European Energy Imports - 1990 Forecast

This chart aims to help us identify the degree of risk in the imports required in our base case. In 1990, this forecast shows 383 MT of oil imports, and they amount to 71% of total oil requirements and 28% of total primary energy demand. In this time period, we are not overly concerned about world supply capability. The European requirement plus comparable requirements for the rest of the world imply production from OPEC countries of about 25 MBD, still below anticipated supply capacity. However, such an upswing in demand on OPEC from its 1983 level of 17 to 18 MBD is likely to bring with it some price increases. The major uncertainty and the prime purpose of this workshop is the risk we face from the instability of some oil exporting nations, and the possibility of international conflict stemming from political differences quite apart from oil supply.

An added source of concern in the years ahead is the possible impact of product and intermediate feedstock imports on the European refining industry, an industry already badly damaged by falling demand, over capacity and surplus raw materials. By 1990, it is estimated that the capacity of North African and Middle East refineries will total 6 MBD versus today's level of 3 MBD. If this capacity is used according to economic rules that differ from those characteristic of European refining, it could curtail investment in upgrading European

refineries. The greatest risk is that these producing countries will look beyond the refining costs and use crude profits as an incentive to move products into Europe.

Natural gas imports in our base case make up 31% of total supply and come from existing and proposed new contracts with the USSR and Algeria. I leave it to you to assess whether this level of dependence is serious in view of the ideological and other differences between these countries and western Europe. During the 1980's these Russian and Algerian contracts are likely to constrain domestic production in the Netherlands and Germany. Dutch and German supply contracts were struck in a period when natural gas was breaking into the European market and they are considerably more flexible in their yearly and seasonal commitments than the recent Russian and Algerian contracts.

Coal imports for 1990 in this case constitute 33% of total coal requirements. Our outlook on world supplies indicates that they will continue to be abundant with new capacity available from several countries, including South Africa, Australia, United States, Colombia and Canada. However, market penetration may be limited if European customers do not proceed with installing the essential handling and burning facilities. Environmental concerns may also constrain coal's growth in Europe, and leave a greater demand on fuel oil.

In summary, through 1990 European <u>imports</u> of energy in any form are <u>not threatened by physical supply capability</u> at the level required in our base case. Any problem is not likely to be caused by a lack of resources.

However, relative to the base case of 1344 MTOE in 1990, energy demand could be as low as 1250 or as high as 1500 MTOE. I would now like to consider how Europe's energy needs would be supplied in both these situations. Let us first examine the high case where demand in 1990 is 1500 MTOE.

Vugraph 4: European Energy Supply Flexibility - 1990
If demand 1500 MTOE

To determine the impact of this case on individual fuels, we have had to make certain assumptions about growth in the economy, and the pattern of growth in demand in each sector. However, to simplify these issues we can say that a total demand of 1500 MTOE in 1990 is consistent with an oil price of about $30 a barrel (1982 $) and a GDP growth of over 3% per annum from 1982.

Of the total energy growth of 156 MTOE, we believe oil demand would increase by about 57 MT, largely fuel oil required to fuel accelerated industrial activity. All of this increase would have to be supplied by imports and if similar economic growth occurs in the rest of the world, the pressure for higher oil prices would strengthen.

The increase in natural gas demand would amount to about 32 MTOE, and would provide additional outlet for indigenous gas in Europe; Dutch and German production would be expected to increase to cover part of this new demand. Although stronger demand would stimulate new projects to develop European reserves, by 1990 they would not be on stream. So, imports would increase to about 85 MTOE or 35% of total gas demand.

Coal would experience the biggest change with an increase of 62 MTOE in demand. The increase would be even greater if we were more optimistic about customer installations. Almost all of the increase would be supplied from imports. However, as I said earlier, there is ample world supply and keen price competition.

In total, an energy demand of 1500 MTOE would be expected to raise imports to 672 MTOE or 45% of total demand. However, the decisive turnaround in

economic growth from the downward trend of recent years implied in this case means that employment would be higher and European citizens and governments better off than they were in the recession of the past three years.

Vugraph 5: European Energy Supply Flexibility - 1990
If demand 1250 MTOE

Now let us consider how European energy requirements might be affected by a demand of 1250 MTOE in 1990. This demand would be consistent with European economy growing at only 1.5% per year from 1982. Again, we have made some assumptions about the impact of such low growth on each sector in order to assess the overall impact on each fuel.

With these assumptions, a fall in oil demand accounts for 43 MT of the decrease in total demand. Fuel oil use bears the brunt because of the decline in steam raising and process heat that results from the low growth rate in GDP and industrial production. All of the reduction in oil demand would be from imports.

With respect to natural gas in this low case, demand would decrease by 18 MTOE, reducing production in Holland and Germany and further discouraging new developments in the North Sea. If one assumed that contracted gas imports were unaffected with demand as slack as this, additional indigenous supply would be backed-in.

Coal demand might fall by about 23 MT and most of this decrease would come from imports. With even lower prices available in world markets, it is likely that the pressure to rationalize European production and reduce subsidies would intensify.

In total, this low demand case would be expected to reduce imports to 38% of total demand and reduce our exposure to political events in other regions. However, it is the result of a very unhealthy economy and levels of unemployment in excess of today's very serious situation.

To this point we have discussed the considerable range of energy demand in 1990 and the effect of a high and low case on energy supplies, particularly on imports. I would now like to examine more closely how specific government policies could affect both demand and supply in Europe. First, let us consider the issue of direct government actions to manage energy demand.

Vugraph 6: European Energy Demand Management

From our observation and experience, the governments of Western Europe know more about the behaviour of energy markets than they did ten years ago. Most appreciate that market forces can support their energy policy goals of diversification and conservation and so they are less inclined to tinker with the situation than they were following the 1973 oil crisis. Several countries — notably Norway and Netherlands — recently have joined the U.K. in abandoning oil product price controls. Others such as Italy and France have relaxed their oil price regulations. We feel that the trend will continue to be in the direction of greater flexibility.

Nevertheless, some importing governments are likely to be unwilling to rely primarily on market forces to manage demand as long as oil imports remain subject to politically inspired interruptions. Some may still feel that they should intervene to promote further reductions in oil demand through fuel substitution, excise taxes and the like, either at the national level or through the EEC. To assess the efficacy of that approach, however, let's review the impact that government conservation measures vs. higher energy prices have had on fuel consumption over the past ten years.

There is no doubt that higher energy prices have contributed to slow economic growth, particularly in energy intensive industries. In turn, recession and the painful restructuring of the European economy have depressed fuel demand.

Since 1973 there has been a steady decline in the use of energy per unit of output in the economy and we would suggest that this trend will continue.

In contrast to the impact of higher prices and lower economic activity, direct government initiatives to reduce energy demand have had a much smaller and in our opinion not always productive effect. Exhortation through speeches and advertisements has had little influence over consumption. State subsidies for conversion from one fuel to another have proved to be a poor substitute for market forces because they have often encouraged uneconomic decisions. For example, incentives for industry to shift to coal have been based on the perception of significantly high prices for oil or gas in the future. These price rises, however, have not materialised over the long term. In a related area, some governments have provided a thinly veiled subsidy to local industry by offering artificially low electricity rates in certain areas. Such subsidies are more likely to interfere with than to enhance the economic use of all fuels.

We are all familiar with excise taxes on motor fuels. They have not risen in the last decade as fast as energy prices and for governments faced with significant financial problems they are bound to be an inviting opportunity if oil prices fall. Of all of the consuming sectors, however, the private transportation market appears to be the least elastic. The evidence indicates demand is less responsive to higher prices in this sector and it is also of course very sensitive politically. You may have noted the action of the Italian Government to increase excise tax as oil prices have declined in recent weeks. To the extent that excise taxes are increased to offset falling oil prices, we believe it will be motivated primarily by the need for revenue, and that it will not have much effect on demand.

In the near future, governments are likely to continue relying on market forces to manage demand for some very pragmatic reasons. They have little scope in their national budgets to provide energy susbsidies of any sort on a scale that

would affect consumption. Above all, the primary goal of governments today is economic recovery. If governments replace market price reductions on industrial fuels with excise taxes designed to depress fuel use, such measures will raise fuel costs and so hamper Europe's competitiveness with the rest of the world.

Vugraph 7: European Domestic Energy Supply Potential through 1990

Now with this next slide, we turn to the question of what can be done to increase the production of energy within Europe by 1990. In brief, the answer is not much and the key problem is lead time. Almost regardless of the need or the incentive, it takes about ten years from start to finish for a major energy project to come on stream, be it an offshore oil project or a nuclear power plant.

With respect to oil, there are a number of projects under development, in the North Sea, that will come on stream between now and 1990 (e.g. Hutton, Maureen, Alwyn, Clyde in the U.K.; Statfjord C, 34/10 and Valhall in Norway) but they will not prevent the downturn in production which we expect to begin in the late 1980's. The lead time required makes it very difficult to affect the 1990 production forecast significantly by policy changes or decisions between now and then.

There are significant reserves of natural gas in the Netherlands and small reserves in Italy which could contribute to the European energy supply in this decade. However, in both cases, it has been government policy to retain these reserves for domestic use in later years. However, recent indications from the Netherlands suggest that additional exports in the 1990's may be sanctioned. The maximum speed-up of development in the offshore UK and Norway (e.g. UK Southern Basin and Norway Ekofisk and 30/6 projects) might produce as much as

8 MTOE additional gas supply by 1990. However, with gas supply capability exceeding anticipated demand, the business prospects are inhibiting.

Coal production in Europe might be increased by 5 MTOE but it would be at very high cost. In our view, German lignite is probably the only sizeable supply source which can compete profitably against imports.

Regrettably, any variability in the supply of nuclear electricity by 1990 is downward. Like other forecasters, we have had to reduce our estimates of nuclear power every year for reasons such as the threat of the new Spanish government to abort the completion of 3 plants there. With continued opposition from environmentalists, uncertainty in electricity demand and lower prices for fossil fuels, there is no scope for increasing supply in this decade.

To round out this review of demand and supply variability, and import dependence through 1990, it is appropriate to look briefly at how Europe would respond to a cut in its oil or gas imports emanating from an international crisis — a cut that would be large in size but temporary. The many sources of supply for coal suggest that vulnerability to a cut in coal imports is insignificant.

Vugraph 8: Vulnerability to 6-Month Crisis

In this slide we show a possible response to Europe losing half of its oil and gas imports for six months.

Half of Europe's oil imports amounts to about 4.0 MBD or about 35% of the daily oil demand likely in the later 1980's. With this loss, the IEA crisis supply programme could be triggered, and we would expect actions something like shown here. The 10% cut in demand called for in the IEA agreement in such

a crisis amounts to about 1.0 MBD. Most countries have standby allocation and rationing systems intended for just such an emergency but they will take at least several weeks to implement. The quickest way to achieve a major cut would be to replace fuel oil in power stations and major industrial plants wherever there is dual firing capability. However, this could turn into an unmanageable fuel oil glut and do little to alleviate a shortage of transport fuels. Any cut in demand would have to recognize the limited flexibility in refinery yields.

The second action listed is the drawdown of commercial inventories, that is any stock above the compulsory level. In recent months this has varied from 5 to 15 days, and 0.5 MBD reflects 10 days' inventory.

Supplies provided by other IEA countries could be as much as 2.5 MBD if Europe alone were cut off half of its imports. On the other hand, if all the IEA countries lost half of their imports, Europe as a whole would not receive any extra supplies. There would of course be reallocation of available supplies within Europe. Both situations are extreme and arbitrary but they serve to illustrate the IEA system in operation.

To this point, we have either made up the full loss of 4.0 MBD or as little as 1.5 MBD, depending on the extent of the countries having their imports cut. Accordingly, we would have to draw on compulsory inventories by up to 2.5 MBD. At the low level of inventories remaining after such a cut, about 50 days, some parts of the system would probably have had stocks removed that are necessary to keep the system operating, and more onerous consumer cutbacks would be indicated. However, the personal welfare and economy would be in reasonably good shape. The problem of course is that we would never know in advance how long such a crisis would last.

Assessing the response to losing half of Europe's gas imports for six months is more straightforward and the situation is less threatening. Half the imports

likely in the late 1980's is 3.9 GCFD. To replace it, we have again assumed a 10% reduction in total gas demand and this would provide 2.5 GCFD. Again, the quickest way to do this would be to substitute fuel oil and coal in major dual-fired installations.

In such a crisis, increased production from Dutch and Italian reserves could provide more than the rest of the shortfall. However, there could be problems in distributing the gas or in the willingness of Dutch and Italian governments to bail out other European countries. Bear in mind that with imports coming only from Russia and Algeria in this period, the loss would focus solely on the countries usually receiving these imports.

Finally, to make-up the loss, inventories established in France and Italy for just such a purpose could be called on. They are capable of providing 2.2. GCFD for six months, but the question remains as to the willingness of these governments to come to the rescue of those countries that have not built up similar reserves.

In conclusion, it is apparent that lower energy demand has reduced Europe's vulnerability to supply crises. Still a loss of either oil or gas supply in the proportions we have assumed would be a serious problem for Europe and a challenge to the relationships between have and have not countries.

Vugraph 9: Conclusions to 1990

Let me try to sum up everything that I have been saying with respect to the energy demand and supply outlook to 1990.

There is clear evidence that the trend to lower energy consumption per unit of output is continuing. Lower prices will reduce the incentive for conservation

and for investments to reduce energy use. However, we will continue to conserve from the energy saving practices and capital goods introduced to date plus the normal replacement of worn out plant and equipment.

We have also concluded that there is little scope for increasing the supply of energy in Europe by 1990. Increased oil production is not feasible because of the long lead time. The scope for gas increases is complicated by the current oversupply and import contracts. Finally, any coal increase would be small and very costly.

Before concluding, however, that this situation is a serious problem for Europe, it should be noted that the exporters of energy have their own vulnerability. Nearly all the OPEC countries are in financial difficulty or having to dip into their financial reserves. Russia has a desperate need for hard currency. Exporting countries have a great need for our markets.

Europe is expected to depend on over 40% of its energy supply coming from imports in 1990. We do not believe that it has much choice in this decade if we also want a healthy economy. On the other hand, this should not be assumed to be a tremendous liability to our economic future or our security provided that all nations are successful in avoiding a major political conflict that would interfere with energy and other trade.

I cannot resist saying a few words about the situation beyond 1990 because there are opportunities for significantly increased indigenous energy supplies in Europe in the 1990's if we take actions soon enough.

Vugraph 10: Beyond 1990 - Opportunities and Constraints - 1

Looking first at oil, we are reasonably satisfied that the North Sea has a resource base sufficient to sustain the present level of production, say 3 MBD through the end of the century. We are not optimistic about expanding reserves on the continent, but in the North Sea, we believe the reserves are there, they can be developed at a cost within the present level of world crude prices and there is sufficient time to do the job. The constraints, however, are very real and serious. Fiscal regimes structured with the perspective of steady increases in real oil prices do not leave enough for the developer to proceed with many of these fields. Last week's new budget in the U.K. took some steps in the right direction that will assist development activity significantly. Of course, if crude prices fall well below today's level and are perceived to stay low, not many of these fields can proceed because they are too costly.

Even greater opportunities in terms of resource base apply to natural gas particularly in Norway. However, offshore gas developments require costly pipeline systems, and markets dedicated to these supplies by long-term contracts. The near term gas supply/demand situation in Europe and the Russian export potential cloud the prospects for these costly new North Sea projects when coupled with the high tax regime.

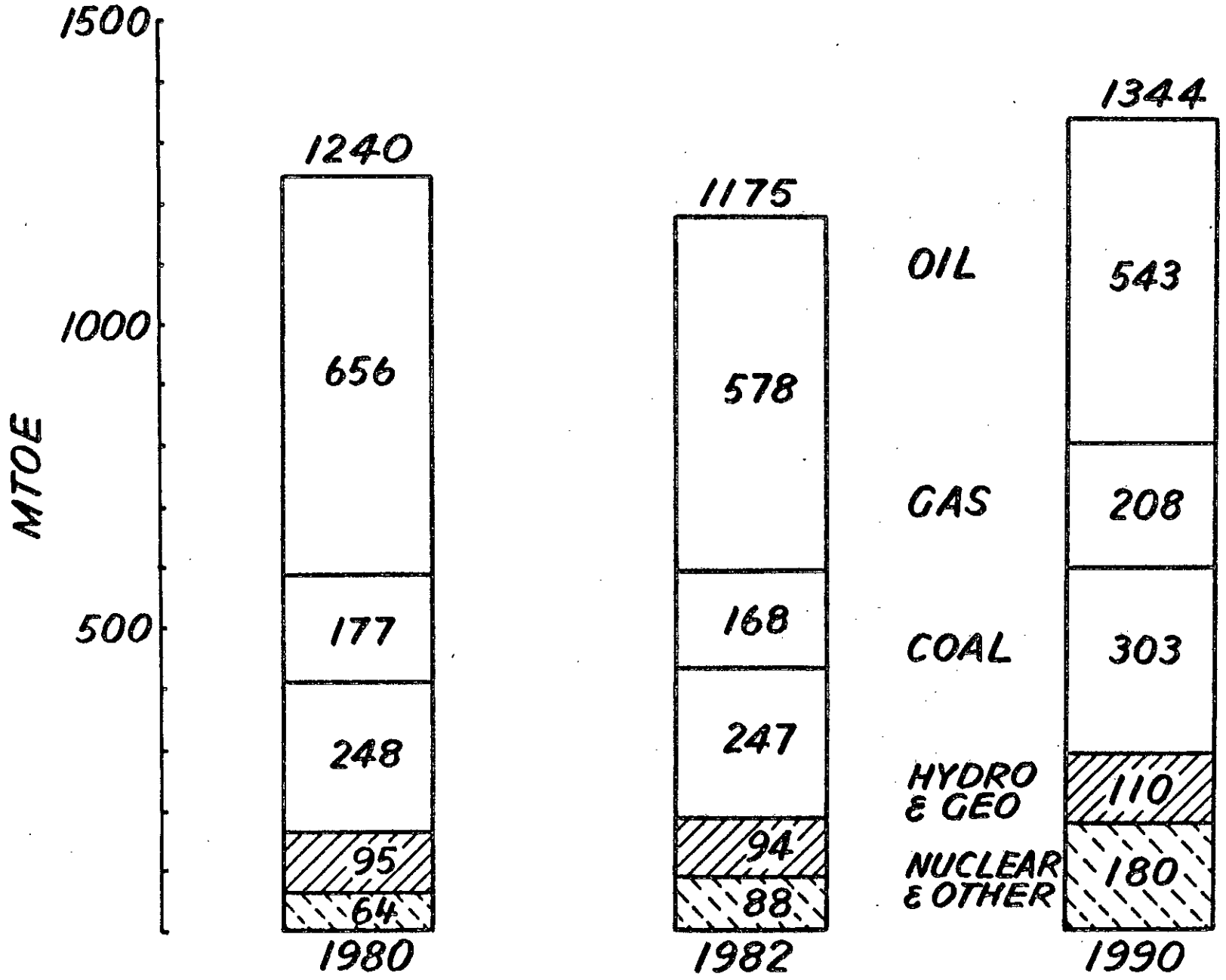
Vugraphs 11: Beyond 1990 - Opportunities and Constraints - 2

Europe does not have much opportunity to increase its domestic coal output economically. The current costs of subsidising indigenous production in fact tend to divert funds from development of mines which could compete with import supplies. On the other hand, we think there is little risk in counting on imports to supply Europe's growing coal market.

