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The internationalization of energy supply structures

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off-setting the secular fall in industrial employment. Thirdly, there is trade competition. Here Europessimism sees the region threatened by a combination of low-wage producers at one end of the market, and by producers like Japan who can achieve very high levels of productivity. This ability to rejuvenate capital stock and thus incorporate technological advance rests, *inter alia*, on a high rate of profit and labour mobility, which for political reasons cannot be matched by Europe. The newly industrialising countries (NICs), approaching a share of 10 % of world markets for manufactures, combine the advantages of green-field technology and low wages. No exchange rate can compensate for these large but narrowly based absolute advantages.

There is growing doubt, except in the Federal Republic (which has the most up-to-date capital stock and production structure and the highest rate of turnover in capital stock), that Western Europe can play the economic game by the old rule without facing

massive unemployment, stagnation, and what the British call "de-industrialisation". The first victim of such a process would be the European Community and with it the greater European free-trade area. For as the Federal Republic would strenuously resist protectionism at the Community level, other member governments would be driven to act unilaterally.

A working, genuine free-trade area accounting for two thirds of the export markets of member states would then have been sacrificed for the idea of an open world economy which on closer examination already largely consists of highly protectionist, planned, and even state-trading entities. By insisting on a policy of unilateral free trade for the Community a little too long, the break-down of both the common external policy and of the Common Market itself will be accelerated. The consequent Balkanisation of Western Europe would put more at risk than the continued existence of democratic and cooperative regimes. Here, economic and political security become inextricably mixed.

ENERGY POLICY

The Internationalization of Energy Supply Structures

by Heinz Jürgen Schürmann, Cologne*

The World Energy Conference will be held in Munich in mid-September. It will have to deal with diverse and complex problems of energy policy, for the seventies have presented tremendous challenges in the energy field¹. The control over oil – with 46 % of the world supply still by far the most important source of energy – has been reorganized and two oil crises have exposed the flow of supplies to severe disruption and political hazards. As far as can be foreseen, the supply is unlikely to keep abreast of the world-wide rise of energy consumption. To replace the oil gradually will therefore be the major task in the energy field in the coming decades. What will be the supply position between now and the year 2000? And which structural changes will have to be effected?

Under physical aspects there is no need for dramatic energy supply scenarios. On a static basis the fossile sources of energy (oil, gas, coal) can be expected to last a good long time if the putative resources are added to the reserves already opened up. On the basis of such putative energy resources and

static consumption the fossile energy materials will last for more than 200 years from today. Energy will however be much dearer in the future, and very speedy

¹ Cf. on details of the development processes and market results, H. J. Schürmann: *Multinationale Energieunternehmen und ihre energiepolitische Beurteilung* (Multinational energy enterprises and their assessment from the point of view of energy policy), Munich 1980.

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efforts will be needed in the world economy in order to render flexible adjustment processes possible. There will have to be persistent changes in consumption patterns and the relationship between the various sources of energy, for one thing because of different physical scarcity ratios between consumption and stocks and for another in view of the politically unfavourable focalization on certain supplying groups.

Table 1
Contribution of Major Sources of Energy to World Consumption

	(in %)			
	1928	1948	1968	1978
Coal	74	57	34	27
Oil	16	27	42	46
Natural gas	3	8	18	19
Others	7	8	6	8

Source: BP, Statistical Reviews.

It is true that structural change has always been typical of the developments in the energy field (see Table 1). The characteristic feature of the structural changes in the past was however that sources of energy that were cheaper and superior in application made great strides forward in a time of ample energy supplies. The distinguishing features of the structural change in front of us are, in contrast, the speed of the readjustment process and the change-over to energy sources which are far less advantageous from the cost point of view and under (external and internal) political aspects insecure.

