Surrey Energy Economics Centre

ENERGY TRENDS AND THE DEVELOPMENT OF ENERGY POLICY IN THE UNITED KINGDOM[1]

by Colin Robinson

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This paper traces changes in energy consumption and energy supply in Britain during the post World War Two period and considers some of the reasons for those changes. It then explains the energy policies which governments have pursued and discusses the effects of those policies on the energy market.

1. An overview

In the mid-1940s, the Labour government led by Clement Attlee nationalised many of the "commanding heights" of the British economy, including the coal, electricity supply and gas supply industries. Oil was the only energy industry left in private hands.

For the next ten years, fuel policy was concerned primarily with attempts to expand the coal industry. Coal output increased for a few years but, from the late 1950s onwards, the British coal industry resumed the decline which had been evident since 1913 (Figure 1) as it suffered competition from imported oil and later from North Sea natural gas. However, new sources of indigenous fuel appeared to replace coal as production of North Sea oil and gas increased rapidly in the 1970s and 1980s (Figure 2). Two thirds of British fuel production is now offshore oil and gas.

Coal production would have fallen much faster in the postwar years had not successive British governments sheltered the industry from the competition of other fuels. Coal protection was the centrepiece of energy policy until the mid-1980s. The other principal element of policy was promotion of civil nuclear power from 1955 onwards. There were two programmes of British-designed reactors and then in the 1980s an attempt was made to introduce Pressurised Water Reactors (PWRs) to the United Kingdom.

By the late 1980s the twin policies of coal protection and nuclear promotion were changing under the impact of energy privatisation and other significant changes in Britain's energy market. Radical shifts in energy policy seemed inevitable as the gas and electricity supply industries were privatised and the Conservatives stated that they planned to privatise coal if they were returned at the next General Election in 1992.