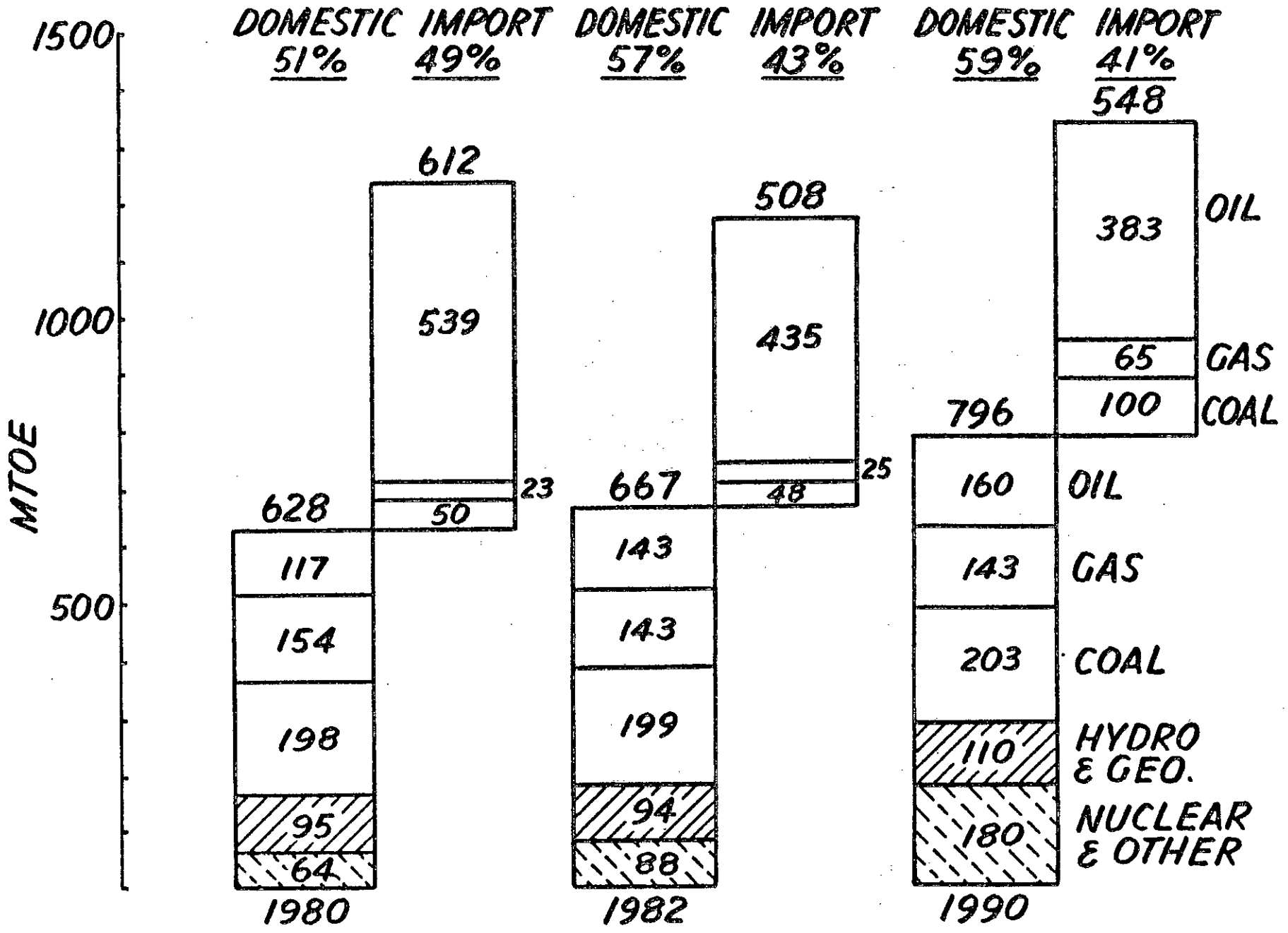
Nuclear electricity remains an option for indigenous low cost energy supply in the 1990's but as a whole we are not making much progress in this direction. The decline in the growth of demand for electricity has taken the spotlight off the need for nuclear power and its case needs updating and re-emphasizing. Its safety record is extremely impressive but the environmentalists opposing it are sincere and cannot be wished away.

My conclusion for the 1990's is that economic growth will require that energy demand continue growing albeit at a slower pace than pre-1973. We will only be able to keep imports at the 1990 level if there are significant policy changes to encourage oil and gas and major additional nuclear power programmes. Without such changes, and soon, we can look forward to meeting again in 1993 and concluding that nothing much can be done to reduce imports in this century.

EUROPEAN PRIMARY ENERGY DEMAND



EUROPEAN ENERGY SUPPLY



EUROPEAN ENERGY IMPORTS - 1990 FORECAST

OIL

- 383 MT IMPORTS ARE 71% OF OIL DEMAND, 28% OF TOTAL ENERGY DEMAND
- ADEQUATE WORLD SUPPLY CAPABILITY AT A PRICE
- KEY UNCERTAINTY IS POLITICAL STABILITY
- PRODUCT IMPORTS (INCLUDING NGLS) COULD BE 100 MT, 10% OF OIL DEMAND

NATURAL GAS

- IMPORTS OF 65 MTOE ARE 31% OF GAS DEMAND, 5% OF TOTAL ENERGY DEMAND
- USSR (38 MTOE) AND ALGERIA (27 MTOE) ONLY IMPORT SOURCES THROUGH 1990
- DOMESTIC PRODUCTION CONSTRAINED IN MID 1980S BY IMPORT CONTRACTS

COAL

- IMPORTS OF 100 MTOE ARE 33% OF COAL DEMAND, 7% OF TOTAL ENERGY DEMAND
- ABUNDANT WORLD SUPPLIES MEAN STRONG COMPETITION
- MARKET PENETRATION PERHAPS LIMITED BY CUSTOMER FACILITIES

EUROPEAN ENERGY SUPPLY FLEXIBILITY - 1990

1. IF DEMAND 1500 MTOE, 156 MTOE (12%) ABOVE BASE FORECAST

-- OIL DEMAND INCREASES BY 57 MT (10%), WHILE OIL IMPORTS INCREASE TO 440 MT, 73% OF TOTAL OIL DEMAND. UPWARD PRICE PRESSURES STRENGTHEN.

- GAS DEMAND INCREASES BY 32 MTOE (15%) AND INCREASES DOMESTIC PRODUCTION. INDIGENOUS PROJECTS STIMULATED BUT IMPORTS INCREASE TO 85 MTOE, 35% OF TOTAL GAS DEMAND.

- COAL AVAILABLE AND COMPETITIVE. DEMAND INCREASE OF 62 MTOE (20%) ALMOST ALL IMPORTS.

- ACCELERATION OF NUCLEAR PROGRAMMES AND IMPROVED SERVICE FACTORS MIGHT YIELD 5 MTOE.

- TOTAL IMPORTS RISE BY 134 MTOE TO 672 MTOE, 45% OF TOTAL DEMAND.

EUROPEAN ENERGY SUPPLY FLEXIBILITY - 1990

2. IF DEMAND 1250 MTOE, 94 MTOE (7%) BELOW BASE FORECAST

- OIL DEMAND DECREASES BY 43 MT (8%), WHILE OIL IMPORTS DECREASE TO 340 MT, 68% OF TOTAL OIL DEMAND.

- GAS DEMAND DECREASES BY 18 MTOE (9%), REDUCING DOMESTIC PRODUCTION AND DELAYING INDIGENOUS PROJECT DEVELOPMENT.

- COAL DEMAND DECREASES BY 23 MTOE (8%) AS PACE OF SUBSTITUTION SLOWS. BULK OF DECREASE IN IMPORTS, BUT PRESSURE FOR RATIONALISATION OF INDIGENOUS PRODUCTION INTENSIFIES.

- NUCLEAR PROGRAMME SLOWS AND REDUCES SUPPLY BY ABOUT 10 MTOE.

- TOTAL IMPORTS FALL BY 74 MTOE TO 474 MTOE, 38% OF TOTAL DEMAND.

EUROPEAN ENERGY DEMAND MANAGEMENT

- ENERGY DEMAND REDUCTIONS SINCE 1979 DUE TO:
  - DEPRESSED ECONOMIC ACTIVITY, ESPECIALLY IN ENERGY INTENSIVE INDUSTRIES
  - CONTINUED CONSERVATION RESPONSE TO HIGH PRICES

- GOVERNMENT POLICIES HAVE HAD FAR LESS SIGNIFICANT IMPACT:

  EXHORTATION
LEGAL LIMITS, MINIMUM STANDARDS — NOT SIGNIFICANT

  SUBSIDIES — POOR SUBSTITUTE FOR MARKET FORCES

  FUEL TAXES — BASICALLY VIEWED AS REVENUE RAISERS
  - POTENTIAL MEANS OF DEMAND MANAGEMENT

- GOVERNMENTS NOW MORE KNOWLEDGEABLE AND LESS AFFLUENT

EUROPEAN DOMESTIC ENERGY SUPPLY POTENTIAL THROUGH 1990

OIL - LITTLE OR NO SCOPE TO PREVENT LATE 1980S DOWNTURN

NATURAL GAS - POLICY CONSTRAINTS ON DUTCH AND ITALIAN PRODUCTION

- SPEED UP IN UK/NORWAY PROJECTS MIGHT PRODUCE 8 MTOE

- BASE CASE OVER SUPPLY INHIBITING

COAL - INDIGENOUS PRODUCTION INCREASE OF 5 MTOE POSSIBLE

- HIGH SUBSIDIES NEEDED TO MAKE INDIGENOUS COAL COMPETITIVE

NUCLEAR/OTHER - VARIABILITY ALL DOWNWARD

. ENVIRONMENTALIST OPPOSITION
. ELECTRICITY DEMAND UNCERTAINTIES

VULNERABILITY TO 6 MONTH CRISIS

			MB/D
OIL	ASSUME 50% LOSS OF IMPORTS		(4.0)
	COMPONSATED BY:		
	10% DEMAND CUT INCLUDING SUBSTITUTION		1.0
	DRAWDOWN OF COMMERCIAL INVENTORIES		0.5
	IEA SUPPLIES		0.0 - 2.5
		SUB TOTAL	1.5 - 4.0
	∴ DRAWDOWN OF COMPULSORY INVENTORIES		2.5 - 0.0
			GCFD
NATURAL GAS	ASSUME 50% LOSS OF IMPORTS		(3.9)
	MADE UP BY:		
	10% DEMAND CUT INCLUDING SUBSTITUTION		2.5
	PRODUCTION INCREASE		UP TO 1.8
	DRAWDOWN OF INVENTORIES		UP TO 2.2
CONCLUSION	DEMAND REDUCTIONS HAVE REDUCED BUT NOT ELIMINATED VULNERABILITY TO "EUROPE ONLY" CRISIS		

CONCLUSIONS - TO 1990

- o LIMITED SCOPE FOR MANAGING DEMAND REDUCTION
  - STRONG EFFICIENCY TRENDS WELL ADVANCED
  - LOWER PRICES WILL REDUCE INCENTIVES FOR CONSERVATION INVESTMENT
  - HEAVY TAXES COULD STIFLE ECONOMIC RECOVERY
- o LIMITED SCOPE FOR INCREASING INDIGENOUS SUPPLIES
  - OIL INCREASE INFEASIBLE BEFORE 1990 BECAUSE OF LONG LEAD TIMES
  - SCOPE FOR GAS INCREASE LIMITED AND INHIBITED BY CURRENT OVER SUPPLY AND IMPORT CONTRACTS
  - COAL INCREASE WOULD BE SMALL AND HIGH COST, BUT IMPORTS AVAILABLE
- o BUT ENERGY EXPORTERS HAVE OWN VULNERABILITIES
  - NEARLY ALL EXPORTERS IN FINANCIAL DIFFICULTY OR HAVING TO DIP INTO RESERVES
- o THIS VULNERABILITY CAN BE AND HAS TO BE LIVED WITH

BEYOND 1990 - OPPORTUNITIES AND CONSTRAINTS - 1

OIL - NORTH SEA RESOURCES CAN PROBABLY SUSTAIN PRESENT PRODUCTION THROUGH 2000, IF:

- GOVERNMENTS MODIFY FISCAL REGIMES
- CRUDE PRICES DO NOT FALL FAR

NATURAL GAS - NORTH SEA RESOURCE BASE WILL SUPPORT PRODUCTION INCREASE. SIMILAR FAVOURABLE ENVIRONMENT NEEDED TO PROMOTE RAPID DEVELOPMENT. IN ADDITION:

- OFFSHORE DEVELOPMENTS REQUIRE PIPELINE SYSTEMS AND, HENCE, DEDICATED MARKETS
- GAS OVER SUPPLY CLOUDS MARKET GROWTH PROSPECTS

BEYOND 1990 - OPPORTUNITIES AND CONSTRAINTS - 2

COAL	-	SUBSIDISED INDIGENOUS PRODUCTION INHIBITS NEW LOW COST FIELD DEVELOPMENT
	-	PRICE COMPETITION AND WIDE RANGE OF SOURCES MEAN THAT INCREASING IMPORTS IS A LOW RISK POLICY
	-	HANDLING AND ENVIRONMENTAL PROBLEMS NOT LESSENING
NUCLEAR	-	DESPITE SAFETY RECORD ENVIRONMENTAL CONCERN IS REAL AND UNDERSTANDABLE
	-	ECONOMIC CASE NEEDS RE-EMPHASISING
RENEWABLES	-	MINIMAL PROSPECTS OF SIGNIFICANT CONTRIBUTION BEFORE 2000
CONCLUSION	-	BASIC CHANGE IN POLICIES FOR OIL AND GAS AND/OR NUCLEAR POWER ONLY WAY TO AVOID IMPORTS INCREASING SHARE

(3)

PROGRAMME FOR STRATEGIC AND INTERNATIONAL SECURITY STUDIES
PROGRAMME D'ÉTUDES STRATÉGIQUES ET DE SÉCURITÉ INTERNATIONALE

THE GRADUATE INSTITUTE OF INTERNATIONAL STUDIES
INSTITUT UNIVERSITAIRE DE HAUTES ÉTUDES INTERNATIONALES

ENERGY WORKSHOP

OPEC AND EUROPE

By

Fereidun Fesharaki

March 1983

Introduction

Despite a significant decline in oil demand, the Western European economies are and will remain a major market for oil. Indeed, Western Europe accounted for around 40 percent of world oil imports in 1981 and was the largest single market for internationally traded petroleum. In the same year, the Western European economies paid out $107 billion for their oil imports.

As the turmoil in the international oil market continues, the Western European nations remain heavily dependent on OPEC oil, particularly on oil from the Persian Gulf and North Africa. This heavy dependence, together with political uncertainties on the future of Europe's major oil suppliers, raises the question of energy security and policy choices open to the governments in the region. This issue is particularly significant at present as the current oil glut and the changing perceptions of future demand and supply for oil are leading many nations into a false sense of security.

The purpose of this paper is to examine the following issues: the state of the oil market and the role of key OPEC nations; Western European oil dependency; and major policy options and vulnerabilities facing Western Europe. In a sense this paper attempts to provide a glimpse into future scenarios of oil availibility in the next 10-20 years, while at the same time focussing on issues facing the Western European nations.

OPEC AND THE WORLD OIL MARKET

The 1973/74 and 1979/80 oil price increases have been dubbed as the two oil shocks. The 1980-82 decline in demand for oil certainly merits the title of the third oil shock. Non-communist consumption of oil declined

from 52.6 million barrels per day (mmb/d) in 1979 to an estimated 45 mmb/d in 1982. OPEC production, which peaked in 1977 at 31 mmb/d, is expected to decline to less than 20 mmb/d in 1982 and non-OPEC supplies exceeded OPEC supplies in the non-communist world for the first time in 1982.[1]

The decline in demand was due to three main factors. First, the world recession; second, structural decline in demand for oil; and third, oil company de-stocking of inventories. None of these factors are likely to continue indefinitely. The world economy will recover, probably in 1983/84, and oil company de-stocking will halt once the excess supplies are exhausted. As far as the structural changes in demand are concerned, some irreversible changes in energy/GDP ratios have taken place. However, many analysts feel that the conservation cycle has run its course--at least with the present level of prices. The question of what has led to the decline in demand is still not fully answered, and we may well not find out about it until the end of this decade. We are still not sure whether the "structural" portion of demand decline (as compared to the recessionary portion of demand decline), has been caused by the 1973/74 oil price shock or by the 1979/80 oil price shock. If, according to the World Bank, the long-term price elasticity of demand takes 15-20 years to work itself through[2] (through the change of energy using capital stock), then the full impacts of the first oil shock will be seen by the late 1980s and the full impacts of the second oil shock will be observed between 1995 and 2000. This does not mean that demand will continue to drop, since the "income effect" through GDP growth, could neutralize the price effect.

For the medium term outlook we have drawn on a number of studies made available in 1981. These studies by CONOCO,[3] EXXON,[4] Gulf Oil Production and Exploration Co. (GP&E),[5] International Energy Agency,[6] U.S. Department

of Energy's International Affairs (DOE/IA),[7] and World Bank[8] provide projections for the future outlook for oil.

The share of oil in energy balance

Table 1 provides a summary and mean of projections regarding the percentage share of oil in the world energy supply during this century, given the different assumptions about substitution of oil by other fuels. The share of oil in world energy consumption is projected to decline but remains nevertheless prominent. OECD nations are seen to reduce their energy dependence on oil from 50 percent in 1980 to 35.5 percent in the year 2000. The non-communist world's share of oil in energy use is expected to fall from 53 percent in 1980 to 43 percent in 2000, while CPE's demand for oil is expected to decline from 31 percent to 21 percent in the same period. LDC's and OPEC remain very much dependent on oil. LDC's oil use of around 55 percent in 1980 is expected to decline to 47 percent by 2000, while OPEC's dependence will remain over 70 percent. On the whole, the world's dependence on oil as a source of energy will decline from 45.5 percent in 1980 to 31 percent in the year 2000.

The above data are interesting mainly because there are fewer differences of opinion than one might have expected from private oil companies, governmental studies and international organizations. In all cases the expectation of massive shifts away from oil is not seen to take place in this century.

TABLE 1
Projections of Oil's Share in Energy Supply/Demand (%)

	1980	1985	1990	2000
1. OECD				
a) Exxon	52	-	51	32
b) GP&E	50	46	42	39
c) IEA	-	45	37	-
d) DOE/IA	50	45	40	-
e) World Bank	48	45	40	-
2. WOCA[a]				
a) CONOCO	55	-	43	-
b) GP&E	51	48	45	43
c) DOE/IA	53	49	49	-
3. CPEs[b]				
a) Exxon	32	-	28	23
b) World Bank	30	-	28	-
4. LDCs/OPEC				
a) GP&E	55/71	52/73	50/73	47/72
b) World Bank	62	-	49	-
5. World				
a) Exxon	47	-	38	31
b) World Bank	44	-	39	-
Mean of Projections				
OECD	50	45.25	40	35.5
WOCA	53	48.5	44.3	43
CPE's	31	-	28	23
LDCs/OPEC	62.5	62.5	55.25	47/72
World	45.5	-	38.5	31

[a] World outside Communist Areas.
[b] Centrally Planned Economies.
- Not available

Source: Footnote nos. 3-8.

World Supply and demand for oil

Table 2 provides an indication of what the world supply and demand for oil might look like in the next twenty years. For OECD, most projections see a consistent decline in oil production as well as comsumption. OECD imports of petroleum are seen to be virtually unchanged during 1985-2000 at 21-22 mmb/d, or a drop of 1 mmb/d compared to 1980. Non-OPEC LDC's production of oil is expected to increase from 5.7 mmb/d in 1980 to 9.7 mmb/d in 1990 before dropping back to 7.0 million barrels per day in the year 2000. In the same period, consumption is seen to increase to outstrip supplies so that LDC net imports will rise from 2.5 mmb/d in 1980 to around 4.7 mmb/d in the year 2000. This conclusion is contrary to the expectations in the industrial world that LDC oil production will rise substantially in the next 20 years to replace a large portion of OPEC oil. OPEC production is seen to remain relatively steady during the period, at around 27 mmb/d, but will decline to 23.1 mmb/d in 1990 and 19.5 mmb/d in the year 2000. In total, the world supply and demand are seen to be in relative balance during the 1980s but lead to a shortfall of 6.4 mmb/d by the year 2000, which will surely result in a big jump in the price of oil.

OPEC's share of the world oil output fell from the 1977 peak of 52 percent, to 45 percent in 1980, and to around 40 percent in 1981/82. However, OPEC oil production as a percentage of world oil output is a poor measure of OPEC influence. What we should measure instead is the contribution to world oil trade. In 1981, OPEC accounted for three-quarters of the world oil trade, with the Persian Gulf nations' oil making up two-thirds of OPEC output. OPEC's current contribution to world oil trade is an indication that, despite growing non-OPEC output, a major part of the additional non-OPEC production is going to satisfy oil demand in these countries themselves.

TABLE 2
World Oil Supply and Demand--Mean of Projections (mmb/d)

	1980		1990		2000	
	Prod.	Cons.	Prod.	Cons.	Prod.	Cons.
OECD	15.5	38.3	14.7	35.8	13.8	35.0
OPEC	27.8	2.7	27.8	4.7	26.7	7.2
NOLDCs	5.7	8.2	9.7	10.8	7.0	11.7
TOTAL	49.0	49.2	52.2	51.3	47.5	53.9

Source: Footnotes 3-8.

OPEC is likely to remain the major force in the world oil market, and the Persian Gulf nations will be the key to the developments in the market.[9]

OPEC nations' production policies are determined by the inter-play of three major factors: world demand for oil, physical ceilings due to technical reservoir production capabilities, and policy ceilings on production. At any point in time, one of these three factors weighs heavier in determining production levels, but it is misleading to suggest that the OPEC nations respond only to oil demand or say, only to domestic, economic and political pressures in deciding production levels. Western analysts, basically used to studying private firms, often make the mistake of equating sovereign OPEC nations to private firms and try to "model" their responses to market changes. This approach is not very helpful. Let us briefly examine each of these three factors.

First, oil demand and market responses have different significances for oil exporters depending on the status of the market. If the market is tight or in balance, OPEC will watch the spot market developments to adjust their prices upwards. If the market is in a state of glut with spot prices

significantly below the official prices, they will strongly resist downward adjustments, trying to maintain nominal prices while they let inflation erode the real price. As the current oil market softness is expected to last for a number of years, OPEC nations' most obvious option would be to curtail production. Those who can afford it, such as the Arab Gulf states (minus Iraq) will have to bear the brunt of cutbacks. So, the issue of response to a soft market is likely to come mostly through curtailment of production rather than price reductions. The major problem in this situation is the distribution of losses in production. Contrary to the conventional wisdom in the West that OPEC production and price policies aim to slow down the longer-term switch out of oil, we contend that this consideration plays only a minor role in OPEC's decision-making process. The decision-making process is simply not geared to the luxury of long-term concerns, because short-term and medium-term considerations predominate their thinking. For instance, responses to market are influenced greatly by the short-term impact on world economy, but not so much by whether solar energy or coal liquefaction will displace petroleum. In short, response to oil demand is problematic for those in immediate need of foreign exchange, though the remedy is seen as curtailing production with the bulk of curtailment falling on the richer nations.