Even if it is presumed that the energy-intensity is likely to decline markedly (by about 30 % compared with 1973) as a result of considerable changes in price relations and of public energy conservation programmes and that the economic product will on a world scale rise by the year 2000 only about parallel to the population growth, the supply of primary energy sources will have to be increased substantially (see Figure 1). On the strength of our basic assumptions (see Table 2 for details) the primary energy supply would still have to increase by more than 60 %, and considerable structural adjustments between the primary energy sources would be required in order to improve the chances for a better balance on the supply side (see Figure 2). The fullest possible use must be made of all options in order to avoid undue concentration on particular sources. The task of carrying out the adjustments in the time spans available to us will be made immensely more difficult if certain energy supply alternatives, nuclear energy for

instance, are blocked by political factors: the market situation, unstable as it is, would be in even greater peril.

World Energy Trade

About the middle of the seventies not much more than one-third of the world's energy production was traded internationally of which about 80 % fell to the share of mineral oil. An extension of the world-wide interrelations in the field of energy supply will be indispensable in the future because of the uneven distribution of energy resources. There is a special need for intensifying the trade in coal and gas world-wide in the shortest possible time. International division of labour in opening up new energy resources would be most advantageous for all national economies because it would enable the scarce world capital to be concentrated on the reserves of energy which can still be utilized at relatively low cost.

As for the pace of oil extraction, it has to be borne in mind that the seventies have shown evidence of a persistent disparity between newly-tapped crude oil resources and rising rates of oil consumption. More oil

Table 2
Energy Supply Scenario up to the Year 2000*

I. Basic Assumptions				
1. Gross World Product		2. Primary Energy Consumption		
Annual Growth Rates (in %)				
1978-1990: 3.4				1978-1990: 2.6
1990-2000: 3.0				1990-2000: 1.8
1978-2000: 3.2				1978-2000: 2.2
3. Trend of Elasticity Factor		4. Energy/Output Relation (Energy-Intensity)		
1978/1990: 0.75		1978	:	1.00
1990/2000: 0.60		1990	:	0.91
1978/2000: 0.68		2000	:	0.81

II. Primary Energy Consumption 1978/2000 (in mn bbbls/day oil equivalent and % of total)						
	1978		1990		2000	
Oil (conventional)	50	(54)	58	(46)	56	(37)
Synthetics (non-conventional oil)	0	(—)	2	(2)	6	(4)
Gas	16	(17)	20	(16)	21	(14)
Coal	17	(18)	26	(21)	37	(25)
Nuclear energy	3	(3)	9	(7)	15	(10)
Other sources of energy	7	(8)	10	(8)	15	(10)
Total	93	(100)	125	(100)	150	(100)

III. Origin of Oil Supply ^a 1978/2000 (in mn bbbls/day)			
	1978	1990 ^b	2000 ^c
OPEC	30	33	33
Non-OPEC (free)	18	24	25
Imports from communist state trading countries	2	1	(-2)

^a Incl. liquefied natural gas (LNG) but excl. synthetics.

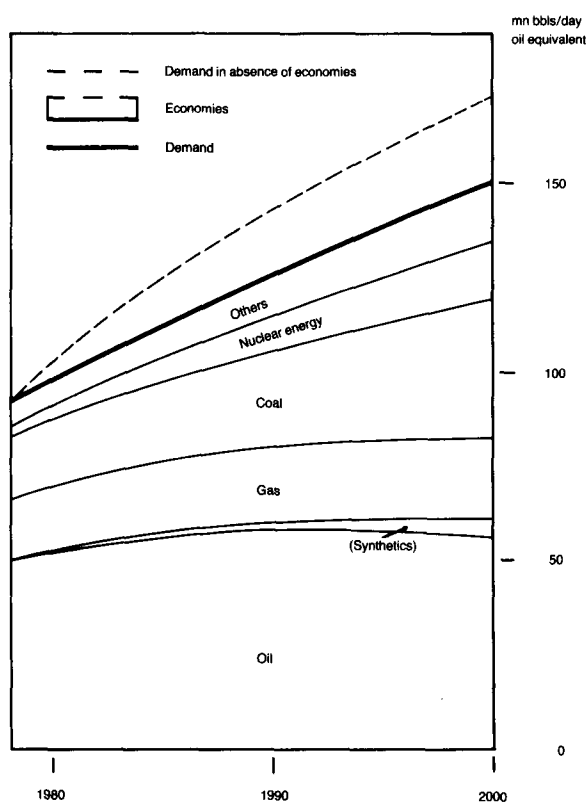
^b80% from already opened fields.