FIGURE 1

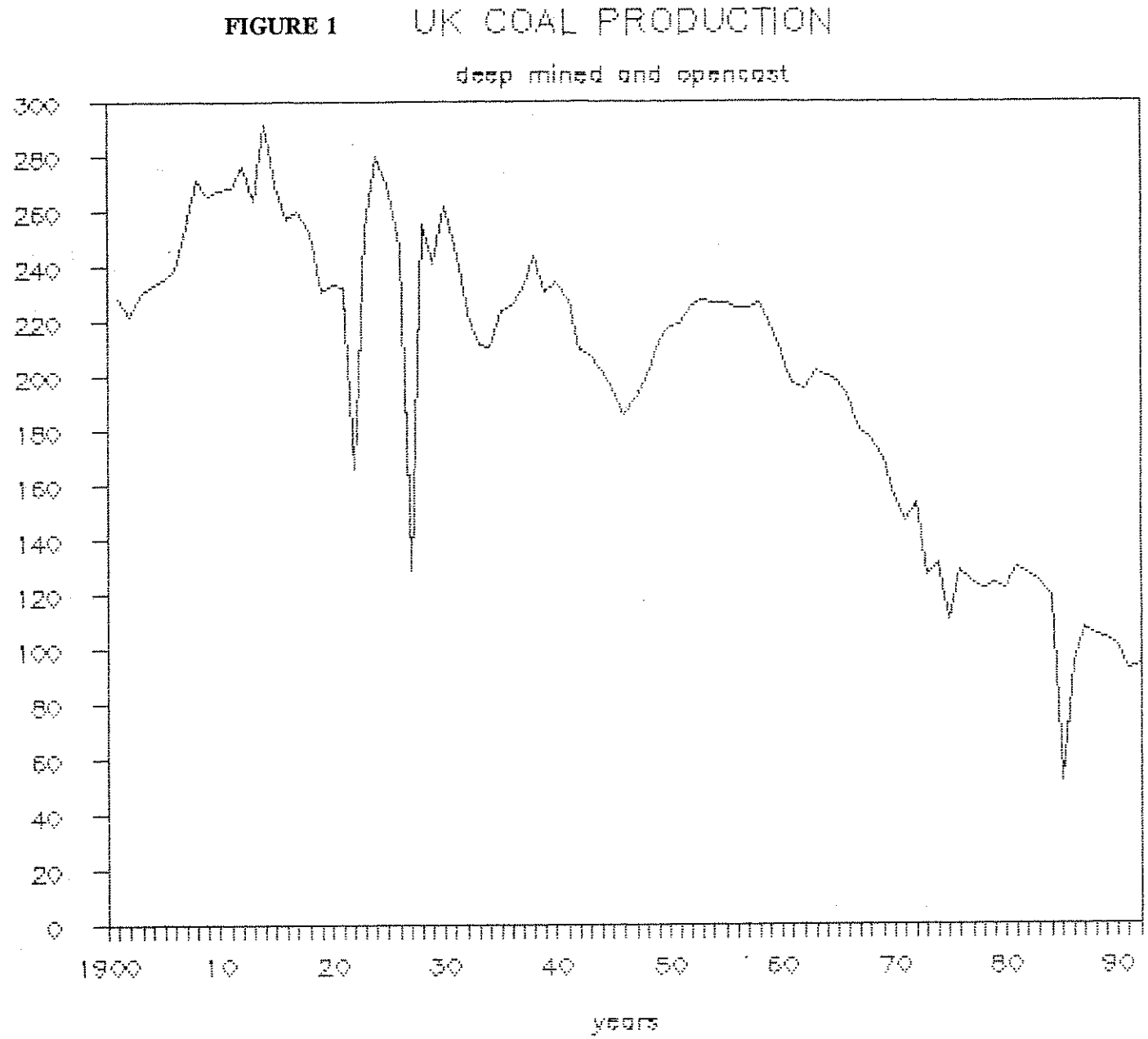
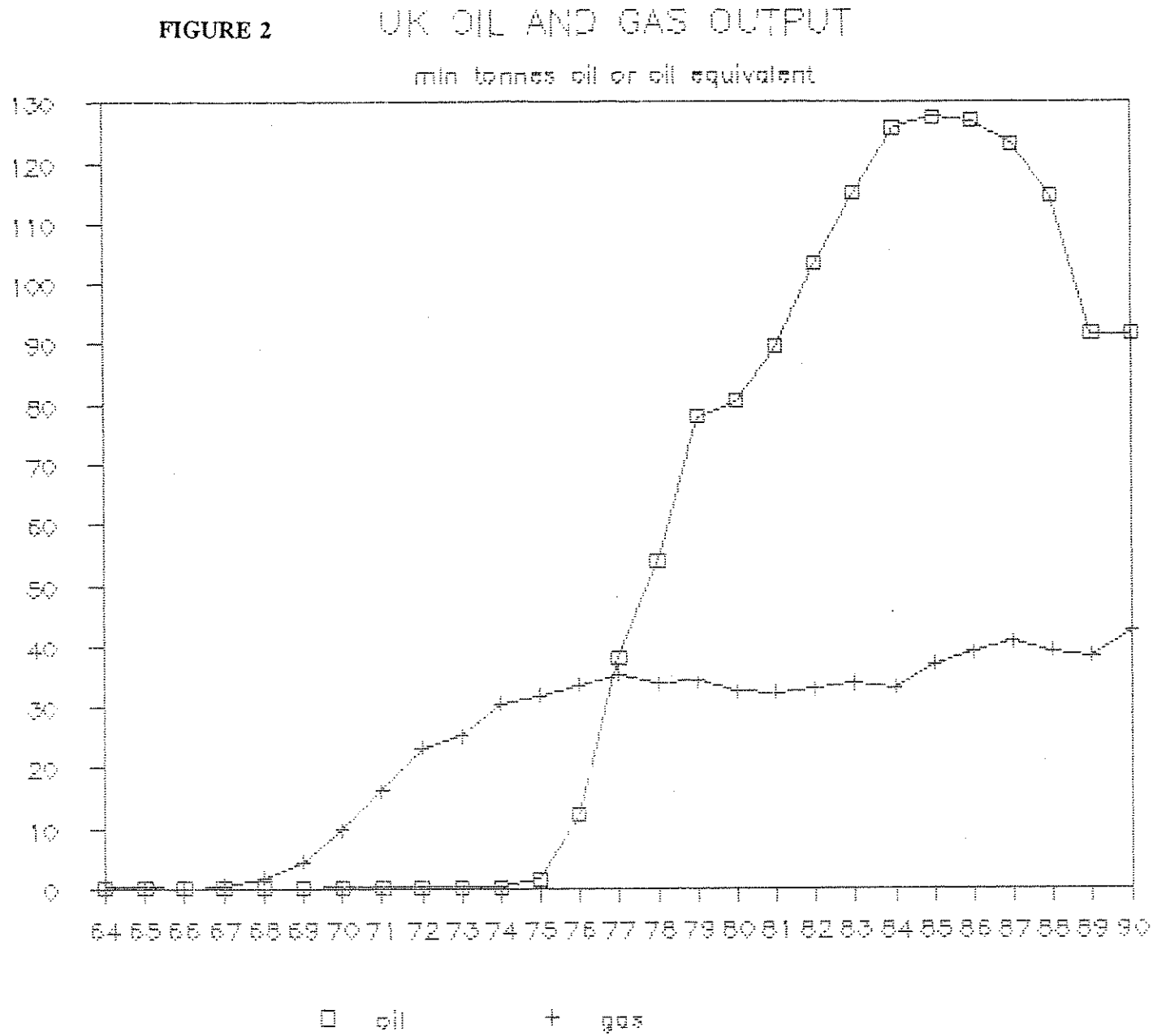