Second, there are clearly physical limits to output which place a ceiling on oil production. Outside of the Gulf states, all OPEC members have relatively small reserves and none could sustain production at 2 mmb/d for more than a few years. If the market softness continues for a prolonged period of time, the physical ceilings will not be a determining factor until the 1990s, however, if demand picks up, the physical pressures to curtail production might emerge by late 1980s.

Third, policy ceilings--that is, curtailment of production for political and economic reasons--are mainly applicable to the Gulf states which have the largest reserves and potential production capability (perhaps with the exception of Qatar). Saudi Arabia and Kuwait have, for some time, placed official and unofficial ceilings on their production. The United Arab Emirates maintains "allowables" (ceilings), and post-revolutionary Iran is restricted to a maximum ceiling of 4 mmb/d, and has in the past preferred an output level of around 3 mmb/d. Iraq has a physical ceiling of 3-4 mmb/d and might be prepared to go up to that level if there is sufficient demand.[10]

Physical Limitations

In looking at potential OPEC supplies, a good starting point on the potential OPEC supplies is the physical limitation the exporters face. There are many studies which have addressed this question. Here we would only briefly refer to two studies by Rand Corporation[11] and the U.S. Department of Energy.[12] Nehring's well-known study estimates ultimate conventional world oil resources by region. This study identifies the Persian Gulf as not only having the largest proven oil reserves, but also the largest potential from future discoveries and enhanced recovery. Table 3, adapted from Nehring, estimates that around 50 percent of potential addition to world oil reserves is likely to come from the OPEC Gulf states. According to Nehring, enhanced recovery alone could add 250-400 billion barrels to proven Middle East reserves--equal to around one-third of all potential additions to world reserves. However, the same study sees a much smaller addition through enhanced recovery for other OPEC nations. For instance, increased recovery for North African nations is seen at 15-30 billion barrels.

TABLE 3
Estimated Ultimate Conventional World Oil Resources By Region
(Billion Barrels)

Region	Known	Potential	Total[b]
North America	179.8	100- 200	280- 380
South America	68.4	52- 92	120- 160
Western Europe	24.6	25- 45	50- 70
Eastern Europe/ Soviet Union	102.4	63- 123	165- 225
Africa	75.6	45- 94	120- 170
Middle East	509.9[a]	350- 630	860-1,140
Asia/Oceania	50.8	54- 104	105- 155
Total	1,011.5	688-1288	1,700-2,300
		420-730 Enhanced Recovery[b]	263-555 Future Discoveries[b]

[a]Of this figure 503.3 billion barrels are located in OPEC Gulf.
[b]Totals do not add up due to rounding.

Source: Richard Nehring Giant Oil Fields and World Oil Reserves op. cit p. 88. Date as of 1/1/76.

Another major study by the U.S. Department of Energy is less optimistic about prospects for enhanced recovery in most OPEC countries. This study is less comprehensive than the Rand study in that it does not consider either new discoveries or tertiary recovery. However, this study is much more detailed and focussed--providing for the first time information which has been regarded as confidential for decades. For instance, DOE figures indicate secondary recovery of only 87 billion for the Persian Gulf. Since tertiary recovery is not expected to increase the recovery factor to much above 50-60 percent of oil-in-place, the Nehring estimates would be around twice as much as DOE estimates, even if we add 50 percent to DOE estimates for tertiary recovery. Such a wide difference is, however, not that unusual

when it comes to predicting future additions to oil reserves. If we had to choose among the two estimates, we would tend to lean toward the DOE study for the following reasons. First, the DOE study is undertaken and managed by people who are known to be competent to the author, and who have had access to Petro-consultants data files, which were evidently not available to Nehring. Second, the latest information was obtained by DOE through the United States Geological Survey and the oil companies. Third, in the case of Iran, their data is very close to confidential Iranian data which were not generally made public. This in itself is one test that they may not be too far off the mark. Table 4 summarizes the broad conclusion of the study on the Persian Gulf. An important characteristic of these data is the relatively high rates of primary recovery and low rates of secondary recovery. Iran, for instance, has the second highest volume of oil-in-place. However, recovery factors are very low, giving a lower remaining recoverable oil supply to Iran than Kuwait. (Indeed in another study on Libya and Algeria, DOE data indicates very low rates of secondary recovery of no more than 2.5 percent for each country). Outside of Iran and the neutral zone, the total of primary and secondary recovery factors are not that far off from the U.S. average of 35-40 percent. The Gulf nations have a remaining reserve of around 439 billion barrels, which is around 90 billion barrels, or 25 percent, more than their current proven reserves. From the point of view of oil importers, it is important to note that for policy planning purposes the additions to OPEC oil through secondary recovery, though substantial, are less than previously assumed and that these indications should clearly be taken into account for assessing longer-term petroleum supplies. Tertiary recovery might indeed add 150 to 200 billion barrels to recoverable oil in the Gulf, but it is as yet too

Table 4

Reserves and Resources of Crude Oil from Known Fields of the Persian Gulf Area as of January 1, 1979

Pertinent Data	Country							Country			
	Saudi Arabia	Kuwait	Iran	Iraq	United Arab Emirates	Divided Neutral Zone	Qatar	Total OPEC Gulf	Oman	Bahrain	Total Gulf
Original Oil in Place, MM bbl	550,583	258,446	437,063	127,240	151,640	75,954	26,472	1,600,925	26,256	2,718	1,656,372
Proved Ultimate Recovery, MM bbl	179,658	95,874	72,100	47,193	37,972	12,914	8,390	454,101	4,550	1,005	459,656
Cumulative production MM bbl	33,718	18,986	28,227	13,630	5,884	2,968	2,836	105,249	1,273	651	108,173
Proved Oil Reserves, MM, bbl	145,940	76,888	43,873	33,563	32,088	9,946	5,554	347,852	3,277	354	351,483
Indicated Additional Recovery, MM bbl	31,321	14,135	20,400	3,391	12,745	3,262	2,100	87,354	0	0	87,354
Total Ultimate Recovery, MM bbl	210,979	110,009	92,500	50,584	50,717	16,176	10,490	541,455	4,550	1,005	547,010
Remaining Recoverable Oil, MM bbl	177,261	91,023	64,273	36,954	44,833	13,208	7,654	435,206	3,227	354	438,837
Primary Recovery Factor %	32.6	37.1	16.5	37.1	25.0	17.0	31.7	28.4	17.3	37.0	27.7
Secondary Recovery Factor %	5.7	5.5	4.7	2.7	8.4	4.3	7.9	5.5	0	0	5.3
Ultimate Recovery Factor %	38.3	42.6	21.2	39.8	33.4	21.3	39.6	33.9	17.3	37.0	33.0

Source: U.S. Department of Energy Middle East: Crude Oil Potential From Known Deposits op. cit p. 9.

early to say much about it. It is possible that like secondary recovery, tertiary recovery will not increase the recovery factor by the expected 10-20 percent and, in fact, we will not know for sure how much more oil can be recovered until we have tried it.

For policy planning purposes, the gross volumes are less important than expected production profiles. That is to say, how long can a country produce oil at a specific level and what is the most likely level an individual country will choose? This approach uses logistic functions and decline curves to show the range of possibilities.

In the following we will briefly discuss the reserve and production profile of each country of the OPEC Gulf. In each case it is assumed that indicated additional reserves can be brought on stream in time for the scenarios under consideration. It is also assumed that sufficient investments worth tens of billions of dollars can be made in that time span. Figures 1 to 6 consider alternative production schedules for six OPEC Gulf nations. For Saudi Arabia a production rate of 12 mmb/d would mean a decline by 1998, while production of 8 mmb/d could be maintained until 2019. In Kuwait, a 6 mmb/d could only continue until 2015, when decline would begin, while a 2 mmb/d output could last until 2095. For Iran, a production level of 4 mmb/d could be maintained until 2016, but at a 3 mmb/d level, the decline would set in around 2030. In Iraq, a 4 mmb/d output could not be sustained until the end of this century and output will begin to decline by 1997, however, if a 3 mmb/d production is targeted, it could be maintained until 2004. In the United Arab Emirates, the higher output level of 3.5 mmb/d could not be maintained beyond 2003, but a 2 mmb/d level could last until 2027.

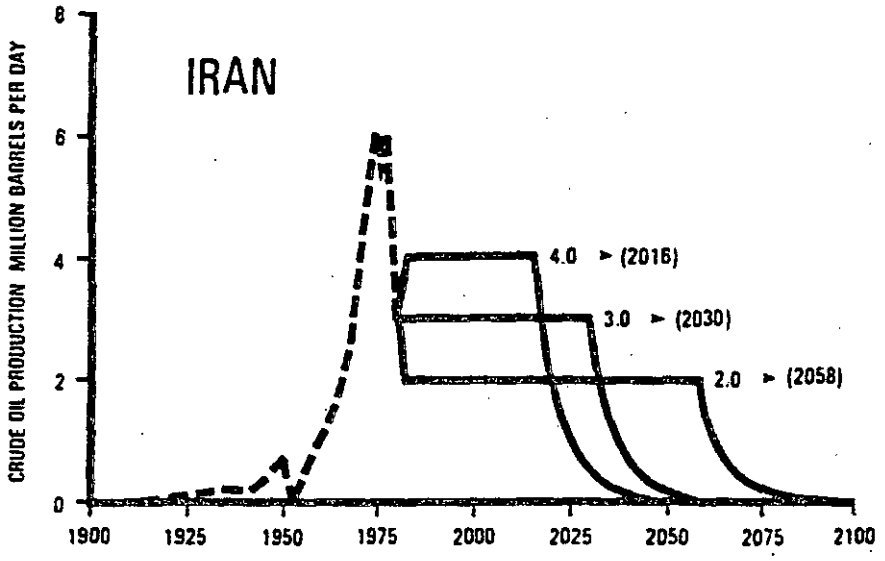


Figure 1. Historical and Projected Production Profiles Based Upon the Ultimate Recovery from Known Oil Deposits in Iran

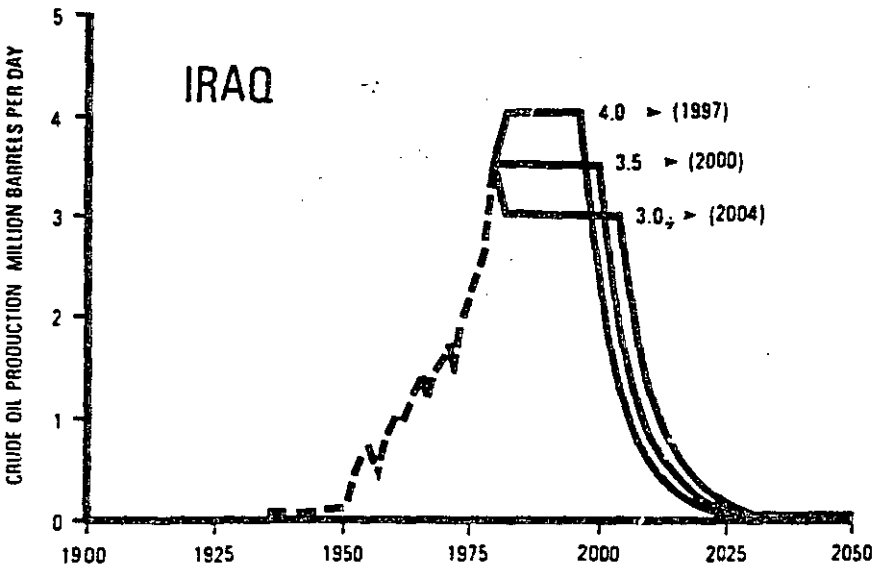


Figure 2. Historical and Projected Production Profiles Based Upon the Ultimate Recovery from Known Oil Deposits in Iraq

Source : Modified from Middle East - Crude Oil Potential from Known Deposits (Washington D.C. : U.S. Department of Energy, 1981).

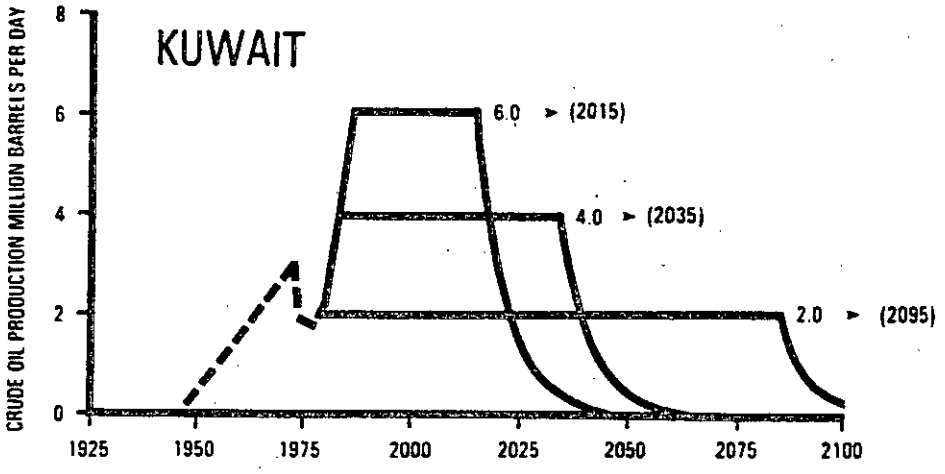


Figure 3. Historical and Projected Production Profiles Based Upon the Ultimate Recovery from Known Oil Deposits in Kuwait

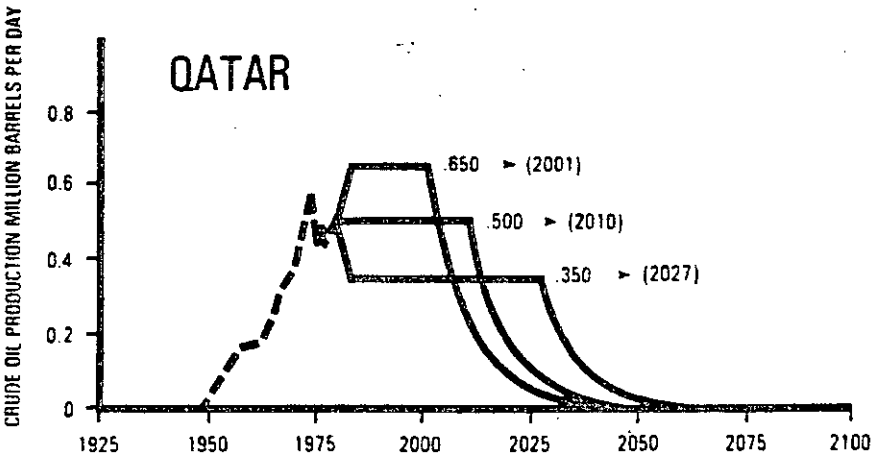


Figure 4. Historical and Projected Production Profiles Based Upon the Ultimate Recovery from Known Oil Deposits in Qatar

Source : Modified from Middle East - Crude Oil Potential from Known Deposits (Washington D.C. : U.S. Department of Energy, 1981).

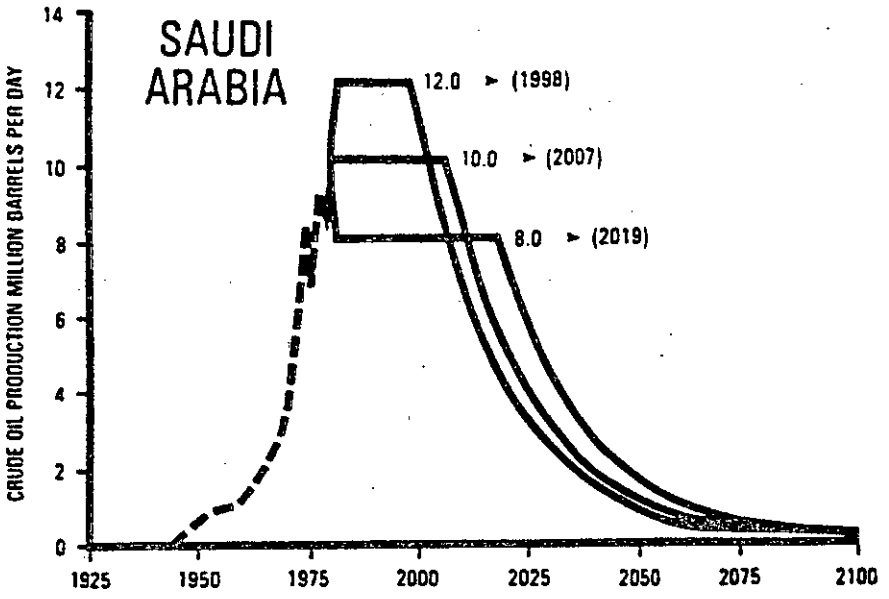


Figure 5. Historical and Projected Production Profiles Based Upon the Ultimate Recovery from Known Oil Deposits in Saudi Arabia

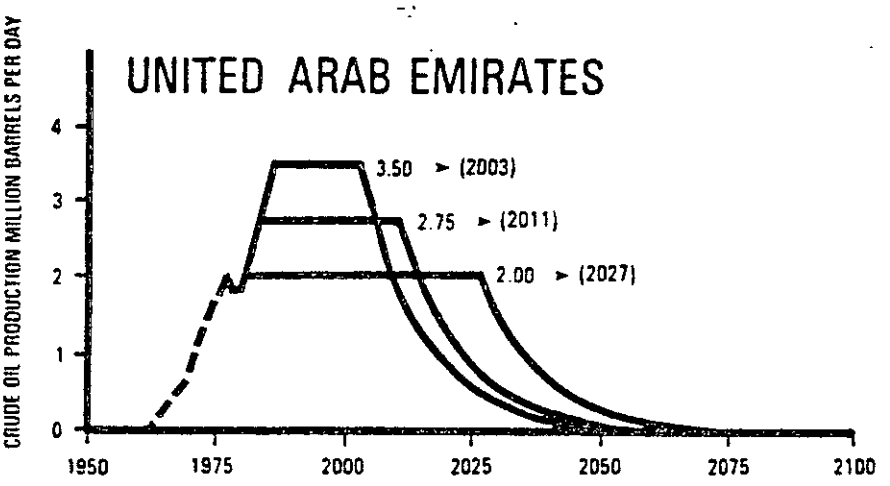


Figure 6. Historical and Projected Production Profiles Based Upon the Ultimate Recovery from Known Oil Deposits in United Arab Emirates

Source : Modified from Middle East - Crude Oil Potential from Known Deposits (Washington D.C. : U.S. Department of Energy, 1981).

The above discussion is, of course, based on known deposits and potential additions from secondary recovery. Possible additions to reserves from tertiary recovery and new discoveries are not included in these analyses. Clearly, higher reserves could affect the shape of the curves significantly. However, many experts both within and outside OPEC do not expect major new discoveries of the size experienced so far in this century. As to the impact of tertiary recovery on proven reserves, there is little agreement among experts, simply because we do not know much about it. Before we close this brief section on reserves, a few words must be said about Iraqi reserves. Since the mid-1970s, there has been a great deal of speculation that the size of Iraqi reserves may be much larger than what is reported in the trade press--possibly near the Saudi levels. This speculation has been fuelled by vague statements from the Iraqi leadership that Baghdad is "floating on oil." We remain unconvinced that massive deposits have been in existence but essentially hidden from the outside world. There is little doubt that more oil will be discovered in the Arabian-Iranian geological province, but there is no reason to believe that new Iraqi discoveries are going to be substantially larger than the others.

Economic and Political Factors

In the previous section we discussed the general boundaries of oil production possibilities in the key OPEC nations of the Persian Gulf. Here we will briefly supplement our discussion of the physical limits with some of the general economic and political factors which are superimposed on the physical constraints of these nations.

Iran

Iran's peak production of 6.5 mmb/d in the mid 1970s would have declined to 3-4 mmb/d after 1985, even if the Shah had survived the Iranian revolution.[13] The decline in production could have been slowed down if the massive gas injection secondary recovery program that the Shah had started was not suspended by the revolution. As things stand at the time of writing this paper, Iran's production cannot go much above 3-3.5 mmb/d in 1985 (in line with the Iranian government's declared oil production ceiling preference), and by 1990 this production could be maintained if parts of the gas injection program are resumed. As shown in the earlier section, Iran's known deposits are capable of maintaining an output level of 3-4 mmb/d well into the 21st century. Given the structure and the size of the Iranian economy, Iranian planners estimate a need for foreign exchange of around $15 billion a year (in 1981 prices) for 1982-85, and possibly $20 billion in 1985-90, at a minimum. This necessitates export levels of between 1.3 to 1.7 mmb/d in 1985 and 1990 respectively--a range well within the capabilities of Iran. As domestic demand is expected to be around 600,000 b/d in 1985, and about 800,000 b/d in 1990, and as Iran would need to build up her now-depleted foreign exchange reserves, we estimate a production level of around 3.5 mmb/d during the 1980s. For the year 2000, rising domestic oil consumption and population growth may lead to a production level of 4 mmb/d. We feel Iran's oil production policy in the mid-range is to a great extent independent of who rules the country.

Iraq

Iraq's resource base and secondary recovery prospects do not allow the country to sustain a production capacity of much beyond 3.5 mmb/d in the

1980s. Although no clear information exists as to the minimum foreign exchange requirements of Iraq, past budget and expenditure data suggest that this level of output generates sufficient cash for Iraq's needs. These levels would not allow grandiose economic programs simultaneous with massive military buildup. For the year 2000, Iraq's production is expected to decline to 2.5 mmb/d as recoverable reserves fall. Like Iran, Iraq's production profile is partly independent of the regime which rules the country.