^c65% from already opened fields.

*The communist state trading countries are included in the tables only with their net energy exports/imports. The figures thus relate to the energy supply for "the world exclusive of communist state trading countries".

Figure 1
Primary Energy Supply Scenario 1980/2000

(in mn bbbls/day)



Source: Author's calculations.

has to be opened up quickly: our consumption scenario envisages that in the year 2000 already approximately 35 % of the total output will be obtained from as yet untapped deposits. The opening-up of oil reserves presents a number of problems: while adequate resources (of conventional and non-conventional oils) probably exist, the exploitation of the new capacities will involve overproportionally rising costs, especially if a better world-wide balance of the production structures is to be achieved in order to avoid instances of one-sided concentration with inherent political hazards. The exploration efforts must be intensified by advancing into greater drilling depths, off-shore areas and the Arctic region and the production methods must be improved (through greater use of tertiary recovery processes) in order to lessen one-sided dependences. Further, it is to be assumed that the so-called synthetics² will be developed at a faster pace and that they will cover the future growth of oil consumption. The fact that the OPEC states do not want to let their crude oil outputs rise above a certain ceiling is in any case taken into account in our projection. The produced crudes will,

moreover, have to be processed to a higher level: the vertical range of processing will have to be extended by capital-intensive conversion processes so as to increase the yield of light products (for transport and chemical use).

Cooperative Financing Solutions

Approximately 50 % of the future gas supply (which by the year 2000 will include 5-10 % of coal gas) still remain to be discovered and tapped. If the consumption of gas is to increase as projected, the disparity between the regions of production and consumption will render the evolvement of a world-wide gas-trading infrastructure indispensable: the pipeline grid will have to be extended further and more liquefied natural gas (LNG) supply chains will have to be provided. From approximately 10 % at present the international gas trade would have to be brought up to over one-third of the global exchange of energy: the total quantity of gas would have to be more than trebled (from approximately 200 bn cu.m. at present to well over 600 bn cu.m. a year in 2000) and be moved over overproportionally widening distances. The quantity of LNG traded internationally would have to grow more than fivefold. In view of the large long-term capital commitments required to start up such trade flows cooperative financing solutions seem to be needed to spread the risks fairly. It must be possible to encompass all contracting parties in a system of mutual dependences. In view of the long investment fruition periods such cooperation patterns should be developed as quickly as possible.

The coal industry may look forward to a revival. That is the gist of an international study which has just come out, "Coal: Bridge to the Future"³. The contribution of coal to the energy supply may increase quite considerably by the year 2000: the resource situation allows it, and the existing (and even more the likely future) energy price relations make it feasible. In view of the natural imbalances between places of production and centres of consumption it will however be necessary to increase the international coal trade overproportionally. According to the World Coal Study (Wocol) the scope for trade expansion varies widely according to the underlying scenario assumptions: from three times the present trade volume (of approximately 200 mn tonnes) to nearly five times (930

² The synthetics include tar sands and oil shales as well as coal derivatives.

³ C. Wilson (ed.): Coal: Bridge to the Future, Cambridge (Mass.) 1980.

mn tonnes) in the year 2000. It is regarded as imperative that the (West European, Japanese) consumer groups should as soon as possible set clear and binding signals for the potential producer states.