UK COAL PRODUCTION
deep mined and opencast
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
million tonnes
1900
10
20
30
40
50
60
70
80
90
years

FIGURE 2


UK OIL AND GAS OUTPUT
mln tonnes oil or oil equivalent
130
120
110
100
90
80
70
60
50
40
30
20
10
0
64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90
oil
gas

2. Trends in consumption and supply

Table 1, expressed in coal equivalent, illustrates overall trends in fuel consumption and supply from 1950 to 1990. More detailed comments on particular fuels are in section 3.2 below. The intermediate years in Table 1 are selected so as to reveal postwar energy trends: in 1960 the postwar decline in coal had just begun, 1973 is the year of the first oil "shock" and 1985 is the year of peak North Sea oil output. A crude self-sufficiency ratio is shown at the foot of the table, not because "self-sufficiency" has any economic significance[2] but simply to summarise movements in the ratio of production to consumption.

2.1 Substitution for coal, 1950-1973

Using Table 1 for reference, three sub-periods can usefully be distinguished. The first is from 1950 to 1973. During these years total British fuel production was declining gradually. Coal output fell sharply from about 220 million tonnes in 1950 to just below 200 million tonnes in 1960 and then to only about 130 million tonnes in 1973 (that is, by 40 per cent over the period as a whole) but this decline was partly offset by rising production of natural gas (discovered in the southern basin of the British North Sea in the mid-1960s) and to a much lesser extent by increasing quantities of nuclear-generated electricity.

During this period of falling indigenous fuel supplies,total fuel consumption in Britain was, as in other European countries, increasing substantially. It rose about 60 per cent between 1950 and 1973, equivalent to an annual average compound rate of increase of about 2 per cent at a time when the rate of increase of real GDP was some 3 per cent per annum. Thus the crude energy coefficient (the ratio of the percentage rate of increase of total fuel consumption to the rate of increase of real GDP) was approximately 0.67. Fuel consumption per unit of GNP declined by about 20 per cent over the twenty three years.

Oil consumption rose particularly fast. In 1973 oil consumption was over six times what it had been in 1950 and oil's share of the fuel market had risen from 13 to 50 percent. Instead of being primarily a transport fuel, oil was by the early 1970s used extensively for burning in power station and industrial boilers and was the main source of raw material for the petrochemical industry. Natural gas began to penetrate the market from the late 1960s onwards: by 1973 it had 11 percent of the British fuel market as it became the preferred fuel for household heating and began to substitute for coal in industry and commerce. Coal suffered badly from oil and gas competition; its market share fell from 87 per cent in 1950 to 70 per cent in 1960 and then dropped rapidly to only 35 percent in 1973.

TABLE 1

UNITED KINGDOM FUEL PRODUCTION AND CONSUMPTION 1950-1990

	1950 mtce	% of total	1960 mtce	% of total	1973 mtce	% of total	1985 mtce	% of total	1990* mtce	% of total
PRODUCTION										
Coal	219	100	198	99	132	70	94	24	93	27
Oil	-	-	-	-	1	1	217	54	156	44
Hydro	1	-	2	1	2	1	2	1	3	1
Nuclear	-	-	1	-	10	5	22	5	24	7
Natural gas	-	-	-	-	43	23	63	16	72	21
TOTAL	220	100	201	100	188	100	398	100	348	100
CONSUMPTION[1]										
Coal	208	87	199	70	133	35	105	30	109	30
Oil	30	13	84	29	193	50	134	39	141	39
Hydro	1	-	2	1	2	1	2	1	3	1
Nuclear	-	-	1	-	10	3	22	6	24	6
Natural gas	-	-	-	-	44	11	82	24	83	23
Imported electricity[2]	-	-	-	-	-	-	-	-	5	1
Total	239	100	286	100	382	100	345	100	365	100
Self-sufficiency ratio[3]	0.92		0.70		0.49		1.15		0.96	

1 home consumption, including non-energy uses, and bunker fuel
2 from France
3 production divided by consumption

* partly estimated
\- means less than ½ mtce or less than ½%

Sources: Department of Energy, Digests of UK Energy Statistics, Energy Trends

Similar declines in indigenous production relative to consumption can be observed in the 1950s and 1960s in other European countries with old-established coal industries which suffered from the competition of low-priced oil and gas. In Britain's case, as the share of imported oil in energy consumption rose the ratio of home fuel production to home fuel consumption fell from 92 per cent in 1950 to 70 per cent in 1960 and 49 per cent in 1973.