Kuwait

Kuwait's large recoverable reserves permit this small nation the greatest flexibility in the Gulf. Kuwait can produce up to 6 mmb/d of oil and continue at that level until 2015; however, it is highly unlikely that Kuwait's output will ever exceed 1.5-2.0 mmb/d. Kuwait's production capacity still remains at around 3 mmb/d, but production has consistently been below that level since the mid-1970s. Kuwait's acute awareness that oil remains its only major export product, and that its limited population (indigenous population is only 40 percent of the total population of around 1.2 million) and land base will not permit economic diversification inside the country, has pushed Kuwait to be the most conservation-minded OPEC nation. In the past, Kuwait has imposed production ceilings of 2.0 and 1.5 mmb/d. The last formal ceiling announced was 1.25 mmb/d. In 1982, Kuwait's output fell below 1 mmb/d, not because of new ceilings, but because of demand declines resulting from recession, conservation, and oil company stock drawdowns. It is expected that Kuwait may be producing below its preferred ceiling for a year or two, which might result in some drawdown of foreign reserves. To compensate for such drawdowns, Kuwait may prefer to

produce 1.5 mmb/d by the mid-1980s and maintain that level through the year 2000. The higher level of output compared to the present ceiling was arrived at by considering the unusual growth in domestic consumption of oil products in Kuwait. In 1981, Kuwait had the second highest energy consumption per capita in the world; at 60 barrels oil equivalent per person, Kuwaiti consumption was second only to the United States. Although consumption growth is likely to slow down, we feel that a ceiling increase to 1.5 mmb/d is likely. The Kuwaiti refining capacity would require around 700,000 b/d of crude for processing. This level can, in fact, be regarded as a floor to the likely Kuwaiti production. The preferred level of 1.5 mmb/d could well be maintained through early in the 22nd century before decline sets in--and this is based on known deposits only.

Kuwait's tremendous flexibility also stems from her foreign exchange accumulations. By the end of 1981, Kuwait had amassed around $65-70 billion, and return on income was more than $6 billion in 1981.[14] Indeed, Kuwait could cease production and survive for many years. If production is continued at the expected levels, sometime early in the 21st century Kuwait's income from investments may well be equal to her oil revenues.

Unlike Iran and Iraq which suffer from domestic instability, Kuwait is relatively stable. Although there are some dissenting voices which led to a period of suspension of the parliament, the massive influx of oil revenues has ensured the nation's stability--despite the existence of around 750,000 guest workers.

Insofar as international politics are concerned, Kuwait remains in the pro-western camp, but with a decidedly independent line. She has proved herself to be the most future-conscious Gulf nation, with a generally clear idea of where she is going. Kuwait's acute awareness of her vulnerability

to foreign attacks or invasions has made Kuwait the only nation in the Gulf Cooperation Council to seek cordial relations with the Soviet Union, although she is unlikely ever to leave the pro-western camp. Like Iran and Iraq, Kuwaiti oil policy may again remain independent of the leadership of the country. No matter who rules Kuwait, the projected production levels are likely to prevail.

Qatar

Qatar's small recoverable reserves mean the small nation's output is likely to decline slightly during the remainder of this century from their current figure of about 500,000 b/d. Qatar does not pursue a particular oil policy, and depends on the general Saudi or Kuwaiti line of policy in OPEC. Like Kuwait, Qatar is relatively stable internally, but has the same vulnerabilities to foreign interference. Output in Qatar is not dependent on the leadership of that country.

United Arab Emirates

UAE is a federation of seven small emirates. The largest portion of reserves and production comes from Abu Dhabi (1980 production: 1.35 mmb/d), a smaller portion from Dubai (1980 production: 0.35 mmb/d) and a very small fraction from Sharjah (1980 production: 0.01 mmb/d).

UAE's recoverable reserves from known deposits permit a production of 2 mmb/d before decline sets in in 2027. UAE's preferred level of output is around 1.8 mmb/d, although no official government policy has been declared. We expect the level of 1.8 mmb/d to continue through 1990. By the year 2000, UAE's preferred level of output might rise slightly to 2 or 2.5 mmb/d, to accommodate rising domestic demand, and the subsidies to non-oil producing members of the federation.

Abu Dhabi is the principal financier of this loose federation--put together at the urging of the British after their 1971 withdrawal from the Gulf. The income gap between the haves and the have-nots has been a source of tension in the federation. If the federation is to survive, Abu Dhabi would have to continue to bankroll the poorer states. Internal opposition in UAE is minimal within individual nations, although some degree of hostility is apparent between the emirates. If the federation does not survive, Abu Dhabi's oil production may fall by 0.5 mmb/d due to smaller budgetary needs. Thus, the range of 0.5 mmb/d is, in our view, the maximum volume of change which may take place in UAE's output.

UAE's oil policy and foreign policy is very much a carbon copy of Saudi Arabia. On a number of occasions UAE has been the only supporter of Saudi policies in OPEC.

Saudi Arabia

The large resource base and recoverable reserves of Saudi Arabia put the Kingdom in the position of dominating the world oil scene well into the next century. Saudi Arabia's self-imposed production ceiling of 8.5 mmb/d during the 1970s (with some deviation above the ceiling after the Iranian revolution and the Iraq-Iran War), was reduced to 7.0 mmb/d in April 1982 in the face of declining demand for oil. By October of 1982 Saudi output had fallen to below 6 mmb/d.

Saudi Arabia's policy of moderation on the OPEC front has been the subject of much debate in the past decade. Saudi moderation, defined as high output and lower prices (lower than other OPEC nations would have liked) has been typically (and inaccurately) attributed by many analysts to: a) the Saudi's "enlightened" self-interest--i.e. not wanting to price their

large oil reserves out of the market and cause massive shifts into non-oil energy sources; b) Saudi interest in economic stability in the OECD nations, since recession and economic problems weaken the industrial world, which is the natural political ally of the Kingdom; and c) Saudi interest in the economic well-being of the western world, in which all of their estimated foreign assets of $160-$170 billion are invested, since any economic damage would automatically depreciate the value of their own foreign investments; d) the Saudi "special relationship" with the United States--that Saudi moderation on the oil front is rewarded by a pledge to protect the kingdom against foreign military actions, and by a U.S. promise to help resolve the Palestinian issue with Israel; and e) the Saudi's budgetary needs, which some analysts claim require high levels of production that might not find markets at higher prices.

The arguments outlined above are a mixture of fact, half-facts, and fantasy, forwarded by different interest groups in the West, or coming from western analysts who are simply unaware of the decision-making process in the Middle East. Our own subjective interpretations of the Saudi policies are that, first, the Saudis are not interested in destroying the economies of the industrial world or their own assets, but neither are the other OPEC nations. The Saudi's interest in seeing the world economy in a reasonable state is only a minor factor in the oil policy. Second, the Saudi's budgetary needs are often misunderstood and misinterpreted by various groups. The confusion between domestic currency and foreign exchange, resulting from conversion of Saudi Riyals to U.S. dollars, has created major overestimates of Saudi needs. Indeed, the Saudis have made it clear since 1981 that they could continue their present pace of development with production of 6 mmb/d. The Saudis also enjoy great flexibility with their

massive foreign exchange holdings, which we estimate resulted in a return on investment of $18-20 billion in 1981. They can also slow down their development projects with negligible impact on the economy (many of the capital investments are located in industrial enclaves with no real linkage to the domestic economy); and, of course, they can draw on their foreign reserves. Though short-term budgetary pressures may appear every now and then, we feel it pointless to try to base Saudi oil production projections in revenue needs alone. Annual budget and 5-year development plans are really only guidelines, and it is rare that actual numbers ever match. Indeed, we believe that short-term difficulties, such as the $5 billion budget deficit, and the $12 billion balance-of-payments deficit in Saudi Arabia during 1982, will result in rationalization of expenditures and will not have the longer term impact of pushing production to higher levels. Finally, we feel that the U.S.-Saudi connection provides the most relevant explanation of the Saudi policies: the expected defense of the nation from foreign attack, and defusing the Arab-Israeli time bomb.

While an Iran-type revolution in Saudi Arabia is unlikely, discontent, particularly among the educated middle classes, is apparent. Even within the Royal Family there are many who believe that overt cooperation with the United States is neither in the best interests of the country nor the regime. They argue that the United States has not been willing or able to deliver a solution to the Palestinian problem, and that overt friendship with Israel's main ally destabilizes the regime and makes it look like a U.S. puppet. None of these groups wish a break with the United States, but many believe in following a more independent Arab line. To show such independence they would favor production levels below the historical rates.

There are also other technical factors which favor a lower output of oil. First, Saudi Arabia's reserves of light oil are being depleted fast, while heavy and medium oil reserves are large and are lifted at a slower rate. Saudi Arabia has declared a policy of changing the current 65 percent light to 35 percent medium/heavy crude exports to a 50-50 level. In early 1982, a number of direct sales and "incentive crude" contracts were based on contracts with a 50-50 ratio. Moving to such a ratio will necessitate an output reduction to 6-6.5 mmb/d unless future additions to heavy crude production capacity actually take place. Second, Saudi Arabia's Master Gas System--a massive $21 billion gas-gathering project--cannot utilize associated gas beyond 7 mmb/d of oil output. It is quite plausible that oil output could be reduced below this level, and non-associated gas could be used--though such fields remain underdeveloped as yet.

Taking into consideration all arguments--political, economic and technical--it is the authors' view that Saudi's preferred production level will be in the range of 6-7 mmb/d in the 1985-1990 period. By the year 2000, rising domestic consumption could push Saudi production to around 8 mmb/d.

A Scenario of OPEC Oil Production

One can obviously build an indefinite number of scenarios of OPEC oil output based on one's subjective judgment of policies and physical limits. Our own preferred scenario shown in Table 5 is no exception. We have attempted to combine a reasonable school of thought on market demand for OPEC oil, together with OPEC nations' preferences, economic needs and physical limits. Our scenario denotes a gradual increase in Iranian output to 3.5 mmb/d during the 1980s and to 4 mmb/d by the turn of the century; an

TABLE 5
OPEC Oil Production Projections (mmb/d)

	1981 (Actual)	1985	1990	2000
Saudi Arabia	9.6	6.0**	6.5**	8.0**
Iran	1.3	3.5*	3.5*	4.0*
Iraq	1.0	3.0*	3.5*	2.5*
Kuwait	0.9	1.2**	1.5**	1.5**
UAE	1.5	1.8**	2.0**	2.5**
Qatar	0.4	0.5*	0.5*	0.3*
Neutral Zone	0.4	0.5*	0.4*	0.2*
Total OPEC Gulf	15.1	16.5	17.9	19.0
Ecuador	0.2	0.2*	0.2*	0.2*
Gabon	0.2	0.2*	0.1*	0.1*
Libya	1.1	1.7**	1.7*	1.5*
Algeria	0.8	0.9*	0.7*	0.5*
Nigeria	1.4	2.0*	2.0*	1.5*
Indonesia	1.6	1.6*	1.8*	1.4*
Venezuela[a]	2.1	2.0*	2.0*	1.5*
OPEC Total	23.4[b]	25.1	26.4	25.7
NGL	0.9	1.5	2.0	2.0
Totel OPEC Oil	22.5	23.6	24.4	23.7
Domestic Consumption	2.6	3.2[c]	4.2[c]	8.0[d]
OPEC Exports	19.9	20.4	19.9	15.7

*Physically constrained
**Policy constrained or market constrained

[a]Allows for heavy oil output of 200,000 b/d in 1990 and 500,000 b/d in 2000.
[b]Total includes 900,000 b/d of NGL. Actual 1981 country data excludes NGL output.
[c]Based on L. L. Totto and T. M. Johnson OPEC Oil Consumption: Future Scenarios, Resource Systems Institute, East-West Center, September 1982. Excludes bunkers and oil industry use.
[d]Estimated.

Source: OPEC Downstream Project, Resource Systems Institute, November 1982.

increase in Iraqi output to 3.5 mmb/d in 1985-90, declining to 2.5 mmb/d by the year 2000; and a long-term downward shift in Saudi production to 6-6.5 mmb/d in the 1980s and perhaps mid-1990s. We feel that the Saudis will eventually accept that their long range production levels will have to be significantly below the technical limits. The Saudis may not yet be fully persuaded that they should accept such lower limits, but we feel both the pressure from other OPEC members, and the political sentiments of the Arab-Israeli conflict, will gradually resolve themselves in lower limits.

In our scenario, OPEC oil output (excluding NGL) will hover around 23.6 to 24.4 mmb/d in the 1980s, but will decline to 23.7 mmb/d as physical limits begin to reduce output in a number of countries at the turn of the century. Rising domestic demand, though now expected to be substantially below previously estimated levels, will reduce OPEC oil exports from 19.9 mmb/d in 1981 to 15.7 mmb/d by the turn of the century.

Production Programming

In April 1982 when the first actual (operational) OPEC production programming took place, many analysts expected it not to work. It worked well for a few months and then began to falter. The production ceilings are not today respected by a number of OPEC nations, but the prices have not yet collapsed. Indeed, it is the resilience of the OPEC price structure which has surprised most analysts. Saudi Arabia has born the brunt of the decline in oil demand, as well as the effects of their OPEC colleagues' added output above the ceilings--at times, Saudi exports have fallen below 5 mmb/d. The Saudis are displeased, as are their OPEC partners in the Gulf Cooperation Council (UAE, Kuwait, Qatar), who have respected the OPEC price and production structure. The Saudis and their GCC partners do not however seem

angry enough to withdraw from OPEC and force a massive price collapse. Even in that event, they expect such a price collapse would be of a temporary nature, and that production curtailment would again push the prices back to the current levels--after punishing some of their OPEC colleagues, and non-OPEC nations such as the U.K. and Mexico.

OPEC nations' decision to unite and save the organization is obviously driven by the state of the market. At demand levels of around 16-17 mmb/d for OPEC oil, the member countries were prepared to take the drastic action of respecting production ceilings. At levles of 21-22 mmb/d or higher, each producer could export sufficient volumes and be reasonably content (assuming the Saudis would not insist on producing more than 6.5 mmb/d). So, the danger level is the zone between about 17 to 21 mmb/d, where the distribution of production between the various members is proving troublesome. The world oil market's demand for OPEC oil has remained in this danger zone from June 1982 to the present. It is the authors' opinion, that if the demand for OPEC oil declines to the lower limit again, we will observe the same signs of unity of March 1982, and if the demand surpasses 21-22 mmb/d, the situation will also become manageable. But without a moderate economic recovery, demand for OPEC oil could not pass the danger zone. However, if the current state of the world economy--the most serious recession since the 1930s--continues for a few more years, the world will face such serious economic and social disorders that the issue of the oil market imbalance will be of little significance.

Over the medium-term: 1985-1990, we expect the demand for OPEC oil to be above our defined danger zone. As shown in Table 5, our production scenario will meet and satisfy the revenue needs and preferred output levels of the majority of OPEC suppliers. However, it hinges upon the Saudi

acceptance of lower production limits (as compared to historical rates, but a little above present rates). We believe the Saudis will come round to accept this level reluctantly. In the medium term, however, production programming will remain a feature of OPEC supply, but there will be no need for stringently enforced regulation. A loose general understanding would suffice to defend the general level of Arabian marker at current prices.

Over the longer-term--by the turn of the century--we expect the demand for OPEC oil to be in the range of 28-30 mmb/d. In this period, as physical constraints and policy constraints will have a much more pronounced impact on output than market/demand considerations, oil prices are likely to increase significantly.

Beyond this century, irreversible declines in production in all OPEC countries outside of the Persian Gulf, will leave the control of world oil output in the hands of the OPEC Gulf nations (with the exception of Qatar). Indeed, the new OPEC (or de facto OPEC) will consist of big brothers: Saudi Arabia, Iraq, Iran, Kuwait, UAE, and Mexico. Small brothers will perhaps include Nigeria, Venezuela, Libya, and the emerging oil exporters of Ivory Coast and Cameroons.

The Price of Oil

The price of oil is not likely to fall in real terms long beyond 1983. If demand does not recover, we expect production cutbacks to maintain the real price. We expect real prices to continue to decline in 1982 in real terms. For 1983, we expect real price to fall by one-half of the inflation factor, hold steady for 1984, and then begin to rise by 3 percent per annum until 1990. Our scenario, shown in Table 6, indicates real 1985 prices to be about equal to 1980 prices, but by 1990, real prices may have risen 15 percent over 1980. We would not venture a price projection beyond 1990.

TABLE 6
Average Composite Official OPEC Rates
(Dollars Per Barrel)

	1980	1981	1982	1983[b]	1984[b]	1985	1990
Constant 1980 prices[a]	30.9	31.2	30.7	29.6	29.6	30.5	35.4
Nominal prices[a]	30.9	34.5	33.0	34.2	36.5	40.2	64.7

[a]Assumes 9.5 percent inflation for 1981 and 7 percent thereafter.
[b]Assumes a decline in real prices equal to half the inflation factor for 1983 and stable prices for 1984.
[c]Assumes 3 percent real growth in price during 1985-90.

Clearly, the price of oil will not rise in an orderly fashion. Cyclical price movements are now an integral part of the oil market. Our scenario is clearly a no-interruption scenario. Interruptions cannot be predicted; however, we feel it inevitable that some kind of crisis will again shake the Middle East and play havoc with prices. Many analysts see the soft oil market, the recession, and high interest rates as factors which will lead to slow down or postponement of decisions to convert capital stock to non-oil and/or energy-efficient equipment. This, they argue, will lead to higher demand by 1985. As interruptions often come at a time of higher demand, such combinations could lead to another round of cyclical upward movements of oil prices.

Emerging OPEC Export Strategies

We have so far covered two important facets of OPEC oil supply into the latter half of the 1980s: first, reduced oil export availability from the OPEC countries as a group is likely to result in a permanently tight world oil market; and, second, increasing concentration of oil production and export availability in the unstable Persian Gulf region, and particularly in Saudi Arabia, Iran, and Iraq, will contribute to oil price and supply volatility.

But the structure of the OPEC export market will also change in the coming years in important ways, compounding the uncertainty and volatility. While it is not possible to define a uniform future oil export strategy for OPEC as a group, the emerging trends since 1979 do provide some useful clues about the direction of individual countries' oil export policies.

The first important trend has been the steady reduction in the international oil companies' or "majors'" preferential access to OPEC oil. This decline in availability has been caused by rising state-to-state sales and direct commercial sales by OPEC countries themselves.

In 1973, 93 percent of OPEC production of 27.9 mmb/d was made available to the majors on a long-term or preferential basis (i.e., equity or buy-back oil). This amounted to some 90 percent of world oil trade. By 1980, this ratio had dropped to around 50 percent of OPEC exports and 42 percent of world oil trade. At the same time, direct state-to-state sales by OPEC rose from 1.5 mmb/d in 1973 to 5 mmb/d in 1979 and possibly 7.8 mmb/d in 1980. Also, increasing volumes of oil were sold directly by OPEC national oil companies to the majors under short-term or spot sales. In total, OPEC countries' ownership/entitlements to their own oil rose from 2 percent in 1970 to 30 percent in 1980. The OPEC countries directly sold about 50 percent of this entitlement oil in 1980 compared to a negligible volume in 1970 (see Table 7).

One important casualty of this structural change is the so-called "third party" market, involving oil sales by the majors to other smaller oil companies or state-owned companies of the developing or industrial countries. Third party sales are extremely important for oil-deficit companies and for countries that do not possess tanker transport or distribution facilities. Between 1973 and 1979, such third party sales were

TABLE 7
Structural Changes in the World Oil Market

	1970	1973	1978	1979	1980	1981
OPEC Sales of Crude (mmb/d)						
Majors						
Affiliates	--	21.1	14.5	14.1	--	--
Third Party	--	6.8	4.8	3.4	0.9	--
Total	--	27.9	19.3	17.5	--	--
Direct Sales						
State-to-state	--	1.5	4.6	5.0	7.6	6.0
Commercial	--	0.9	5.1	7.8	--	--
Total	--	2.4	9.7	12.8	--	--
TOTAL	--	30.3	29.0	30.3	--	--
Other Indicators (%)						
OPEC Ownership/entitlements to own crude	2	20	75	80	80	80
Direct OPEC exports	1	7	33	42	50+	45
State-to-state deals	1	7	19	24	37	35
Majors' share in OPEC oil	99	93	67	58	50	--
Majors' share in world oil trade	92	90	50	42	--	--

Sources: "Petroleum Intelligence Weekly," February 25, 1980; Mohnfield, J. H., "Changing Pattern of Trade," "Petroleum Economist," August 1980; A Statistical Approach to Analyze the Evolution of Major Oil Companies' Control of the World Market, Organization of the Petroleum Exporting Countries, Vienna, August 1980; J. Roeber Associates, quoted in "Middle East Economic Survey," February 1, 1982.

slashed from 6.8 to 3.4 mmb/d. In 1980, the last year for which data are available, estimates were below 1 mmb/d. The underlying trend toward higher OPEC involvement in direct sales and state-to-state sales has been temporarily halted and slightly reversed since 1981 as a consequence of

market "glut." A number of oil-importing governments that had contracted to buy oil directly from the OPEC countries either cancelled or reduced their lifting since they were able to buy crude at lower spot prices. OPEC preferential sales to the majors probably increased slightly in 1981 but state-to-state sales fell by about 1.6 mmb/d that year. In effect, OPEC's state-to-state sales declined from its peak of a high 37 percent of total exports in 1980 to 35 percent in 1981. An important reason for such a decline in state-to-state sales was clearly the Iran-Iraq War. Both countries were heavily involved in such sales and their lower production and export since 1980 has led to a reduction in the aggregate OPEC direct sales volume.