More Nuclear Energy

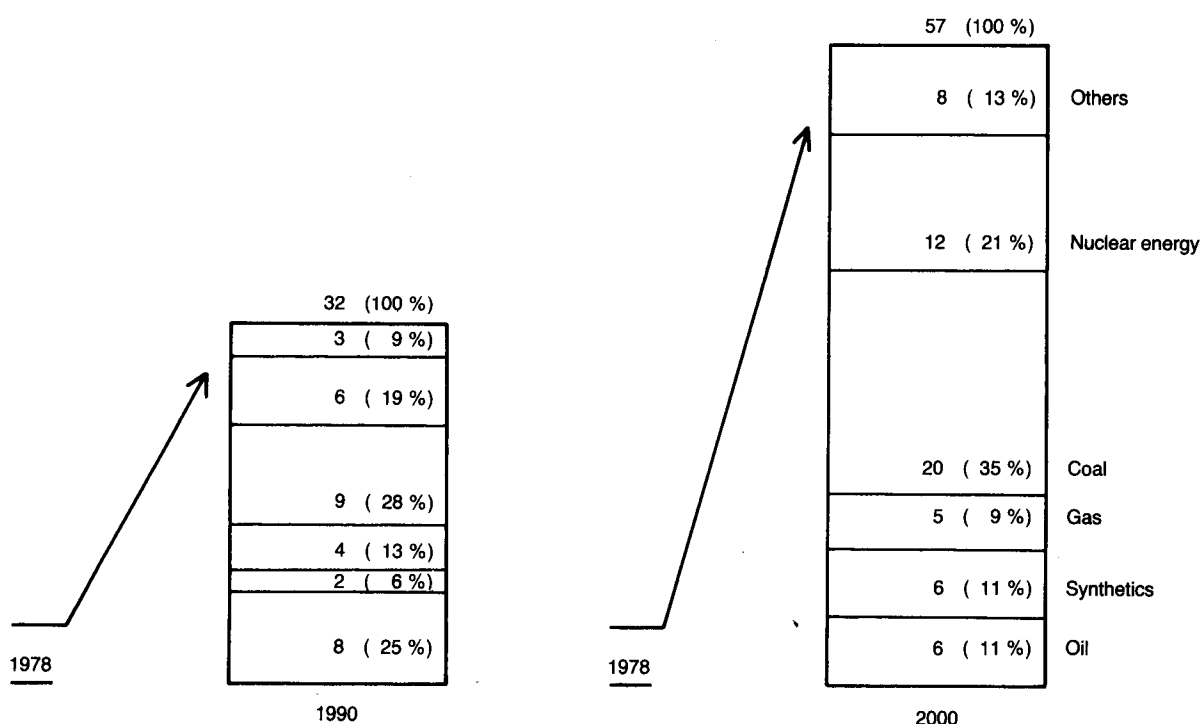
To go by the Wocol findings, the real problem of a rapidly rising contribution by coal does not arise from the capital requirements which, though enormous, could be met from growing national products but in connection with the market organizational needs of future trade exchanges. Cooperative solutions have to be found between mining companies as potential investors and groups of future consumers. The size of the investments required for the creation of a world trade infrastructure (reaching from new production capacities to new processing or conversion plants) are such as to necessitate mutual long-term commitments in place of the present wait-and-see attitude in order to allow a closer assessment of the risks. Considerable structural changes are expected to take place in coal

processing: approximately 15 % of the supply are likely to be used for producing synthetic fuels.

Even on relatively optimistic assumptions about the fossile sources of energy and possible energy savings it seems certain that the forecast growth rates of the world product, although representing a minimum programme, are only attainable if more nuclear energy capacities are provided at the same time. The growth rates envisaged in previous supply projections have been scaled down considerably however. It is now assumed that the current nuclear energy investments will be carried through while further projects will – with some variations between individual countries – make only tardy progress. One fundamental fact which is neglected in the public debate is nevertheless worth noting: if the oil substitution is to proceed at the envisaged rate, the coal processing programmes will be sustainable over the longer term only in connection with nuclear energy. Otherwise their conversion-performance is not nearly good enough to justify supply patterns of such low energy-generating efficiency for the long term.

Figure 2
Coverage of Energy Growth until 1990 and 2000

(in mn bbls/day and %)



Source: Author's calculations.