2.2 Rising production, falling consumption, 1973-1985

In the second sub-period, from 1973 to 1985, there was a remarkable change in fuel market trends in Britain. Indigenous production, which had been falling, increased very sharply -indeed it more than doubled, despite a continued fall in coal output, principally because of the rapid development of North Sea oil. The first few barrels of crude oil from the North Sea were produced late in 1975: by 1985 oil output was nearly 128 million tonnes - equivalent to 217 million tonnes of coal or over 50 per cent of Britain's indigenous fuel production - and Britain was the world's fifth largest oil producer. Production of North Sea natural gas also increased considerably as did output of nuclear-generated electricity.

Indigenous consumption, which had been rising before 1973,also changed direction. Between 1973 and 1985 total fuel consumption dropped by almost 10 per cent, even though real gross domestic product increased by 17 per cent. Consequently, fuel consumption per unit of real GDP declined by some 23 per cent over the period. Further comments on the increasing aggregate efficiency of energy use in this period are in 3.2.2. below.

There were also significant changes in the composition of British energy demand. Sales of oil fell particularly fast - by over 30 per cent - and its market share dropped from 50 percent in 1973 to only 39 per cent in 1985. Coal sales also fell considerably between 1973 and 1985 though both output and consumption of coal were depressed in 1985 by the miners' strike of 1984-85 and its aftermath. Natural gas was the fastest expanding energy source: its sales almost doubled and its market share rose from 11 per cent in 1973 to 24 per cent by 1985. Consumption of nuclear-generated electricity more than doubled between 1973 and 1985, though its market share remained small, at around 6 per cent

A combination of rising fuel production and falling fuel consumption between 1973 and 1985 caused a sharp increase in the self-sufficiency ratio from 0.49 in 1973 to 1.15 in 1985. So, in just over a decade, Britain had by the mid-1980s once again became a net exporter of fuel, as it had been before the Second World War. The difference in 1985 was that the exports were primarily crude oil rather than coal as in prewar times.

2.3 Rising consumption, falling production, 1985-1990

The third sub-period covers the last five years during which time some of the trends of the 1973-85 period have been reversed. Production of North Sea oil fell from nearly 128 million tonnes in 1985 to only about 92 million tonnes (156 million tonnes coal equivalent) in 1990. A slight decline was expected in this period but, in the event, it was accentuated by a serious accident to the Piper Alpha platform in July 1988, by some other less serious accidents and by subsequent actions taken to improve safety offshore. Primarily as a consequence of lower oil output, total indigenous fuel production fell about 13 per cent from 1985 to 1990.

Fuel consumption, on the other hand, increased by over 5 per cent, though it remained lower than in 1973. Energy consumption per unit of GDP declined more slowly than in the energy "crisis" years - at 1 per cent per year or about the same rate as in the pre-1973 period. Oil consumption increased in the second half of the 1980s as a consequence of lower oil prices, though late in 1990 - following the rise on crude oil prices resulting from the Gulf crisis - it was falling again. For 1990 as a whole oil sales were about 5 per cent higher than in 1985 so that oil's market share remained approximately the same as in 1985.

Coal consumption also increased by some 5 per cent between 1985 (when it was still depressed in the aftermath of the 1984-85 miners' strike) and 1990. Natural gas sales were virtually unchanged between 1985 and 1990. Consumption of nuclear-generated electricity rose about 2 mtce (10 per cent) as new reactors were commissioned. From 1986 onwards, electricity was imported from France via a cable under the Channel: by 1990 these imports were equivalent to about 5 million tonnes of coal or the output on base load of a 2000 MW power station.

As production fell and consumption increased between 1985 and 1990, the self-sufficiency ratio declined from 1.15 in 1985 to 0.96 in 1990.

3. Analysis of demand trends

3.1 Principles

Some special features of fuel markets determine the speed at which demand adapts to disturbances such as relative fuel price changes[3]. They need to be examined briefly before one can comment sensibly on the demand trends discussed above.

One particularly significant characteristic of the demand for any fuel is that, though the fuel itself is evidently a"non-durable", it is invariably in complementary demand with a

durable good since fuels require equipment which consumes them(for instance, cars, heating appliances or power station boilers)[4]. Sometimes the durable is specific to one type of fuel; less frequently, fuels can be switched without changing the durable (as where a boiler can burn oil or gas or a consumer has both oil and gas fired equipment).