It is, of course, only natural to observe a slight turnaround in times of glut, as oil-importing countries begin to trade off lower spot oil prices against the security of supply of oil. Alternatively, it is also natural to expect a sharper increase in direct and state-to-state sales in a tight market. However, such short-term market reversals should not be confused with the emerging long-term trend. As the oil market begins to move back into balance, state-to-state and other direct sales by the OPEC countries will pick up, both in absolute terms and as a percentage of the total.

We believe there are a number of reasons compelling the oil-importing countries to continue direct dealings with the OPEC national oil companies. First, as the majors' access to oil becomes more and more limited, the oil-importing countries (previously third-party purchasers) will seek to ensure continued access to OPEC oil supplies. Second, the oil-importing countries are increasingly involved in bilateral trade agreements, export promotion, and credit guarantees, and may find it advantageous to structure oil purchases within the framework of their own export of goods to the OPEC

countries. Finally, the ever-present dangers of an upheaval in the Persian Gulf may serve to persuade many oil-importing countries that a long-term direct relationship with the OPEC national oil companies will provide some security against another supply crisis.

In 1980, the majors were obliged to go into the spot market to buy 1.2 mmb/d of oil to meet their integrated networks' product commitments. This indicates the future difficulties that these companies are likely to face in terms of preferential access to crude. Since 80 percent of total OPEC oil production is now handled by the member countries themselves, these countries could easily expand their direct sales to that level. Indeed, by 1990, OPEC may well be handling over three-quarters of its exports directly. State-to-state deals are encouraged by the OPEC countries, particularly when the second party is from the developing world. Third party sales are likely to be eliminated altogether and the majors will themselves become crude-short. Third party purchasers can no longer depend on the majors and will have to make their own arrangements with OPEC national oil companies. Other expected market changes include:

1. Long-term contracts are not likely to be awarded. Six-month to 12 month contracts are expected to become the norm, particularly as the market begins to tighten once more.

2. Oil liftings will be more and more destination-controlled. The flexibility of the international oil companies to switch around supplies in times of an embargo will no longer be available. Embargoes will hurt embargoed nations ever more severely.

3. Oil sales will be made as part of broader "package" deals. These packages may include:

   a) Oil liftings linked to investment in exploration in the OPEC countries or joint investment in petrochemical, refining, or other industries.

   b) Oil liftings linked to lifting of refined products and petrochemicals, even though there may be surplus capacity available elsewhere in the oil-importing countries.

c) Oil liftings linked to partial transport in OPEC-owned tankers.

d) Oil liftings linked to natural gas pricing and sales policies.

e) Oil liftings linked to arms sales, technology transfer, and other commrcial and diplomatic dealings.

f) Oil liftings linked to major concessions from the industrial world to the developing world in a "North-South" type dialogue.

g) Oil liftings linked to indexation of OPEC investments in the industrial world.

Package deals are eventually likely to become the dominant characteristic of OPEC oil sales. Since 1979, we have seen Saudi Arabia's linkage of some oil sales to investment in refining and petrochemicals (500 barrels a day of oil supplies for each $1 million investment in such projects) through the so-called "incentive crude program" linkage of oil sales by Libya and Algeria to oil exploration; and Algeria's partial linkage of some oil sales to purchases--and higher prices--for its liquefied natural gas.

The political and economic implications of package deals may be far more profound than are generally recognized. First, the expansion of refining capacity based on current plans may mean that about 20 percent of OPEC oil will be exported as products in the mid-1980s, increasing in the latter part of the decade. OPEC's total refining capacity in 1981 stood at 5.7 mmb/d and is slated to increase to about 8.8 mmb/d by 1986, or some 5 mmb/d greater than OPEC's combined domestic oil consumption. Table 8 shows a country-by-country breakdown of OPEC refining capacity. At the same time, OPEC's petrochemical production and export capacity will also increase substantially.

Existing excess refining and excess petrochemical capacity worldwide will have to be retired, and this capacity is unlikely to be OPEC capacity.

TABLE 8
Current and Projected Refining Capacity in OPEC
(thousand barrels a day)

	1981	Under Construction	Additional Planned[a]	Projected 1986
Saudi Arabia	717	734	466	1,917
Iran[b]	1,235	-	-	1,235
Iraq[b]	249	140	-	389
Kuwait	554	58	154	766
UAE	126	56	172	354
Qatar	14	47	-	61
Persian Gulf	2,895	1,035	792	4,722
Nigeria	260	-	-	260
Libya	142	220	-	362
Algeria	442	-	344	786
Gabon	20	-	-	2-
Africa	864	220	344	1,428
Venezuela	1,349	-	150	1499
Ecuador	87	-	108	195
Latin America	1,436	-	258	1,694
Indonesia	486	186	265	937
TOTAL OPEC	5,681	1,441	1,659	8,781

[a]There are plans for refining additions beyond those in this table; some are spurious, some speculative, and others are fairly clearly planned but for the post-1986 period.
[b]The situation in Iran and Iraq is confused. The extent of the war damage is not clear. Moreover, both countries had completed new capacity on the eve of the war, and both had plans to scrap some outmoded capacity. These capacity estimates should therefore be treated with circumspection.

Source: East-West Center, OPEC Downstream Project Data System.

Second, the expansion of OPEC's tanker fleet--though not too significant on a world scale--could lead to requirements that part of OPEC oil be transported under their own flags. (See Table 9). Third, the decline in the majors' access to crude would mean that their flexibility to constantly switch around supplies within large integrated networks, as in the 1973 embargo, will diminish. Destination controls and embargoes will be far easier to impose and monitor by the OPEC countries in direct sales, and this growing rigidity will affect the buyers significantly in the event of embargoes or other restrictions imposed by the sellers.

At the same time, package deals and increasing state-to-state deals expose the OPEC countries themselves to political risks, which they for their part do not yet seem to appreciate fully either. The international oil companies had by the mid-1970s shown themselves to be a useful buffer between the buyers and sellers of oil. As such they probably served both sides equally well. Reducing the companies' flexibility in terms of lifting and distribution, and switching their allocations to state-to-state sales, are likely to create new problems arising from the increased rigidity of the system. Once individual OPEC exporters begin to deal even more directly with the governments of oil-importing countries, any change of production levels, diversion of supply from one buyer to another, or a change in the price structure, will create substantial friction between the two sides. When such deals are linked to imports of food, technology, industrial goods, and arms purchases, the direct reprisals, both economic and political, could be extremely dangerous for OPEC. The oil-importing countries could retaliate by freezing OPEC nations' assets, embargoing exports to OPEC countries, restricting their access to capital markets, and even--in extreme situations--threatening to use military force. Maintenance of the oil

TABLE 9
OPEC Tanker Fleet in 1981[a]
(deadweight tons)

Saudi Arabia	2,665,174
Iran	1,161,748
Iraq	2,159,532
Kuwait	2,328,133
UAE	135,510
Qatar	135,502
Persian Gulf	8,585,599
Nigeria	272,535
Libya	1,479,977
Algeria	1,078,740
Gabon	138,680
Africa	2,969,932
Venezuela	406,377
Ecuador	77,767
Latin America	484,144
Indonesia	141,576
TOTAL OPEC	12,181,251

[a]Includes only tankers of 6,000 DWT and over.

Source: OPEC Secretariat.

company buffer and an active international market in oil thus may well be in the longer-term interests of the OPEC countries themselves.

The emerging OPEC export strategy may also hurt the developing world. Many developing countries have little or no domestic oil production or refining capacity and have traditionally relied on the international oil companies for supplies. Once the oil companies are unable to make such supplies available, the developing countries will have to obtain their own supplies. Though they are likely to be given preference in access to OPEC

oil, they face major logistical problems in utilizing such preferences. With a few notable exceptions, the developing countries consume small volumes of oil. How will they lift it? How will they transport it? How will they refine it? And if they do refine the oil themselves, how will they handle a mismatch between demand and refinery output, as is often the case in such countries? These are important questions; so far, little thought has gone into finding the answers.

To obtain OPEC oil after the mid-1980s, purely commercial considerations will in all likelihood no longer predominate. A host of other political and semi-economic conditions will in all likelihood also be imposed on the buyers. The OPEC countries currently perceive themselves to be exhausting an asset that took millions of years to form. An aggressive approach to oil marketing, the risks notwithstanding, appears to them to provide the best means for maximizing returns from this national patrimony. Changes in political ideology and form of government, or in alliances, are unlikely to change radically the course on which they have embarked.

WESTERN EUROPEAN ENERGY DEPENDENCE

Western European nations are major consumers of oil. Oil consumption in the region rose significantly in the 1950s and 1960s but slowed down considerably in the 1970s. Indeed, during 1980-82, demand for oil declined in most European countries.

Table 10 provides a broad picture of oil and energy use in 15 European countries. It can be seen that the oil consumption declined from 13.7 mmb/d in 1974, to 12.3 mmb/d in 1981. Austria, Greece, Netherlands, Norway, Portugal, and Spain increased their oil consumption slightly, while others, particularly United Kingdom and West Germany, showed large declines. As it

TABLE 10
Western European Oil Consumption
(thousands of barrels per day)

	Oil Consumption[a]		Oil as % of Energy Consumption		Net Imports as % of Oil Demand[c]	
	1974	1981	1974	1981	1974	1981
Austria	207	208	45	44	81	90
Belgium	512	508	56	53	109	63
Denmark	318	239	88	68	108	86
Finland	231	229	67	56	118	92
France	2,367	1,973	66	53	106	93
W. Germany	2,782	2,440	52	45	94	87
Greece	178	211	63	71	125	77
Italy	2,039	1,900	74	66	97	93
Netherlands	651	727	50	51	86	58
Norway	153	154	27	26	80	--
Portugal	131	154	73	77	95	103
Spain	823	965	67	65	94	94
Sweden	538	426	63	55	104	96
Switzerland	268	233	58	45	96	93
U.K.	2,071	1,536	49	38	109	--
Others[b]	402	425	n.a.	n.a.	n.a.	n.a.
TOTAL Western Europe	13,671	12,328	60	51	99.8	75.0

[a]Includes naptha, LPG, gasoline, kerosene, refining fuel, and bunkers.
[b]Iceland, Ireland, Luxemburg, and Turkey.
[c]Where demand is over 100 percent, it indicates inventory build-up.

Source: BP Statistical Review of World Oil Industry 1981, London 1982, and Oil and Energy Trends Statiscal Review 1982, London 1982.

was stated earlier on, we do not as yet know how much of the decline resulted from the economic recession or structural changes in energy efficiency. Many analysts, however, believe that there is not much more scope for energy efficiency in many European countries, and that higher rates of economic growth will once again increase oil demand in Europe.

The contribution of oil to energy consumption has also declined in Europe: from 60 percent in 1974 to 51 percent in 1981. Though this decline

is important to note, nevertheless, one should not lose sight of the fact that in 1981 over one-half of energy use in Western Europe was supplied by one type of energy: oil. Though it is not possible to say with certainty whether the share of oil in energy demand will fall much further in Europe, a number of observations may be made. First, within OECD nations, Europe is still the most energy efficient region, an area which has pushed conservation and alternate energy use to near maximum limit, thus leading many observers to conclude that further backing out of oil will be slow. Second, even assuming the average expected OECD rate (Table 1), it is unlikely that Europe's demand for oil declines below one-third of its energy use by the year 2000.

In considering net oil imports as a percentage of oil consumption in major European economies, Table 10 shows the dependence declining from nearly 100 percent in 1974 to 75 percent in 1981. This decline, though impressive, still leaves Europe highly dependent on oil imports. It should be noted, of course, that almost all the decline in dependence is explicable through North Sea production and sales to other European countries.

A measure of the cost of oil imports is shown in Table 11. Between 1974 and 1981, the value of net oil imports rose from $52.4 billion to $106.7 billion (without North Sea production, the cost would have risen by an additional 25 percent). As the table shows, the oil import bill has been the single largest component of the balance of trade deficit in many European countries. For instance, in 1981, Denmark, France, Italy, Netherlands, Spain, and Sweden would have had a trade surplus if they had had no oil imports. Except for the U.K., at least 39 percent of the balance of trade deficit of all European countries was caused by oil imports.

TABLE 11
Oil and Trade Balance in Western Europe
(million U.S. Dollars)

	Value of Net Oil Imports		Percentage of Trade Balance Deficit due to Oil Imports[b]	
	1974	1981	1974	1981
Austria	765	2,579	41	50
Belgium	2,337	5,044	160	81
Denmark	1,466	2,812	68	184
France	10,380	24,640	160	226
W. Germany	11,292	28,219	(36)[c]	(70)[c]
Italy	7,971	22,304	75	144
Netherlands	1,962	5,555	166	218
Portugal	467	1,967	21	39
Spain	3,016	11,253	36	156
Sweden	2,444	5,776	(96)[c]	1,719
Switzerland	1,336	3,394	52	92
U.K.	8,975	(2,895)[a]	58	(95)[d]
TOTAL Europe (12 countries)	52,411	106,714	--	--

[a]Value of exports.
[b]Where it exceeds 100, it indicates that the trade balance would have been in surplus without oil imports.
[c]Indicates a net balance of trade surplus.
[d]Oil exporters and trade surplus country; i.e. without oil exports, the U.K. trade balance would be in deficit equal to 95% for its oil exports.

Source: Oil and Energy Trends 1982.

Table 12 shows the dependence of Western European nations in oil imports from the Persian Gulf and North African OPEC members. While on the whole dependence on the Persian Gulf was reduced (mainly as a result of North Sea output and the emergence of non-OPEC oil trade), still the

TABLE 12
Western European Dependence on Oil Imports from the Persian Gulf and North Africa,* 1974 and 1980.
(Percentage of Total Net Imports)

	Persian Gulf		North Africa		Total	
	1974	1980	1974	1980	1974	1980
Austria	54	44	12	15	66	59
Belgium	86	98	8	2	94	100
Denmark	42	13	3	1	45	16
Finland	23	39	--	--	23	39
France	78	70	11	6	89	76
W. Germany	43	31	21	17	64	48
Greece	50	49	6	16	56	65
Italy	86	53	20	15	100	68
Netherlands	100	100	--	--	100	100
Norway	80	--	6	--	86	--
Portugal	58	80	--	--	58	80
Spain	88	63	12	11	100	74
Sweden	18	40	1	3	19	43
Switzerland	28	14	11	10	39	25
U.K.	72	--	8	10	80	--

*OPEC member countries only.

Source: World Oil Trade, December 1981.

dependence remains extremely high and dangerous. Except for Denmark and Switzerland, Europe depends on the Gulf for one-third to one hundred percent of its oil imports. Dependence on North African oil has been reduced more sharply than dependence on Persian Gulf oil, primarily because Algerian and Libyan crudes compete directly with Nigerian and North Sea oils; as the latter are of similar quality and less expensive, they have continued to bite into North Africa's market share. Still, in 1980, Austria, Belgium, France, West Germany, Greece, Italy, Netherlands, Spain, and Portugal were dependent on these two sources for over 50 percent of their total oil imports.

FUTURE PROSPECTS: OPTIONS AND VULNERABILITIES FOR EUROPE

The world oil market turmoil has affected the perceptions of many policy planners. Many people feel that the current glut has enhanced the energy security of European nations. They expect the glut to continue, with demand falling and OPEC as well as non-OPEC supplies rising. This may well turn out to be a false sense of security, which may harm the longer term policy options and growth prospects of the European nations.

The analysis in this paper points to a number of factors. First, Western Europe's dependence on oil imports, particularly from the Persian Gulf and North Africa, is likely to remain dangerously high throughout this century. Any embargoes or disruption of supply from the key suppliers of oil to Europe is likely to have devasting impacts on the European economies. Second, the production profiles and reserves analysis point to the fact that the Persian Gulf nations will continue to remain the major actors in the world oil market well through the early part of the 21st century, if not longer. North African nations will remain important through 1990, but by the turn of the century, their lower reserve base would imply less crude available from these nations and consequently more dependence on the Persian Gulf. Third, expectations of continuous additions to non-OPEC supplies are unrealistic. Some additions will no doubt be forthcoming but in much smaller volumes. North Sea output is expected to begin to decline in 1985 and then rise slightly later in the decade. North Sea output can at best be expected to be flat at current rates through the 1990s. Mexican output increases will be matched by massive increases in domestic consumption, which is expected to rise to 2 million barrels per day by 1990, leaving net exports of only 500,000 b/d above present export levels. Two new areas, the Ivory Coast and Cameroon, might add an additional 500,000 b/d by 1990.

Still, the oil market's major actors will remain the Persian Gulf nations. Fourth, Western European refinery capacity utilization remains at around 50 percent in 1982. Such excess capacity will come under even greater pressure when OPEC export refineries begin to flood the market. The natural market for the export refineries of the Gulf is Western Europe. Many billions of dollars of surplus capacity will have to be scrapped or shut down in Europe. At the same time, European imports of refined products from the Gulf will make European energy security even more fragile than it is today.

The options open to European economies are limited. At the same time, it should be noted that vulnerabilities of the region to oil supply disruptions are only marginally reduced by the decline in oil demand. Long-term energy policy should become divorced from short-term glut or shortage considerations and directed more toward policies which maintain the momentum of energy efficiency and supply diversification. However, the momentum of energy efficiency and diversification can not be left to private economic forces. Specific and clear-cut government policies are called for. The European nations cannot rely only on the International Energy Agency's policy recommendations, or short term-political expediency within their own borders. More use of coal and natural gas should be encouraged through government policy. Refinery scrapping and rationalization must be undertaken in spite of union pressures or nationalistic sentiments to keep some inefficient and outmoded refineries open. Diverse sources of supplies of oil and gas should be sought. Unfortunately, such policies must eminate from coordinated European action, a type of coordinated action which has had little precedence in modern Western European history.

More importantly, the European nations should realize that their future energy security is highly dependent on actions of the Persian Gulf oil

producers. Bilateral and multilateral relations both on the economic and political front should be encouraged and expanded between Western Europe and the Gulf producers. Furthermore, it goes without saying, that Western Europe's energy security is greatly dependent on political stability in the Persian Gulf at least for the next 20 years. Ever present threats of domestic upheavals and, more importantly, the possibility of foreign aggression in the Gulf are direct threats to European security. The European nations should watch and monitor closely the political and economic development in the Gulf and use their influence, whenever possible, to stop radical changes in the status quo.

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PROGRAMME FOR STRATEGIC AND INTERNATIONAL SECURITY STUDIES
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THE GRADUATE INSTITUTE OF INTERNATIONAL STUDIES
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ENERGY WORKSHOP

EUROPE'S ENERGY SITUATION

By

Hanns W. Maull

March 1983

1. Europe's Energy Equation 1973 and 1980 : From the First to the Second Oil Shock

As one runs through the comparative data of the European energy position in 1973 and 1980 (they are presented in table 1 a number of obvious conclusions quickly emerge :

a) Total energy requirements in Western Europe increased only very slowly between 1973 and 1980 (and probably not at all during the decade 1973 to 1982 , although data are not yet completely available) .

b) Indigenous energy production rose significantly - with oil playing by far the most important role in this , followed by natural gas and nuclear power .

c) Demand for oil declined markedly in spite of much higher indigenous production . As a result, demand for oil imports contracted even more sharply . The share of oil in total energy consumption was reduced .

e) Overall dependence on imported oil was reduced quite significantly , although this was to a limited extent due to a shift towards imported natural gas and coal ; in those two energy sectors import levels rose modestly . Still : the major burden of this reduction in overall import dependence was borne by stepped - up indigenous supplies and overall stagnation of energy demand .

It is instructive to compare those changes in the European energy position between 1973 and 1980 with the "conventional wisdom" of energy experts after the first oil shock in 1974/5. Practically nobody amongst the established energy economists thought that energy consumption could remain essentially flat in spite of substantial economic growth ; people (such as Amory Lovins) who did argue that expectations about future energy requirements were wildly exaggerated, were considered exotic birds - interesting but useless .

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* "Europe" or "Western Europe" is used interchangeably for the OECD members in Europe .

Most experts also assumed that higher oil prices would bring forth very vigorous development of alternative sources of energy. Nuclear power, in particular , was seen as a major contributor to changes in energy consumption patterns , but there were also great hopes for additional oil , natural gas and coal production within the OECD region , and within Western Europe .[1] Others , however , cautioned that at least for the OECD region taken together , additional supplies of oil would only be sufficient to compensate for US oil production declines in the lower 48 states , that the development of alternative sources such as coal, nuclear , and synfuels could well be slowed by their social and economic costs and risks . As it turned out , those sceptics were basically correct - the development of domestic production of energy in Western European countries has been less successful than hoped and expected in the mid-197os ; the great strides suggested by table 1 are somewhat deceptive in that they include the period of opening up a major new energy province in Western Europe , the North Sea, with its oil and gas . In the future , such a bonus could only come from a massive expansion of nuclear energy .