Because of this complementarity, fuel markets take on some of the characteristics of durable goods markets. In particular,there may be much longer time lags in the market's response to variations in the determinants of demand than one would normally expect of a non-durable market. At any given time,fuel consumers hold a stock of fuel-using equipment which embodies considerable sunk costs. The presence of these sunk(unavoidable) costs imparts significant inertia to fuel markets. In general, consumers who need to invest in new equipment if they are to switch fuels, will proceed to do so only if the net present value (npv) of the costs of making the change appears less than the npv of the costs of running existing equipment. Since the avoidable costs of making the change include capital as well as operating costs whereas the avoidable costs of retaining existing equipment are operating costs only, it takes big price variations or other disturbances to stimulate fuel-switching. Moreover, since most fuel-switching decisions are investment decisions, consumers will not act simply on the basis of short run price changes but on their long run price expectations which may or may not alter as prices vary in the short run.

Inertia is present also because at any time there is an infrastructure specific to particular fuels (for example, a transport and distribution system principally dedicated to moving oil products around a country). Because the physical characteristics of fuels differ, their transport and distribution infrastructures differ also. At any point in time when there are significant variations in relative prices or other determinants of demand, demand response is likely to be inhibited by the sunk costs embodied in the infrastructure. Thus a sudden sharp increase in (say) the price of oil in an economy depending primarily on oil for its energy supply takes many years to become incorporated in the market as the equipment stock held by consumers and the infrastructure adjust to the new price ratios. Of course, other changes in demand determinants are likely to occur as the market is adapting. Consequently, consumers and producers may well be very uncertain much of the time which way the market is moving:their uncertainty influences their decisions and may well lead to periods of "under-investment" followed by "over-investment"so that the market swings from one side of equilibrium to the other.

A further complication in analysing the demand for fuels is that some fuels (coal and oil, for example, though not electricity) can readily be stored. Thus there are likely to be

both speculative and precautionary elements in demand. Consumers may, for instance, build up stocks of oil - thereby temporarily inflating demand, if they anticipate a price increase of sufficient size that it would more than offset the interest and other costs of stockholding. Or they may accumulate stocks of coal for precautionary reasons if they fear a coal strike.

Thus arguments of principle - now supported by a good deal of empirical evidence from many countries - suggest that energy markets are likely to be characterised by long time lags in demand response[5]. The immediate effects of changes in relative prices are likely to be confined to fuel switching by those consumers who can do so with little or no investment and to some behavioural changes (such as minor energy "conservation"measures which in effect substitute labour or management for fuel). As time passes, however, investment will take place in an attempt to bring the actual stock of equipment into line with the desired stock (based on the determinants of demand)and to align the actual infrastructure with the desired infrastructure. The technological characteristics of the equipment stock and the infrastructure will also respond: for example, car manufacturers will produce more fuel efficient vehicles in reaction to a period of increased gasoline prices as they did in the 1970s and 1980s after the first two oil shocks.

Thus there are good reasons of principle to believe that the demand for any fuel will be much more elastic with respect to its own price and to the prices of substitutes in the long run than in the short run (unless there is a high proportion of dual or multi fired equipment in the country concerned so that fuel-switching can occur without investment). It is to be expected also that, at times, there will be significant inventory variations which will make it difficult to identify the underlying trend of demand.

3.2 Experience in Britain

Changes in relative fuel prices have clearly been a powerful force in Britain's energy market in the postwar period though, especially in the second sub-period identified above, the process of adjustment has been rather slow for the reasons given above.

3.2.1 The early postwar years up to 1973

The large-scale substitution of oil for coal during sub-period one demonstrates the power of relative fuel price changes to move markets. During most of that period the British coal industry, like other West European coal industries, was still relatively labour-intensive: labour and associated costs constituted more than half total costs[6]. Productivity increases did not keep pace with increases in labour earnings and consequently coal prices to consumers rose.

The prices of oil products, however, were tending to fall. World crude oil prices in nominal terms hardly changed from 1950 to 1970 (Figure 3) and indeed some discounting by suppliers probably meant that they declined a little. Certainly they were falling relative to the general price level - probably by about 2½ per cent per annum in the 1950s and 4 per cent per annum in the 1960s[7]. Other oil company costs (such as transportation, refining and marketing) fell too and consequently the prices of oil products fell in real terms and in some cases in nominal terms.

There was widespread substitution for coal, especially of products such as fuel oil which are very close substitutes. From 1950 to 1973 sales of oil products (Table 2) grew at an average annual compound rate of about 8½ per cent. Growth was comparatively modest in fuels for motor transport. But fuel oil sales rose at over 11 per cent a year on average and sales of gas oil (other than motor diesel) at 10 per cent per annum. By 1973 the share of fuel oil in total oil product sales in the United Kingdom was 40 per cent compared with only 21 per cent in 1950. Aviation turbine fuel was another very fast growing product.

Table 3 shows the relative movements of coal and heavy fuel oil prices in the 1970s. Even though coal prices increased only slightly in the first half of the 1960s, coal's competitive position relative to fuel oil deteriorated considerably as oil prices fell. Indeed, in most years in the 1960s, measured on a pence per therm basis, delivered coal prices appear to have been higher than delivered fuel oil prices, though coal needs to be priced lower than fuel oil in order to overcome its inherent disadvantages such as higher associated labour and land costs (for example, handling and maintenance costs and greater space requirements): in the power station market, for instance, it is estimated that coal prices need to be about 1 p per therm lower than oil prices if coal is to be chosen in preference to oil in existing plant[8]. As Table 3 shows, even when oil prices first started to rise in the early 1970s, the competitive position of coal did not improve, except very briefly in 1971: after an initial rise fuel oil prices began to fall again between 1971 and 1973 whereas coal prices increased.

By the end of this period, from 1950 to 1973, in which coal was being priced out of the market, its share of British fuel consumption had declined from 87 per cent to 35 per cent (Table 1). Some of coal's traditional markets - such as gas-making and the railways - disappeared completely. In other markets, except for power generation where coal was protected and its sales rose substantially, coal consumption dropped sharply. In the industrial market, for instance, where competition was particularly intense in the 1960s, coal consumption fell by over 50 per cent and its market share fell from 65 per cent in 1960 to 25 per cent in 1973 (Table 4). Oil's share rose from 21 per cent to 44 per cent and the

FIGURE 3

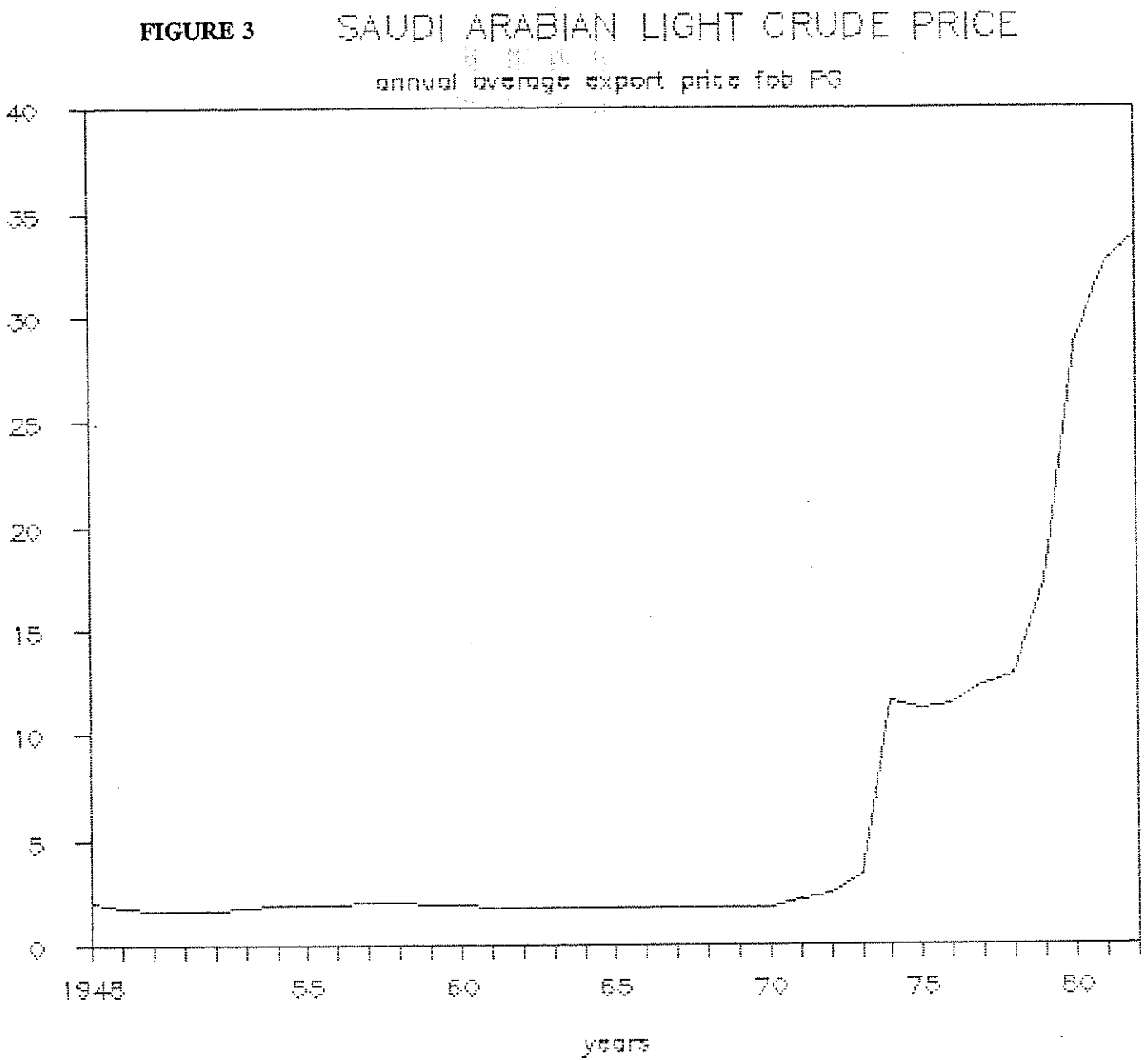

SAUDI ARABIAN LIGHT CRUDE PRICE
annual average export price fob PG
40
35
30
25
20
15
10
5
0
$ barrel
1948
55
60
65
70
75
80
years