All established experts were wrong , however , as far as the evolution of energy demand was concerned . It was the relative stagnation of energy demand over the past decade , which made major progress towards reducing energy import dependence possible . This very slow growth of energy consumption (which pushed the somehwat dubious correlation between economic growth and energy consumption growth from 1 (i.e. 1 % economic growth required a 1 % increase in energy production) in the period 196o to 1973 to o.1 (i.e. with average economic growth of 2.3 % annually in the OECD , energy demand grew by only o.2 % p.a.) for the years from 1973 to 1981 .[2] In fact , it is now

virtually impossible to project the future relationship between economic growth and energy demand . More meaningful is a sectoral analysis of energy consumption, which can take into consideration structural changes in European economies (for instance, the change from industry to services, and from "old", energy- intensive industries such as steel to"new" industries such as electronics and communication , cyclical aspects of energy consumption (economic recessions affect energy-inetnsive industries particularly seriously and thus tend to compress energy consumption beyond what would be implied by the underlying changes in consumption patterns) , and the adjustment to higher energy prices in the shape of greater energy efficiency .

All three of those elements (structural change , cyclical aspects , and effects of higher prices) have been at work during the period under consideration - although the longer - term implications of the second oil shock were atill to come in 1980. Thus, the consumption patterns in that year can reasonably be taken as a picture of adjustment to the first oil shock plus the cyclical downturn triggered by the second oil crisis (but even there, the full effects were to become evident only in 1981 and 1982) . Much more difficult, however , to decide is the contribution made by each factor in reducing energy requirements so much below what had been envisaged .

Beyond this virtual stagnation of energy consumption , the reduction of oil import dependence was achieved through a shift in energy consumption patterns , away from oil towards natural gas , nuclear and , to a small extent , coal . Overall , this shift was not very dramatic , with a decline of oil's share from about 59 to about 52 % of total primary energy requirements between 1973 and 1980 .Nevertheless , this modest shift could not fully rely on rising indigenous production of those alternative

sources of energy but had to draw on increased imports of natural gas, coal (and uranium) .

Table 2 completes the picture of Europe's energy development since 1973 with a look at some individual countries . This set of figures shows that actual developments have differed very much from country to country , with total energy requirements in the UK declining quite strongly , while domestic production of oil and gas surged ahead , thus leaving the country practically energy - self - sufficient in 1980 . France and the FRG both show small increases in total energy consumption but reductions in oil consumption . This reductionwas more pronounced in France , where the shift towards (imported) natural gas and coal as well as to nuclear power was vigorously pushed by the government , while the FRG traditionally relies more on market mechanisms . Overall, however , the differences in performance were less than one might have expected , given the spectacular successes of the French nuclear programme and the difficulties encountered by nuclear power in Germany .All told , the FRG in 1980 still was in a more comfortable energy position - its large coal production , as well as sizeable supplies of domestic natural gas more than compensated for French advances in nuclear energy - all the more so as the poor energy - resource endowment of France was painfully felt in declining production of coal and natural gas . The case of Switzerland illustrates the limited possibilities of resource - poor countries - although this country is fortunate in having fairly ample hydropower .

2. Europe's Oil Import Dependence 1981 : Patterns of Supply and Their Implications

Western Europe has thus been able to reduce its overall energy import dependence quite significantly - from 62 % to 48% between 1973 and 1980 , with further progress since . The share of imported oil in total energy requirements declined even more:

from 58 % to 42 % . Again , this trend has since been underlined. Moreover , the share of OPEC suppliers in total European imports of oil was 81% in 1980 - but only 75.5 % in 1981 . Thus , dependence on OPEC supplies , expressed as a percentage of total energy requirements , fell below 34 % in the early 1980s . The regional distribution of sources of supply for 1981 showed the following picture : of total European oil imports of 504.7 mill.t , some 279.4 or over 55 % came from the Gulf region , a further 18.1 % (91.6 mill.t) from Africa , 34.7 mill.t or 6.9 % from the Western hemisphere , and 98.9 mill.t or close to 20 % from others , including the USSR with 30.3mill.t .[3]

In other words : levels of dependence are still quite considerable . Whatever the progress made , there can be no doubt that Western Europe remains tied to oil supplies from OPEC regions . Dependence per se , however , is not necessarily a problem - it can be economically advantageous (if it involves supplies which cannot be procured at comparable cost at home) and politically harmless , if it does not imply vulnerability, as well . Vulnerability might be defined as"dependence plus" , as a situation in which supplies from abroad might be subject to serious discontinuities which cannot be easily removed by the importing country ; in which the consequent shortfall cannot easily be absorbed or balanced out through alternative supplies and/or painless cutbacks in consumption ; in which , then , the cost entailed by the interruption is very high .

Oil import dependence in that sense clearly still is a problem . The volatility of Middle East politics has produced numerous explosions with consequences for world oil flows - in 1948, at the time of the foundation of the state of Israel ; in 1951 to 1953 , during the Mossadegh oil nationalisations in Iran ; in 1956 and 1967 as a result of Israeli - Arab wars ;

in 1973 , again in connection with an Israeli - Arab war , there was the oil weapon ; and in 1978/9 , the Iranian revolution . There can be little doubt that during the next two decades , more surprises are in store for world oil markets . They are likely to come from the Middle East - but they need to be confined to this area . A study by the US Department of Energy thought a 3 mill.b/d interruption of supplies had a probability of 50 - 95 % over a decade , depending on the assumptions made ; for a supply shortfall of 10 mill.b/d , the study sees a 30 % probability over a ten-year period as the most likely guess . Thus , supply disturbances must be considered quite likely - this fulfills condition number one of our definition of vulnerability , since it would under most scenarios not be easy for the importers to remove the cause of the disturbances.

Condition number two stipulates that crisis management might not be able to contain the costs of adjustment to the shortfall. Demand for oil is not very elastic in the short run : in other words , consumption cannot be lowered very much without serious economic and social inconveniences and losses . Alternative sources of supply - either in the form of mobilised standby production from oil exporters unaffected by the cause of the problem , or through fuel-switching in dual-capable boilers (for instance , in power stations) - would not necessarily be able to replace much of the shortfall : Spare oil production capacity will probably be largely concentrated in the Gulf and thus not necessarily available ; and the possibilities of fuel-switching are , in any case , limited . Stockpile draw - downs and rationing programmes are then the next lines of defence - and they are problematical instruments of protection . Thus, crisis management capacities (the command over technical, physical and managerial resour-

ces needed to facilitate smooth adjustment in situations of supply shortfalls) might not be sufficient . One might also argue this point historically : during the past decade , there were two major supply crises which were managed relatively badly , against one (in 1980/1,resulting from the Iran/Iraq war) where crisis management , for a variety of reasons , was quite successful . Thus, there must be doubts about our ability to cope well with the next crisis .

Condition three for establishing the state of vulnerability has to do with overall costs - and those have been massive even in the case of relatively small supply shortfalls . The shortfalls associated with the Iranian revolution and its aftermath never reached the levels needed to trigger the International Energy Agency Emergency Allocation system , and OPEC production totals during 1979 for every single mpnth ex-/ exceeded figures in 1978 (other OPEC suppliers filled the gap left by Iranian production cut - backs reasonably well) - yet this small shortfall , combined with stock movements which procyclically accentuated pressure on supplies , was sufficient to cause a second oil price explosion which , in turn , led to a loss of about 5 % of OECD real income in 1980 , and close to 8 % in 1981 - a sum approaching $ 1,000 bill. or $ 1,250 per head in all industrialised countries . Those figures represent necessarily only rough approximations - but they are conservative in assessing the economic consequences of the price explosion , and cannot even take into consideration less tangible political costs such as the weakening of the fabric of international cooperation .

These considerations - which try to define more rigidly what constitutes , and what does not constitute , a problem with respect to energy import dependence - also make clear why so far there has been little attention paid to import dependen-

with respect to coal or natural gas . The levels of dependence implied in the data in tables 1 and 2 simply do not constitute vulnerability . Experiences with losses of Algerian gas and Polish coal have shown that supplies of those fuels could well be disrupted , too - but those experiences also demonstrated that so far any shortfalls could easily be substituted and/or absorbed .

3. From the Present into the Future : Diversified Energy Structures . Broader Risks

This exclusive consideration of energy security in terms of oil security will in the future no longer be appropriate . All forecasts and projections about the evolution of Western European energy demand to the year 2000 assume significantly higher levels of import dependence for coal and natural gas ; nuclear power, generally credited with good chances for an expanded role , relies , of course , on uranium , which will also have to be imported by most European countries .

Table 3 presents the projections by the IEA's 1982 World Energy Outlook . Two scenarios are considered : the central assumptions are a decline in the real price of oil to 1985 and then a constant real price in the high demand scenario . Economic growth averages 3.2 % from 1985 onward in this scenario . The low energy demand scenario assumes slightl y lower economic growth rates after 1984 , and a 3 % real increase p.a.in oil prices from 1984 onward . The IEA projections are compared in the table with estimates by Exxon [5] so as to provide a differently coloured glimpse in the crystal ball . Exxon's projections are considerably lower in terms of overall energy demand , and consistently less bullish about coal and nuclear. To a large extent , these differences can probably be explained by the lower growth rates projected by Exxon .

Both sets of estimates are enough in agreement with each other to allow some broad conclusions :

- a more or less stable or slightly declining production of oil and gas in Western Europe
- probably not much increase in solid fuel production , either (although the IEA sees some expansion by 2000 , this seems to be coloured by British(and German) official optimism , which by now looks not very convincing)
- a strong expansion of nuclear power
- declining oil imports throughout the period , although the IEA projections show a wide margin of uncertainty towards the turn of the century , indicating the possibility of a trend reversal
- rising levels of imports of natural gas , coal and (although this does not appear in the projections itself) of uranium .

The share of oil in total energy consumption will continue to decline , and with it dependence on imported oil in terms of its share in total energy consumption . This is , however , a priori not a very useful indicator - it in effect assumes perfect interchangeability of fuels . In reality , the possibilities of switching from one fuel to another at short notice , and even with some lead time , are limited . A more meaningful indicator of dependence is, therefore , the percentage of imports in one particular energy sector . And it is perhaps more interesting to note that dependence on oil imports in those terms will probably not decline very much more , while that on natural gas , coal and uranium imports will increase . Western Europe is thus faced with a diversification of import dependencies .

This raises a number of interesting new issues . The first -

which already has come up extensively in connection with the Western European gas pipeline deal with the USSR - concerns the impact of a diversification of risks on the overall energy security risk . The Western European argument has been that such a diversification has a positive impact on overall risks; the US response ... sometimes appeared to imply the opposite . In fact, there is probably no general answer to this question . It depends - but on balance, one might well conclude that it does not make much difference whether 7o or 8o % of total oil requirements are imported - as long as the additional imports (resulting from lesser efforts at diversification) do not themselves make a supply disruption more likely (by putting pressure on available supplies) or less manageable (by absorbing spare capacity which could be used in a crisis) .

A second , more central question relates to the issue of vulnerability with regard to energy sources other than oil . The criteria used in this essay - probability of disruption , posisibilities of successful crisis management , and costs of shortfalls - have thus to be held against all four major import-related energy sectors , that is to say , oil , coal , natural gas , and uranium . We can discard problems with regard to coal and uranium fairly easily : most imports will come from induatrialised countries such as Canada, Australia and the US ; possibilities of adjusting to shortages are ample , and - with the exception of South Africa , another major future supplier of coal and uranium , the causes of possible shortfalls could probably be removed without great difficulties (they will in all likelihood consist either in labour disputes or in technical failures or natural desasters , in themselves quite unlikely to reach major proportions) .

The situation is different with respect to natural gas .

There , imports will come from Algeria,Libya and the USSR - and , in addition , perhaps from West Africa (Nigeria, Cameroon) and the Gulf - i.e. from OPEC and the Soviet Union . Algeria and the USSR will - even if only firm contracts are counted - reach market shares of 3o % and more in several Western European natural gas markets . The possibility of supply disruptions - either for reasons of economic or political coercion or because of turmoil in producer regions - cannot be disregarded . Thus, the first condition for vulnerability is met .

At the same time , the market shares reached by the USSR and Algeria , separately and in conjunction , are sizeable enough to pose serious potential management problems . There are, to be sure , considerable flexibilities built into the Western European natural gas system . They consist of

- a large and well- integrated European pipeline grid , which allows shortfalls to be distributed widely and to roll in additional supplies from within Western Europe
- considerable surge capacity in the Netherlands and , to a smaller extent (and depending on circumstances at the time of disruption) in Germany . There might also be some flexibility in stepping up production in Norway
- storage . Most storage capacity at present is needed to cope with seasonal fluctuations in demand , but capacities are expanded and this will yield a strategic reserve in some countries (France, Italy)
- interruptibe contracts . A sizeable share of natural gas is marketed in Western Europe on the basis of contracts which allow suppliers to disconnect customers for limited periods. Again , this instrument is needed to balance supply and seasonally varying demand . But interruptible contracts

imply the existence of dual-fired burners , and thus offer possibilities of fuel-switching even for prolonged periods - provided , alternative sources are available . Most dual burners, however , are equipped for the combination gas/oil . This would not be all that helpful if both oil and natural gas were affected by supply disruptions .

The flexibility of the Western European natural gas system is expanding constantly - but so will import dependence in the late 198os and 199os . The European Commission has probed the possibilities of absorbing supply shortfalls of 1o and 25 % for a six-month period during the winter season of 199o ; it concluded that there would be no major difficulties [6]. This result seems to me somewhat optimistic - methodologically , it does not look at the regional (as opposed to the national) implications of such shortages ; and a six months limitation might not be the worst conceivable scenario . Thus, even in 199o , some question marks remain - and the problems could well increase as surge capacity in the Netherlands diminishes and import dependence grows further . Condition two for the existence of vulnerability thus must also be considered as present - at least in the 199os , and as long as crisis management flexibility expands along presently apparent lines .

The last criterion for vulnerability is the cost of disruptions after the easy options outlined above are exhausted . This cost has two aspects : possible negative implications of large price increases , and of disruptions in production and well-being of citizens . The first aspect will probably not be relevant with natural gas . Total natural gas exports of the USSR to Western Europe will net some $ 12 bill. in 199o and 2ooo [7] (constant $). The contract structure for natural gas exports is much more rigid than that for oil ,

and there are (almost) no spot sales . Thus, dramatic price changes are less likely than in the case of oil . Even if they should occur, their impact on the balance of payment , on inflation and hence on economic policies would be much less dramatic than in the case of oil price explosions .

The impact of supply shortfalls beyond interruptible contracts would largely fall on the residential/commercial sector of gas consumption , which will will expand to about half of total demand in Western Europe . Industrial consumption outside interruptible contracts are npt easily substitutable , and this sector would probably have to be protected so as to prevent losses of industrial production . Rationing of supplies to households appears to pose difficult problems , but if this could be implemented , the effect would be some inconvenience (lower room temperatures) rather than serious losses of material production and welfare . Governments might be reluctant to put this burddn on citizens , but in a serious crisis , it should be politically possible . Thus , with this third criterium , vulnerability certainly seems much less dramatic than in the case of oil .

4. Oil : Still the Achilles Heel of Energy Security

Energy security concerns will thus broaden over the next few years - but oil will remain at their core . The simplest reason for this propcsition is volume : even by 2ooo , Western European oil imports will still vastly exceed (in energy equivalence) imports of other fuels . This has , of course , implications for economic security - the balance of payment effect of price increases , and inflationary pressures related to such increases , could pose major problems for economic management in themselves , even without a significant shortfall of supplie Whether the fabric of international economic cooperation

in trade and finance could survive another oil price shock such as the one in 1979/1980 intact , must be in doubt - particularly if such a price explosion would occur within the next few years at a time when the world economy still tries to adjust to the previous changes. Note that smaller oil price percentage increases could in the future produce similar effects in terms of their relation to GNP , as the dramatic jumps of 1973/4 and 1979/80. Note, too, that (assuming stable or increasing real oil price trends) oil consumption will tend to become concentrated in sectors where substitution would be difficult or impossible , while the "fat" of relatively dispensable oil consumption will also be reduced by efforts to enhance energy efficiency . The decline in oil's position in the energy equation could thus be partly compensated for by its heightened importance .

A second reason for assuming a continuing key role for oil security matters has to do with the overlap of the oil and the natural gas markets . Some of the key suppliers are identical (OPEC countries) ; and it is possible to conceive of political scenarios of oil supply disruptions from the Gulf , which would involve both Superpowers and hence draw the question of Soviet natural gas supplies to Western Europe into such an oil crisis. The two energy markets can thus politically not be entirely separated .

Oil supply disruptions would thus continue to pose extraordinary problems of adjustment - both in terms of absorbing a serious shortfall of supplies , and of managing the implications of possible large price increases . Moreover, they could spill over into natural gas supply risks . Given future levels of Western European oil import dependence , a large shortfall could be absorbed only at high economic, social and political costs .

Thus, conditions two and three for establishing vulnerability will continue to be highly relevant - and there can be no doubt about the possibility , indeed probability , of other supply crises.

This last point merits some further discussion . The future pattern of oil supplies to Western Europe is, of course , much more difficult to project than that for natural gas . Still , it seems reasonable to assume that Western European oil imports might increasingly come from the Middle East . Table 4 compares two sets of estimates about OPEC export potential in 1990 and 2000 . They both show a similar trend : OPEC export capacities will increasingly be concentrated in the Gulf . In 2000 , the share of Gulf countries in total OPEC exports could reach , according to those projections , between 79 and 89 % . There are reasons for assuming that this trend will indeed materialise : size of reserves , population , cost of installing additional capacities . A number of non-Gulf exporters will increasingly be hard pressed to maintain production and to meet rising domestic energy demand . Although there are , of course , different policy options and mixes available for those countries (they might either phase out oil exports , or squeeze domestic demand to protect their export earning capacities) , their differences in terms of distribution of OPEC exports would not be great . The increasing concentration of export capacities in the Gulf region will undoubtedly enhance energy security risks: the probability of some form of turmoil in the region affecting oil supplies must be considered high , and the volumes involved could easily become very substantial . Moreover , any crisis in the Gulf is bound to be followed very closely by both Superpowers . Thus, there is always a possibility of a major world crisis .

Trend projections such as this one about the growing concentration of export capacity in the Gulf have, of course , always be considered in the context of the real oil market with its cyclical ups and downs . Thus , at any given moment in the future, the actual share of the Gulf might well be lower - witness developments in recent months . Given the revenue requirements of Gulf and non-Gulf exporters , a reasonable distribution of export patterns would be a full utilization of capacity in the non-Gulf regions, with the Gulf countries playing the role of swing suppliers . Whether this assumption materialises , will depend on the degree of cooperation or conflict within OPEC . In this scenario , however , spare capacity and thus a large element of crisis management flexibility would still be concentrated in the Gulf . Political events in the Gulf which would affect this spare capacity (say, a new regime in Saudi Arabia with a 5 mbd production ceiling) would in themselves be sufficient to transform the world oil situation .

5. Ceteris non Paribus : The Problems of Future Market Instability

The political risk element in the present and future oil equation is one crucial reason for a cautious use of projections . Political events could still transform the oil market over night ; they could drastically change prices and even longer-term price trends and expectations . There is , however, a second, perhaps less well appreciated element of uncertainty: changing oil market structures . The changing role of the oil majors from producers to buyers , traders and refiners of oil; the proliferation of actors in the oil market ; the declining importance of long-term contracts and the increasing role of spot sales (said to have reached up to 4o % of total trade

in recent months), and the growing importance of stock movements (which tend to exacerbate the cyclical fluctuations of demand) as well as the accentuation of OPEC's role as the marginal suppliers suffering from extreme fluctuations in demand for their exports - all this tends to favour market instability and large price fluctuations . To this has to be added the growing fragmentation of the political environment of the oil market - the bitter conflict within the Gulf group between revolutionary Iran and conservative/ pragmatic Saudi Arabia and Iraq ; the weakening of US influence in the Middle East and the continuing deadlock of the Israeli-Arab conflict .

The international oil market will thus probably be more fragile and subject to fairly pronounced ups and downs in the future , if efforts to build a new, viable structure of stability and control continue to fail - and prospects for a successful structuring , be it by OPEC , by the IEA countries , or through joint efforts , appear rather dim at present . At this time, this volatility expressed itself in downward pressure on prices . There is as yet great uncertainty about the price levels which will materialise , and even about longer-term price trends . I do not want to pursue this further by adding my own guess about the future ; rather , it seems to me wise to start from this assumption of uncertainty . Oil prices could , in fact , be as low as $ 15 or as high as $ 50 in 1986 - and under each scenario, they might well be again entirely different in 1987 . What are the implications of this proposition of uncertainty for Western European energy security ?

A first issue to be considered concerns efforts to diversify away from OPEC imports , and to use oil more efficiently . While there are probably good reasons to assume that improvements in energy efficiency will continue to be made , uncertainty about

future , and lower present price levels could well discourage diversification. The problems here might be less on the supply side - up to now,most projects cancelled were probably only marginally profitable , anyway - than on the demand side . Consumers might well be reluctant to invest in alternative energy installations , and lack of demand could then feed back into lower investment in alternative supplies . This seems to be happening in the case of coal . The net result of this would be higher levels of dependence on oil imports than might be possible . Moreover , if we take into consideration what has been said before about growing market volatility and stock movements , there would appear to be greater potential for sudden surges in oil demand , which might quickly run into supply bottlenecks .