TABLE 2

UK DELIVERIES OF PETROLEUM PRODUCTS FOR INLAND CONSUMPTION

thousand tonnes

	1950	1973	1985	1990	Annual average compound rates of change % 1950-73	1973-85	1985-90
Motor gasoline	5,278	16,927	20,403	24,312	5.2	1.6	3.6
Motor diesel	1,050	5,658	7,106	10,652	7.6	1.9	8.4
Other gas oil	1,621	14,594	9,711	8,046	10.0	-3.3	-3.6
Aviation turbine fuel	179	4,202	5,007	6,589	14.7	1.5	5.7
Fuel Oil	3,142	39,447	15,969	11,997	11.6	-7.3	-5.6
Non-energy uses	1,887	11,591	8,482	(12,349	8.2	-2.6	(1.3
Other	1,703	7,367	3,103	(	6.6	-7.0	(
TOTAL	14,860	99,786	69,781	73,945	8.6	-2.9	1.2

Source: Ministry of Power, Statistical Digest, 1964, Table 136
Department of Energy, Digest of UK Energy Statistics 1990, Table A8
Department of Energy, Energy Trends, February 1991

TABLE 3

DELIVERED PRICES OF COAL AND OIL USED BY UK MANUFACTURING INDUSTRY

pence per therm

	Coal	Heavy Fuel Oil*	Coal price as % of oil price
1960	2.04	1.98	103
1961	2.11	1.81	117
1962	2.19	2.03	108
1963	2.19	1.91	115
1964	2.19	1.79	122
1965	2.19	1.67	131
1966	2.23	1.77	126
1967	2.15	2.06	104
1968	2.08	2.25	92
1969	2.11	2.22	95
1970	2.53	2.22	114
1971	3.02	3.33	91
1972	3.25	3.18	102
1973	3.40	3.11	109

* including tax

Source: Department of Energy, Digest of UK Energy Statistics, 1975, Table 86

Department of Trade and Industry, UK Energy Statistics, 1973, Table 100

TABLE 4

ENERGY CONSUMPTION IN UK INDUSTRY

1960 AND 1973

	1960		1973	
	million therms	% of total	million therms	% of total
Coal & other solid fuel	13,903	65	6,544	25
Gas*	1,413	7	5,109	20
Electricity	1,519	7	2,732	11
Oil+	4,516	21	11,464	44
TOTAL	21,351	100	25,849	100

* town gas, natural gas and coke oven gas

\+ including small quantities of creosote/pitch mixtures

Sources: Department of Trade and Industry, UK Energy Statistics, 1973, Table 10

Department of Energy, Digest of UK Energy Statistics, 1975, Table 10

share of gas increased from 7 to 20 per cent. So, instead of being supplied two thirds by coal as in 1960, by 1973 two thirds of the industrial market was supplied by oil and gas.

The rate at which substitution of oil for coal proceeded,almost from the beginning of the postwar period up to the early 1970s, might seem surprising given the reasons of principle suggested above for anticipating relatively slow adjustment to relative price movements in energy markets. The probable reason is that Britain's stock of industrial equipment, and also its transport infrastructure, had been seriously run down during World War Two so that much of it was ripe for replacement by the early 1950s. Substitution of oil-fired equipment for coal-fired equipment therefore occurred faster than might have been expected in more normal circumstances.

3.2.2 The oil shocks and the early 1980s

In the second sub-period, there was a much faster decline in energy consumption per unit of GDP (see 2.2 above), as would be expected given the sharp increase in the price of energy relative to the prices of other productive factors. To demonstrate how the trend changed, Table 5 shows energy consumption per unit of real GDP for each of the years given in Table 1. In Table 5, however, the figures relate to energy consumption (not fuel consumption, including non-energy products, as in Table 1) and they are corrected for temperature variations so that they relate to roughly standardised weather conditions. In each of two earlier postwar periods shown in Table 5 (1950-1960 and 1960-1973), energy consumption per unit of GDP declined at about 1 per cent per annum. But between 1973 and 1985, the rate of decline more than doubled to over 2 percent per annum. Subsequently, during the years 1985 to 1990 (see 3.2.3 below) the rate of decline reverted to its earlier postwar trend, presumably because of the drop in energy prices. 1973-1985 therefore stands out, as one would expect, as a period when aggregate energy efficiency was increasing particularly fast.