Secondly , do falling oil prices and market instability affect the probability of supply disruptions and price jumps ? On balance , I would argue that they do . The fairly drastic fall of oil income to OPEC from $ 275 bill. in 1980 to perhaps 202 bill.in 1982 has already created economic and political problems in some high absorbers (for possible international ramifications of such difficulties , reflect on the expulsion of illegal immigrants from Nigeria). Squeezed by inflation , the revolution of rising expectations and a declining ability to meet demands , the social and political stability of producer governments could come under pressure . Such a situation also would accentuate the risks of regional tensions and conflicts . This could produce unintended supply disruptions due to domestic or regional turmoil - and on balance, this risk , although always present, might now be greater than before .

There is, however , another consideration which points to a similar conclusion . This time, it concerns OPEC policies . The erosion of real earnings from oil will produce frustration

and a strong desire to compensate for"lost income" in the past once the opportunity arises . Producer countries could thus, faced with a surge in demand fuelled in part by stockpiling , rapidly grab opportunities to maximise revenues per barrel . One might find in such a situation additional production ceilings at lower levels than up to now , a full exploitation of the opportunities of sales at spot prices , and similar steps to exploit the occasion . A coordinated OPEC policy of moderation under such circumstances would be extremely difficult ; Saudi Arabia alone could perhaps muster enough weight and spare capacity to prevent another price hike , but there must be doubt as to whether Rijad would politically be able and willing to go it alone. There are at least major uncertainties here , which are not unrelated to future developments in the Middle East as a whole .

The probability of disruptions will thus in my view be influenced negatively by market instability and falling prices. But what about Western European (and OECD) ability to absorb and manage shortfalls ? One observation to be made here is psychological : falling oil prices will in all likelihood not encourage governments to take the energy security risks seriously enough . Thus, crisis preparations might slacken . Secondly , much will depend on at what moment a crisis occurs . Both the first and the second oil shock were accentuated by a situation of rapidly rising demand for oil and energy , while the non - event of 1980/1 in conjunction with the Gulf war had much to do with falling demand . This will be even more important in the future . As noted before, crisis management flexibility in terms of"cutting the fat" will tend to decline in the future (although falling prices will slow the process) . Refinery conversion , on the other hand , will increase flexibility , although again this trend could be slowed by the pressure on price

In a situation of supply shortages under conditions of underlying upward demand pressure , price explosions could probably be only contained by a sophisticated use of stockpiles and/or recourse to OPEC spare capacity . This capacity might not be available due to political reasons . A full exploitation of all elements of crisismanagemengt flexibility in both producer and consumer countries would probably be required to contain the impact of a major shortfall under such circumstances . This presupposes cooperation between the two groups . Whether such cooperation will be possible depends, of course , on a number of political preconditions . One of them might well be the degree of cooperation and dialogue before a crisis .

Overall, then , one certainly cannot be sanguine about the implications of growing market fragility on Western European oil security . The risks will chan ge ; they will be concentrated in periods of demand surges . But their dimensions will be as critical as before ; and government precautions against the dangers of supply disturbances might slacken . Moreover , Western Europe will have to think about new energy security problems, in particular with respect to natural gas . This, too , will require some attention by governments . A third political challenge posed by the Western European energy security outlook concerns the issue of market volatility . The international oil market has never functioned under conditions of competition and fragmented control ; and the peculiarities of this market make it unlikely that it could function well like this . Oil is too important a commodity to be left to market forces alone.

Table 1: Western Europe's Energy Balance , 1973 and 198o (mtoe)

	Production		Imports		Total Requirements		Import dependence (in %)	
	1973	198o	1973	198o	1973	198o	1973	198o
oil	2o	122	687	52o	7o7	642	97	81
coal	229	226	36	54	265	28o	14	19
natural gas	116	159	7	19	123	178	6	11
nuclear		5o	-	-		5o	n.a.	n.a.
other		91	-	-		91	-	-
total	457	649	73o	593	118/	1243	62	48

source : IEA

Table 2 : Individual Countries' Energy Balance , 1973 and 198o (mtoe

		Production		Imports		Total Requirements	
FRG	oil	6.7	4.7	146.5	133.2	153.2	137.9
	coal	92.8	9o.3	-1o.4	-6.5	82.4	83.8
	natural gas	15.4	14.6	12.2	28.7	27.6	43.3
	nuclear	2.7	1o.1	n.a.	n.a.	2.7	1o.1
	other	3.5	4.3	-	-	3.5	4.3
	total	121.1	124.o	148.3	155.4	266.4	272.2
UK	oil	o.4	81.2	116.5	1.7	116.9	82.9
	coal	78.5	74.8	- o.9	1.3	77.6	76.1
	natural gas	25.o	31.9	o.7	9.2	25.7	41.1
	nuclear	7.2	9.o	n.a.	n.a.	7.2	9.o
	other	1.2	1.2	-	-	1.2	1.2
	total	112.3	198.1	116.3	12.2	224.o	2o1.4

Table 2 , cont.'d

	production		imports		total requirements	
France						
oil	2.1	2.4	129.6	113.4	122.5	1o9.3
coal	19.o	14.6	1o.o	21.9	3o.9	35.7
natural gas	6.4	6.3	7.7	16.5	13.8	21.9
nuclear	3.5	14.4	n.a.	n.a.	3.5	14.4
other	11.5	16.6	(o.2)	o.2	11.3	16.8
total	42.5	54.3	147.1	152.o	182.2	198.2
Switzerland						
oil	-	-	15.1	13.1	15.1	13.1
coal	o.2	o.2	o.2	o.5	o.4	o.7
natural gas	-	-	o.2	o.9	o.2	o.9
nuclear	1.5	3.4	n.a.	n.a.	1.5	3.4
other	6.8	8.o	-	-	6.8	8.o
total	8.6	11.6	15.5	14.5	23.9	25.o

sources : OECD Energy Statistics ; IEA Annual Reviews

Table 3 : Western Europe : The Energy Outlook According to IEA and Exxon(mtoe)

	oil		coal		natural gas		nuclear		other		total	
	A	B	A	B	A	B	A	B	A	B	A	B
1990												
production	128-133	160	220-236	202	160-170	150	199-206	167	111-120	139	843-850	820
imports	408-450	402	137-149	109	90-100	70	-	-	-	-	635-699	570
total	541-578	562	367-385	311	260	220	199-206	167	111-120	139	1478-1549	1390
(Import dependence , %)	(75-78)	(72)	(37-38)	(35)	(35-38)	(32)	-	-	-	-	(43-45)	(41)
2000												
production	109-149	144	290-300	215	125-150	137-162	266-296	240	170-190	144	1020-1025	930
imports	359-641	417	271-279	184	130-140	88-113	-	-	-	-	778-1042	673
total	508-750	561	569-57	399	255-290	250	266-296	240	107-190	144	1803-2062	1603
(Import dependence, %)	(71-85)	(74)	(48-49)	(46)	(48-51)	(35-45)	-	-	-	-	(43-50)	(42)

sources : IEA World Energy Outlook 1982
Exxon , Energy in Europe , Dec.1982

Table 4 : Future Export Capacities of OPEC Countries (mbd)

	Production					Domestic Consumption					Exports				
	1980	1990		2000		1980	1990		2000		1980	1990		2000	
		A	B	A	B		A	B	A	B		A	B	A	B
Saudi Arabia	10.3	9.4	11.0	9.4	12.1	0.6	1.1	1.1	1.7	1.4	9.7	8.3	9.9	7.7	10.8
Kuwait	1.8	1.5	1.7	1.2	2.2	0.1	0.2	0.06	0.2	0.08	1.7	1.3	1.6	1.0	2.1
UAE	1.7	2.0	2.0	1.5	2.0	0.1	0.2	0.2	0.2	0.3	1.6	1.8	1.8	1.3	1.7
Qatar	0.5	0.3	0.2	0.2	0.1	0.01	0.02	0.02	0.02	0.02	0.5	0.3	0.2	0.2	0.1
Iraq	2.7	3.5	3.5	3.5	4.0	0.2	0.4	0.3	0.7	0.6	2.5	3.1	3.2	2.8	3.4
Iran	1.5	3.0	3.0	3.0	3.0	0.6	0.7	0.6	1.5	0.9	0.9	2.3	2.4	1.5	2.1
subtotal	18.5	19.7	21.4	18.8	25.4	1.6	2.6	2.3	4.3	3.5	16.9	17.1	19.1	14.5	20.2
Libya	1.8	1.8	1.5	1.7	1.5	0.1	0.2	0.2	0.3	0.2	1.7	1.6	1.3	1.4	1.3
Algeria	1.1	0.9	0.7	0.7	0.7	0.1	0.3	0.2	0.4	0.3	1.0	0.6	0.5	0.3	0.1
Indonesia	1.6	1.4	0.9	1.2	1.5	0.4	0.9	0.9	1.2	1.5	1.2	0.5	-	-	-
Nigeria	2.1	1.8	1.5	1.5	1.0	0.2	0.5	0.5	1.0	1.0	1.9	1.3	0.9	0.5	-
Venezuela	2.2	2.2	2.0	3.0	2.0	0.4	0.7	0.7	1.2	1.1	1.8	1.5	1.3	1.8	0.9
total OPEC[a]	27.6	28.1	28.0	27.1	30.1	2.9	5.5	5.0	8.7	7.5	24.6	22.6	23.1	18.4	22.6
total est.production capacity	35.2	29.1-34.1		27.8-33.5											

a) including Gabon & Ecuador

sources : IEA World Energy Outlook
N.Ait-Laoussine

Notes :

1) Cf. , e.g., OECD , Energy Propsects to 1985 , Paris 1974
2) IEA , World Energy Outlook , Paris : OECD 1982
3) Comité professionnel du Pétrole , Pétrole '81 , Paris : CPP 1982
4) OECD Economic Observer , March 1982 ; IEA ? op.cit., p.64
5) Esso , Energy in Europe , Looking Forward to the Year 2ooo , Dec.1982
6) Commission of the European Communities , Communication for the European Council on Communities Natural Gas Supplies , Brussels , Oct.15,1982 (COM (82)653 final)
7) IEA, op.cit., p.184
8) Petroleum Economist , March 1983 , p.78

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PROGRAMME FOR STRATEGIC AND INTERNATIONAL SECURITY STUDIES
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ENERGY WORKSHOP

THE SOVIET UNION AS AN ENERGY SUPPLIER TO EUROPE

By

Antony Scanlan

March 1983

THE SOVIET UNION AS ENERGY SUPPLIER

Tony Scanlan - BP

The last ten years have seen the most fundamental changes in the world energy market. Ten years ago, Easter 1973, USA oil import quotas which had had the effect of largely divorcing the largest oil consuming nation from the world of oil trading, were dissolved overnight. The basic reason for this was the failure of 15 years of protection aimed at stimulating relatively high cost American indigenous oil production to a level necessary to maintain an effective level of self-sufficiency for the USA. Some increase in United States oil imports had been allowed throughout the period and, as a result, between 1958 and 1970, United States imports rose from about 1.5 m.b.d. to 3 m.b.d.; but production then peaked and in the following two years imports doubled again. Quite simply, stimulus to raise production without any equivalent stimulus to curb consumption could not continue. Are we observing a similar phenomenon ten years later in respect of the USSR?

During this same period from 1970, (when USA production peaked) USSR oil production has doubled making the Soviet Union number one oil producer in the World. USSR and Comecon oil markets have continued to remain a system self-sufficient and therefore only marginally related to oil trading in the rest of the World as a result of this ability to raise production, but, of course, during this period consumption in Comecon has continued to rise almost in parallel and the other Comecon nations do not share the ability of the USSR to increase oil production. As a result, Soviet exports outside Comecon have remained very broadly on the same level, contributing some 4-6% to supply in the Non-Communist World.

During the period since 1970 the rising demand for oil in Eastern Europe has twice caused a rise in non-Soviet imports of oil. The first period ended after the first world oil crisis in 1973 but returned more noticeably from 1975 throughout the next four years. The major problem that this trade posed, for a non-convertible currency area, was the ability to develop and sustain hard currency exports. Could this be done?

1979 provided an abrupt answer when oil prices on the world market exploded for the second time and imports into Eastern Europe from non-CMEA sources fell away and have not yet recovered. But the change has not been confined to Eastern Europe. Today I would like to suggest that the world energy scene in the decade of the eighties - and therefore the economic scene - has changed as significantly from the seventies as the seventies differed from the sixties: and that this is as true of the Comecon Bloc as it is for the rest of the world.

At the same time there is a strong persistent theme throughout all three decades and which also applies as much to the Soviets as to ourselves and that is that the days of cheap, easily accessible petroleum supply which can double every decade in order to sustain the economy are over. For the non-Communist world that period ended with the sixties: for Comecon it ended with the seventies.

In both cases the supply projections - surprising as it may sound to some ears - have been reliable if uninspiring: it is the <u>demand</u> projections and therefore the <u>economy</u> and <u>world trade</u> that have been forced to adapt. In theory, if adaptation is flexible and sensitive, there is no need for

crisis - there is still high cost oil and also other sources of energy, at a cost, and with these should come efficiency and lower energy consumption in every aspect of the economy. The proportion of each dollar spent on investment instead of consumption has to go up, but the potential of energy efficiency should alleviate any slowdown in the economy. Why then, are both Comecon and OECD now obliged to face lower growth rates in the economy - say 2% or 3% per annum compared with twice or three times that rate enjoyed previously? Is there a common endemic oversight in both the major world economic systems? This question was put by one of our leading economists to his Soviet counterpart at a conference recently and drew the cryptic comment "Tell me, comrade, did your authorities listen to your geologists?"

One reason why "doubling every decade" continued longer in the Soviet Union is the relatively late start in major oil and gas production compared with the non-Communist world. Back in Tsarist days at the turn of the century, Russia produced more oil (largely from the Caspian Basin) than any other nation, but the early Five Year Plans and especially the Stalin period favoured coal. When Stalin died, thirty years ago, USSR oil production had re-centred on the Ural-Volga fields developed during and since the second World War, when they were less exposed to German advance into the Northern Caucasus; but USSR production in total was only about 30 million tons per annum (m.t.p.a.) i.e. 600,000 barrels per day (b.p.d.). By 1970 this had risen ten-fold, still dominated by the Ural-Volga area - about the size of Iranian production at its peak - but during the sixties vast new deposits had been discovered at the "Third Baku" in the West Siberian plan. Virtually the whole of the subsequent development of All-Union production has centred on this region

ever since. USSR production has doubled since 1970 despite a progressive decline in Ural-Volga output since 1975, and this is almost solely due to production developed in West Siberia, in particular the super-giant field at Samotlor which alone provides 3 million barrels per day or one quarter of Soviet oil, now again leading the world at 12.2 m.b.d.

Natural gas has followed a very similar pattern, although, as I shall describe later on the reserve base is much greater than it is for oil. Production has risen ten-fold since 1960, and the earlier Caspian, Ukrainian and Ural-Volga fields have been superceded by immense discoveries in Central Asia, Orenburg Oblast in the extreme east of European USSR, and in the west Siberian plain up into the Ob Delta region, where the Urengoi and Yamburg fields are among the world's largest.

The West Siberian plain now provides over half of All-Union production of both oil and gas. Its potential is still rising, especially in natural gas. All-Union production of gas is planned to rise by over one-third during the 1981-85 Five Year Plan, mainly as a consequence of development in this area. USSR oil production growth however is close to its peak because of continuing decline in the "First and Second Baku" regions, the Caspian and Ural-Volga: but "Third Baku" Siberian developments continue to provide enough to offset decline in the older areas. Minor production continues to be developed offshore Sakhalin in the Far East, offshore Lithuania, in the Ukraine, the eastern shore of the Caspian in Kazakhstan, in the extreme north-east European Komi and Pechora region and minor discoveries even as far afield as Kamchatka. But the success of the 5-Year Plan depends on West Siberia almost totally, and it is a

modest plan for oil - about 20 million tons growth in the period whereas in the past decade the annual increment in the oil output was as large. By 1990, on the rather flimsy evidence available from Soviet sources, West Siberia could be providing two-thirds of both oil and gas production. By 1985 the amount of All-Union gas production will roughly equal the oil production in thermal value.

The scale of Soviet oil and gas production and of West Siberia in particular can best be gauged by comparing the Soviet energy balance with that of the United States. Currently - 1981 at present being the latest complete figures for total comparisions - the two nations energy volumes are equally impressive: the USA produces about 32 m.b.d. of energy. This assesses hydro and nuclear power at the high factor, i.e. fossil fuel displacement into electric utilities for both production and consumption purposes; and equates all fossil fuels at oil equivalent (o.e.). United States energy consumption is about 36 m.b.d., requiring oil imports of 5 m.b.d. partly offset by coal exports. USSR energy production is about 29 m.b.d. with consumption of 24 m.b.d. Clearly, it is a net exporter of energy, of which 3 m.b.d. is oil, making it at present second only to Saudi Arabia among oil exporting countries. Its gas exports, as shown in BP's 1981 Energy Review, constitute the largest single international movement of gas in the world, 42 m.t.o.e.

However, when Eastern Europe is added to the Comecon internal energy balance, apart from a net surplus of coal (in normal times for Poland) the Soviet net export surplus is considerably reduced. Eastern Europe has to import 80% of its oil and over half of its gas.

To summarise, the USSR produces 12 m.b.d. of oil, consumes 9 and exports 3 but 2 of those 3 m.b.d. are absorbed in other Communist countries - 80% in Eastern Europe and the rest in small amounts by North Korea, Cuba, Vietnam, Mongolia, etc. I do not include these, nor Yugoslavia or Albania in the definition of Comecon in the rest of this paper - only USSR and "The Six" - Bulgaria, Czechoslovakia, DDR, Hungary, Poland and Romania. Comecon, on this definition, still enjoys a surplus position - indeed energy is the main export stock of the Bloc. In total, Comecon energy production is 5 m.b.d. oil equivalent (o.e.) greater than the USA and consumption 3 m.b.d. lower.

With 75% of the USSR population of 270 million located in European USSR and 75% of each of the three main fossil fuels in Asiatic USSR, the ability to develop an energy system of equal magnitude to that of the United States (and to supply also the 100 million people in Eastern Europe) without the possibility of waterborne transport - there are no seaways and even the rivers run North-South - has necessitated a massive trunk pipeline network being developed over the past 20 years. It is the Soviet equivalent of the VLCC tanker fleet and just as essential. The main trunk systems with which we are most familiar are the twin DRUZHBA (Friendship) oil trunk export lines and the BRATSVO (Brotherhood) twin gas lines and the SOYUZ (Peace) gas lines which all principally export to Eastern Europe. But they are dwarfed by the internal grid for both oil and gas that has been developed linking Central Asia to Leningrad, the Ob Delta to the Ukraine, Caucasus to Moscow and for which the pivotal region is the area between Kuibyshev, Gorky and Chelyabinsk. Many of these lines are of 2000/3000 miles in length, the majority 40 inch diameter or more and many routes have been looped. I estimate about

150,000 kilometres of major lines have been laid in the past 2 decades. The much-debated Urengoi Export Line for Western Europe is only one of five major constructions now under way and is about to expand its pipelaying rate of ten miles per day when one of the other major trunk lines, to Kursk, south-east of Moscow, is completed and transfers its work force in the middle of the year. The current rate of progress on the 4,600 mile Export Line would see it completed inside 18 months - physically: full throughput may take several years.

By 1985 therefore, the West Siberian/Ob Delta complex will be producing oil and gas equivalent to eight times the hydrocarbon production of Alaska or approximately the equivalent of total current hydrocarbon production in the Arabian Gulf.

There is, however, a big difference in the level of oil reserves in that comparison. Soviet oil reserves are a state secret but various non-Soviet estimates place recoverable All-Union oil reserves at between 30 and 80 billion barrels. Our own estimate (1981 Statistical Review) is between 60 and 70 billion barrels, or 10% of total world reserves of oil, and gas reserves at 33,000 billion cubic metres (BCM), 40% of the world total. Current levels of production indicate 12 years of oil and over 70 years of gas and several major gas discoveries occurred since these estimates were made. The Urengoi Export gas pipeline, at 35 BCM, will probably represent 5% of planned USSR gas production by the end of the decade. The oil perspective is very different - with Samotlor (15 billion barrels) scheduled to decline by 1986 and with annual depletion of nearly 5 billion barrels, the equivalent of two more Samotlor fields will be needed simply to maintain reserves at current

levels by 1990. If such new supergiants existed, we would undoubtedly have heard of them - Samotlor was first announced 20 years ago! Of course, the recent indication of a new group of fields in the less-explored north-eastern part of the West Siberian sedimentary basin, capable of 800,000 b.p.d. three years ahead, is a sure indication that there is more to come in this vast basin - but supergiants are another matter. An ability to offset Ural-Volga and Caspian decline, but no more than that, is implied by these new developments, and even more of them will be needed before 1990 as the Siberian fields maturing with Samotlor peak and then decline. Enhanced or tertiary recovery from existing fields is another possible way of maintaining production but will take many years to develop beyond the 1% of All-Union output that it represented as recently as 1980 - and only certain options for EOR are open, i.e. are compatible with the ubiquitous practice of secondary recovery by water drive.

Further north and east there are still many potentially fertile basins awaiting development, and however remote or inhospitable the location, experience has shown that, if technically feasible, super-giants will be attractive if they exist offshore Arctic or in Eastern Siberia or the far North-East. After many years, speculation about the Barents Sea, for example, is about to be ended with the current delivery of offshore rigs delivered from yards in Finland, but it is now inevitable that results belong to the next decade, not this decade, in terms of commercial hydrocarbons. For the rest of this decade - as in many parts of the world - the system is limited by the time factor to existing development regions. Even with gas, the first indicators of planned targets for the 1986-90 Plan anticipate slower growth - about 10% compared with over

one-third in the current plan period, when the major energy increment, it is hoped, will pass from gas to coal. This is not because the gas reserves are in question, nor is it simply because of production lead times - it is as much to do with the total energy structure intended and to the limits to effective large-scale substitution of gas for oil in the internal market. This is probably because Soviet policy is not to burn gas (except locally) in more and more power stations, a point often made by leading figures such as Minister of Power, P. Neporozhniy. The last oil-fired power station has been built in USSR and the future of electricity is planned upon coal, hydro and nuclear. Coal is intended to provide the main energy supply increase in the second half of this decade for this sole reason.

To put oil and gas in focus it is worth taking note of the postion of coal. Three quarters of the coal reserves lie in Asia and Asiatic coal has taken over the major part of coal production, but growth has been insufficient to do more than offset the decline in European USSR with the Donetz now 10% below peak so that All-Union production has remained static for five years. The lack of investment priority in deep mines in the past decade will take another decade to resolve so hopes for the planned increase from 700 to 775 million tons by 1985 rest upon "soft" coals in Asiatic USSR and their use locally or transmission by "wire". The increase in lignite in total output has contributed to a 25% decline in the thermal value of the average ton mined in the past two decades. The decision to build power stations at the coalface has now committed the USSR Power and Electricity Ministry to this option rather than expanded railroads or slurry pipelines, assuming the latter are to be proved feasible over long distances. The rail option, with nearly half

of all rail freight traffic already represented by coal and its supporting requirements, would severely tax a system still giving priority to the second Trans-Siberian railroad from Baykal to Amur (the BAM). Thus, even if the coal targets are met, effective delivery depends upon long distance electricity transmission for which new high voltage direct current (DC) lines are being developed. These lose less power through voltage resistance over long distances than alternating current (AC) systems although they have to be converted into AC, and the use of DC to AC converters on such a large scale is a technical frontier at which equipment delays or failure to operate at full efficiency could be crucial. It is noticeable that dates for commissioning these lines have continuously receded twice during the current 5 year plan. Neither the coal production targets for 1985 nor the All-Union Grid link-up is likely to be effective until the next Plan period when coal expansion expects to benefit from an investment priority it has not had for 25 years. But the increase for coal output indicated for the period 1986-1990 is about three times the increase forecast for 1981-1985 and the 1985 target is the same target originally set for 1980.

Another important aspect in the development of Soviet energy is that, because of the difficultes of "transmitting" Asiatic coal, European parts of Comecon including the USSR are scheduled for a most ambitious nuclear power construction programme. Output is planned to more than double within this five year plan. While this is well within the technical capacity of CMEA, we are now told that "Atommash" which had been indicated to produce about 8 reactors annually will only add 8 or 9 new reactors in the Plan period, so that the official plan is clearly at risk of major slippage. If this occurs, then technical progress in

"coal-by-wire" will become even more important to compensate for delays in nuclear electricity.

In general terms, it may be a reasonable middle view of Soviet coal prospects that they will increase very little, perhaps 10%, in effective contribution to the end of the decade. There are also likely to be delays to the nuclear programme. Thus the ability to prevent the continuing or expanded use of gas in power stations may be adversely affected. But just as the last oil-fired power station has been commissioned so it is intended to use gas to substitute for oil in all possible sectors other than power generation, both internally and for export - and that includes Eastern Europe.

Before looking at Eastern Europe and westward prospects in general the eastward pattern - essentially trade with Japan - is worth attention because it brings into focus another aspect of Soviet energy, namely, the separate character of the Soviet Far East. One has to travel 4,000 miles east of Moscow to reach the Pacific, and two-thirds of the journey is eastward of the major Siberian and Central Asian energy deposits. Two thousand miles east of Tyumen in the Yakutsk A.S.S.R. gas and coal discoveries have been made but these are too far east of any large population centres to allow for any viable outlet except further eastward to Vladivostok and Japan. Offshore the smaller oil and gas deposits of Sakhalin offer better located but more limited prospects for these two markets.

Japan imports about 8,000 barrels per day of Soviet oil and up to 1 million tons of coking coal per annum. The cities in the Pacific

region such as Vladivostok constitute the only significant population in the 3 million square miles of the USSR east of Lake Baykal and are insufficient on their own to justify developments 1500 miles north-west in Yakutia. The Japanese are therefore cast in the role of developer, since the mineral (and other) wealth of the Soviet Far East is much closer to Japan than it is to European Russia.

So far, they have accepted commitments to develop coal at Neryungi in Yakutia which is scheduled to provide about 5 million tons of coking coal annually by rail to Japan via Nakhodka from 1985 to the end of the century: in the meantime, the coal is delivered from Kuznetsk. The Japanese have not accepted a similar commitment for Yakutsk gas, preferring a trilateral deal involving the USA as equal importer. Even if the climate of acceptability to all partners were to re-emerge, the project would still take 10 to 15 years to develop, each importer receiving 7-8 BCM annually by LNG tanker from the port of Olga, north of Vladivostok. However, the project for Sakhalin LNG, from the mainland port of De Kastri, is due to commence by 1985 at 5 BCM annually, and in this case the Japanese appear to have a readiness to proceed which is not affected by US attitudes.

Important as the infrastructure development may be for the USSR, the quantities are tiny - about 1% in the case of Japanese oil and coal demand and 9% of Japanese gas requirements by 1985. The great bulk of Siberian resources are westward orientated; lying at the eastern edge of the populated area but still in the western half of the USSR.

The vast majority of Soviet exports of energy are involved with either Eastern or Western Europe. This was not always the case; in the 1960's a vigorous oil export programme included several Latin American, African and Asian countries: but Eastern Europe has tripled its imports of energy - oil and gas - from the USSR since 1968 and by the early 1970's we were speculating on how the Soviet Union would choose between the developing world, hard currency markets (Western Europe and Japan) and CMEA requirements (Eastern Europe). The developing world was first to go, although other forms of trade deal remain and several supplies of oil - not Soviet domestic oil - emanate from these countries to meet Soviet third party commitments elsewhere as rouble exports. Now the question is being asked how the final choice will be made between the two parts of Europe, as gas supplies increase and as oil exports face up to the problem that rising internal USSR demand is threatening to match or exceed increases.

More recently, speculation increased concerning the oil problem in Eastern Europe. In 1980 I wrote a paper which emphasised that something had to give within the Eastern European economy and although as usual nobody could have predicted the explosive events in Poland that followed, they are by no means inconsistent with that view: nor has the process of adjusting these economies to the new energy perspective yet run its course in the six countries. How that course evolves depends to a great degree on the countries themselves but to an unusually high degree it depends upon policy decisions in the USSR. There is not space in one paper to review all the energy aspects of each Eastern European nation but the key features in Eastern Europe are a unique combination of circumstances for a group of developed nations. Together they share an

almost total dependence on imports for oil, an abnormally low percentage of oil in the energy balance and therefore a low ability to substitute other fuels for oil for certain key economic purposes. This is combined with membership of an economic union, CMEA, whose most substantial export capability is, paradoxically, energy. Add to that the fact that their use of energy per capita is one of the highest in the world, especially taking into account relative economic attainments, and their peculiar sensitivity to imported energy prices becomes clear.

The three northern countries, Poland, Czechoslovakia and the DDR average a mere 20% of oil in their primary energy mix. To find a comparison with the Polish energy balance with only 15% of oil one would have to go to China. The southern countries average about one-third of oil in the energy balance, similar to the USSR, but with Romanian production now in decline prospects are worsening. The great mainstay is solid fuels, mainly low grade outside of Poland and therefore only of use internally. The combined production of solid fuels in raw tons in a normal year is, at 700 million tons, equal to USSR coal output, but the USSR, with 2½ times the population produces ten times as much gas and sixty times the combined oil output of Eastern Europe.

From 1975, since when incremental Soviet gas supplies have exceeded increases in Soviet oil deliveries, the terms of oil imports have gone from bad to worse. The rouble price of Soviet oil is linked to a five-year moving average of world prices. Before the world oil crisis in 1973 the CMEA importers had paid the Soviet Union a full arm's length price for their oil but the five year average system left them below world prices in 1974. In 1975 revisions doubled the 1973 price - less

than the full effect, certainly, but bad news for CMEA importers nevertheless. However demand exceeded Soviet supplies so in the period from 1975 to 1979 Eastern European imports of non-CMEA oil quadrupled from 5 m.t.a. to over 20 m.t.a. The second oil price explosion ended that at a stroke. In 1982 the USSR imposed a 10% cut overall, although some flexibility between national allocations in Eastern Europe was apparent. Total supplies were frozen at 80 m.t.a. (400 m.tons in 5 years). All these adverse movements in volume and price have provided a severe check to economic growth, coupled with Romanian oil production peaking and declining, and the rescheduling of international loans by East European nations has ensued, but the answer to the higher real cost of imports must lie not in contraction but in an expansion of export trade, either with the Soviet Union or elsewhere. In the first of the energy papers produced by the British Institute Joint Energy Policy Programme, produced in the middle of 1982, Jonathan Stern (pages 24-28) drew attention to the likelihood of a rapidly diminishing gap between the price of Soviet oil delivered to Eastern Europe and the nominal equivalent in non-communist world price of crude oil. Since then Soviet prices have been reported to rise about 20% in the past year and, of course, current events in the world market add considerable speculation as to the pace at which this nominal gap may diminish or even invert - so that by 1985 we might be faced with the very opposite of what currently is described by some commentators as "the USSR's oil subsidy" to Eastern Europe. It has to be emphasised however that such nominal i.e. arithmetical comparisons of price do not in themselves take into account the real value of trade with Eastern Europe and Western Europe as this may be perceived by the USSR, or indeed, by the Eastern European nations, but is significant that world parity price is already effective for

quantities above the reduced Soviet oil supply volume available. What market economist could possibly object? Many countries in the developing world, equally caught between the import cost of high oil prices and reduced manufactured goods export opportunities may find new evolving trade balances wherever they can, and this will coincide with an increased need to seek out such trade on the part of Eastern Europe. This in turn could link trilaterally to oil producers, due to their own depressed circumstances in the current recession.

Any increase in non-CMEA trade that might result should not be attributed to a loosening of trade ties within CMEA. The Soviet attitude is not one of disengaging as has sometimes been ascribed to this line of analysis. How can it be when three-quarters of the oil and all the gas imports in Eastern Europe are dependent upon the USSR? But the incremental volume of oil is another matter.

Western Europe is perhaps best brought into focus at this point so that the full range of European options for the USSR can be brought together. Total CMEA exports of energy to the whole of Western Europe and to the EEC in particular are tabled below as they were before the current Five Year Plan.

CMEA: EXPORTS OF ENERGY TO

WESTERN EUROPE: 1980

Millions Tons Oil/Oil Equivalent

	Oil	Gas	Coal	Elec.	Total
E.E.C.	47	22	14	-	83
Other Western Europe	26	1	1.5	0.5	29
	73	23	15.5	0.5	112

Western Europe Total Energy Consumption:-

Western Europe	680	185	265	165*	1,280
% from CMEA	11%	13%	5%	neg.	9%
E.E.C.	517	173	220	70*	980
% from CMEA	9%	13%	6%	-	8%

* Hydro and Nuclear only.

The proposed new gas trunkline deal would approximately double the volume of gas. Statistically this might represent 3% of Western European energy requirements - although by 1990 total energy consumption will have risen and Soviet oil exports may have declined.

One element in the Eastern European pattern of oil exports that has already ceased to be economic, principally affecting Romania, is the re-export of products from crude oil purchased in hard currency. CMEA in recent years has been the largest single external source of oil products for Western Europe and a sizable part of this has been Rumanian and some other Eastern European trade with OPEC crude oil suppliers and Western Europe product disposal: in effect the attraction of this has disappeared with the disappearance of refinery margins in the Western European Market and until a better balance re-emerges between OPEC crude prices, including their tax reference obligations to crude buyers, and

the realization of product netbacks in the market place, the prospects for any refiner throughout Europe as a whole in this type of business look grim. One may add that Soviet crude, like any other oil on the spot market, will also have to compete with product netbacks at world market levels.

The significant point that is emerging is that the main impact of changes in the Soviet supply pattern affect Eastern Europe more than Western Europe. If by the time the Soviets plan to reach full export capacity of the Urengoi-Yamal gasfields they also plan to sell oil to all parties at world prices, with gas somewhat lower, this will put their customers in Eastern Europe under enormous economic pressure. It is the rate of change in world oil prices that is most damaging to importing economies who tend to either over-react towards stringency or to rush for induced expansion, neither route having the structural time to work through without either inflation or stagflation resulting. If, in the longer term, the squeeze on oil prices induces real economies and real productivity compensation through expansion in trade, equilibrium will eventually be re-established. Can Eastern Europe manage with a lower percentage use of oil in its energy mix and still grow - I believe the answer is still no. The potential to economise on energy is large, but not so the potential to substitute oil by other fuels. For example, except in Romania, the extraordinary high percentage of solid fuels in electricity generation - 75% to 90% in the three northern countries - takes out at the root the option the OECD countries - and the USSR - possess to back oil out of the electricity sector. Even if GNP growth is limited to 2% annually, Eastern Europe has a need to increase oil supplies at at least the same rate - another 10 to 15 million tons

annually by 1986. This assumes some sustained recovery later in the current Five Year Plan period. There is a fair degree of flexibility already existing in the Soviet ability to supply both oil and gas, and the current squeeze on oil imposed on Eastern Europe is clearly designed to press home both conservation and the substitution of Soviet gas - which as mentioned has been growing faster than oil for eight years now. Providing however the Soviet Union achieves its hard currency export targets and its planned energy deliveries to Eastern Europe, the degree of flexibility mentioned may allow some variation in the mix of the oil and natural gas exports to each area i.e. whilst the two markets are not interchangeable, the precise quantities of oil and natural gas delivered into each may be of secondary importance providing the primary overall target level is achieved.

It is unlikely, therefore, that a significant long term impact is due to occur either in Western Europe or the USSR as a result of changes in the exportable surplus of CMEA energy. The impact in Eastern Europe is much more severe and in the first half of 1982 the cutback they endured appeared to be equal in volume to the USSR increase in hard currency oil exports. With decline in Romanian oil potential and the difficult road back for Polish hard coal during the current world recession, the danger of further economic implosion - or as in the case of Czechoslovakia, stagnation - is unpleasantly real. Czechoslovakia has just joined the list of countries ending the building of oil-fired power stations but any futher expansion of the solid fuel base in any of the Eastern European economies and the over-optimistic timing of the nuclear power programme may mean further slowdown, or greater dependence on the USSR. Transfer of certain energy-intensive activities such as the production of alumina

to the USSR may help to improve the national energy coefficients in Eastern Europe.

For the USSR itself, the 1986-90 plans detailed at the ECE and in the Ministerial statements are a portent of a major structural change in energy at the end of the decade. If these plans are achieved the USSR would not only have become the leading oil producer and gas producer but also the premier coal producer in the world. Greater emphasis is placed on coal expansion in the second half of this decade than on oil and gas combined. Oil is under pressure - it may even have peaked during this current Five Year Plan, and problems with further gas penetration may be a principal factor in the relatively slow increase in gas projected after 1985 as compared with the current plan period. The nuclear power programme, highly concentrated in European CMEA, Russia included, will be hard pressed by the time factor, and at the base of all this energy development will be Asiatic coal and the crucial question of the rate of progress of "coal by wire" in a nation spanning eleven time zones. Will it be possible - and if not, will it actually be necessary?

The answer to this question depends almost wholly on the answer to another - will the CMEA countries still demand roughly twice the energy input of Western European countries for the same economic output? In March last year the BBC reported a Moscow radio broadcast as stating that the potential for fuel saving in CMEA was 900 million tons of standard fuel. That is the same problem, quantified. There can be little doubt of the sincerity of the Soviet policy to remain self-sufficient in each form of energy, but is must now be obvious that measures to improve the economy on the demand side of the equation have got to complement further

production increases. The position is more urgent in Eastern Europe where self sufficiency is out of reach and economic viability itself may be the central issue. But by 1990 the USSR itself will be facing the same issue and there is little doubt that the inclusion of the subject of energy efficiency in the first major speech as First Secretary by Yuri Andropov is highly significant.

Meanwhile the trade balance should not present any undue problems for the USSR, unless world oil prices remain completely unstable, but they do present problems for Eastern Europe. The Soviets have demonstrated in recent months their ability to switch oil from one part of Europe to another. They have also made great strides in substituting gas for oil in leading energy intensive industries and in the use of combined heat and power. And where oil is in a unique sector such as gasoline, price increases are very noticeable to curb excess demand.

The Soviet pattern is regularly one in which 10% of their oil and gas pay for imports of food, machinery and raw materials in about equal measure - essentially to assist Soviet agriculture, heavy industry and energy development. There is a major prize to be gained within the USSR by improving the agricultural outlook either in productivity or distribution, i.e. improving the delivered percentage of the crop, although it is perhaps not sufficiently appreciated by the world at large that grain output rose 50% during the Brezhnev period. A 10-15% improvement in agricultural efficiency would be of as much advantage to the balance of payments as the total current volume of gas exports. Coal also stands to gain considerably from the new leadership drive for efficiency and release more gas for sales abroad. Therefore any economic

feedback from international trade may provide a non-market system with the opportunity to evaluate demand management. The main impact is not whether the Soviets achieve all their energy production targets by 1990, but rather where do they go from there unless efficiency in demand takes a decisive step forward.

The significance of this question for Comecon oil prospects is crucial. If energy efficiency can compensate i.e. offset delay in the supply of any of the major primary energy programmes in this decade and if natural gas continues to supplant oil, then the pressure on Soviet oil production and Soviet ability to export will ease more significantly than by any other means. But there is a limit to the extent that these measures can be provided by oil-deficit Eastern Europe: it is the Soviet Union, in the long term, that will have to provide the means. At present internal Soviet oil demand for unique i.e. non-substitute purposes is about 3 m.b.d. out of total oil use of 9 m.b.d. and total energy use of 24 m.b.d. The other 6 m.b.d. of oil demand is potentially substitutable and oil exports to non-CMEA markets represent only about one-quarter of this volume of oil and 5-8% of total energy consumption in the USSR. Put in this way it does not sound too formidable a target to find ways of maintaining an adequate volume for hard currency export, increasingly assisted by sales of natural gas.

Before they can achieve this target however, the main problem is not one of adequate energy resources so much as the ability to achieve means of enabling the internal Comecon market to conserve oil. Essentially this refers to the USSR itself rather than Eastern Europe because of its much greater size and flexibility. Technically it appears to be possible to make efficient substitution of other energies for oil, but this would

have to be part of an acceptable evolving social structure within the tenets of the existing politico-economic orthodoxy. Therefore whilst it is observed that the physical potential exists to do so and that the drive to efficiency throughout the economy continues to be debated at all levels and in many activities including energy, this still leaves open the question about whether it will be possible to successfully deal with the demand aspects of the energy balance before the supply potential becomes seriously extended.

One thing emerges very clearly, whatever the outcome may be: the vast majority, perhaps 90%, of Soviet energy exports are linked to Europe, either Eastern Europe or Western Europe. Solutions for part of Eastern Europe's future oil development may lie with non-Soviet suppliers if they can solve their particular problems of trade, although the main bulk of their supplies will continue to come from the USSR. It is only in incremental terms, and only in oil, that this growing tendency for Eastern Europe to look elsewhere is likely to be significant and "elsewhere" must mean non-European sources of oil. We are not envisaging a Western to Eastern European oil flow of any significance.

Leaving Eastern Europe aside, Soviet Union energy supplies to Western Europe comprise about 10% of Western European demand, but this outlet to the Western European market is almost certainly going to represent the vast bulk of total CMEA energy exports for the foreseeable future.

Western Europe, however, is in a very different basic energy position to Eastern Europe, the bulk of its supplies coming from non-Soviet sources and with a high degree of flexibility between primary energy sources and between countries.

While the implications of this speak for themselves it is fair to add that, in total, Western Europe remains more energy import dependent than North America, so that it is clearly not possible for Western Europe to regard susceptibility to import dependence as a factor that can be curbed or dealt with to the same degree open to the United States or Canada. It is more analogous to the options open to Japan. Dr. Paul Frankel, in a memorable phrase, described this as "the diversification of insecurity". In this sense Western European dependence on Comecon supplies of energy is never likely to approach the level of Western European dependency on world oil supplies or become as concentrated as are Soviet energy exports upon one region, the Western European market. East-West European energy trade, therefore, must be seen in a global content and not simply in the purview of a European perspective.

The author is currently Economic Adviser, BP International p.l.c. in London. Source of data is from Soviet origins wherever possible. Views expressed are personal but assistance from colleagues is gratefully acknowledged.

POSSIBLE CMEA OIL BALANCE Million Tons

		USSR	EAST EUROPE	TOTAL
1985	Production	620-630	15-17	635-647
	Consumption	480-520	90-110	570-630
	Balance	+150/+100	-73/-95	+77/+5
1990	Production	600-650	12-15	612-665
	Consumption	500-550	100-130	600-680
	Balance	+150/+50	-85/-118	+65/-68

N.B. Highs and lows are cross-balanced but most probably high USSR consumption if it occurs will pull production up and East Europe balances down. Ranges stated are therefore extremes but export surplus is reducing on all counts. However, conservation is only just beginning to take a high priority which will improve these balances to the degree it is successful.