Another feature of the sub-period is the much greater inertia of fuel demand than in the earlier postwar years. When oil prices first rose sharply in 1973, it was at the end of over twenty years in which oil had been substituting for coal. The equipment stock was therefore dominated by modern oil-fired appliances which consumers would replace only if there was a very big price differential in favour of some other fuel. The transport system was also geared principally to the distribution of oil products. Moreover, there was considerable doubt in the early and mid 1970s whether the new, increased price level would persist: consequently, long term price expectations remained unaltered for a while.

TABLE 5

INDEX OF UK PRIMARY ENERGY CONSUMPTION PER UNIT OF GDP

1950 = 100

	Total inland consumption of primary energy*	Gross domestic product at factor cost+	Inland energy consumption per unit of GDP
1950	100	100	100
1960	119	130	92
1973	156	195	80
1985	142	229	62
1990	156	266	59

* temperature corrected
\+ average estimate

Source: Derived from Department of Energy, Digest of UK Energy Statistics, 1990, Table A5

The early effects of the oil price increases appeared quite small in comparison with the scale of the two oil shocks of 1973-74 and 1979-80. Measured from the lowest point of crude prices in early 1970 (about $1.25 per barrel) to the highest point crude spot market prices reached early in 1981 ($42 per barrel), the increase was some 34 times[9]. Even after correction to real terms, using the UN index of prices of world manufactured products, the increase was around ten times. But,of course, most consumers do not buy crude oil: the price increases which faced them (after taxes and oil company costs other than crude oil) were on a lesser scale though still very substantial. Table 6 shows some comparisons between the increase, from early 1970 to early 1981, in the prices of exported crude oil and in the prices of fuel oil, heating oil and gasoline in Britain[10]. The price of fuel oil rose about twelve times, retail gas oil about eight times and gasoline about four times.

For a few years, the response to these price increases was rather limited. Oil sales fell in 1974 and 1975 but then started to increase slightly again as the economy began to recover from recession. In 1979, UK oil consumption was only some 17 per cent less than it had been in 1973. It was not until after 1979 that oil consumption became set on a clear downward trend which lasted until the mid-1980s. At its lowest point in 1983 oil consumption was about 36 per cent lower than in 1973.

Over the period 1973-85 as a whole, as Table 2 shows, there was continued though slow growth in oil products used for transport (motor gasoline, motor diesel and aviation turbine fuel). But consumption of products which were in competition with natural gas and coal, such as fuel oil and gas oil, fell very substantially. Fuel oil sales in 1985 (in which year they were still inflated by the after-effects of the 1984-85 miners' strike) were only 40 per cent of what they had been in 1973; they constituted 23 per cent of oil product sales compared with about 40 per cent in 1973. There was also a considerable decline in sales of oil for chemical feedstock and other non-energy uses and in sales of kerosine (included in the "other" category in Table 2).

There were probably two reasons for the long time lag before oil sales responded significantly to the price increases. First, there was market inertia (for the reasons discussed above) which meant that the effects on consumption of the first oil shock were only just becoming apparent by the time they were reinforced by the impact of the second shock. The second reason is that price expectations did not change decisively until the second oil shock of 1979-80 which led to the expectation (mistaken as it turned out) that crude oil prices would rise into the indefinite future and thus prompted consumers to move away from oil.

TABLE 6

CRUDE OIL EXPORT PRICES AND OIL PRODUCT PRICES IN BRITAIN

1970 AND 1981

	SAUDI LIGHT CRUDE OIL	FUEL OIL	RETAIL GAS OIL	RETAIL GASOLINE
	fob, export port	delivered to large consumers	pence per litre	4 star pump price - price per litre inc. tax
	$ per barrel	£ per tonne		
1970	1.25*	8.3+	2.02*	7.15*
1981	42.00*	98.6+	15.80*	29.05*
1981 ÷ 1970	33.6	11.9	7.8	4.1

* January
\+ first quarter

Sources: Department of Energy, Digests of UK Energy Statistics, 1978, 1983, 1990

3.2.3 The last five years

After the second oil shock, crude oil prices stabilised, then drifted downwards for a few years before dropping sharply in the first half of 1986. Figure 4 illustrates the considerable swings in crude prices in the second half of the 1980s, using the average price of crude oil imported into International Energy Agency countries. A more sensitive measure is the price of Brent crude oil for prompt delivery: it had been nearly $30 per barrel in November 1985, but for a short time dropped to $8 per barrel in July 1986. As a consequence, oil product prices also fell.

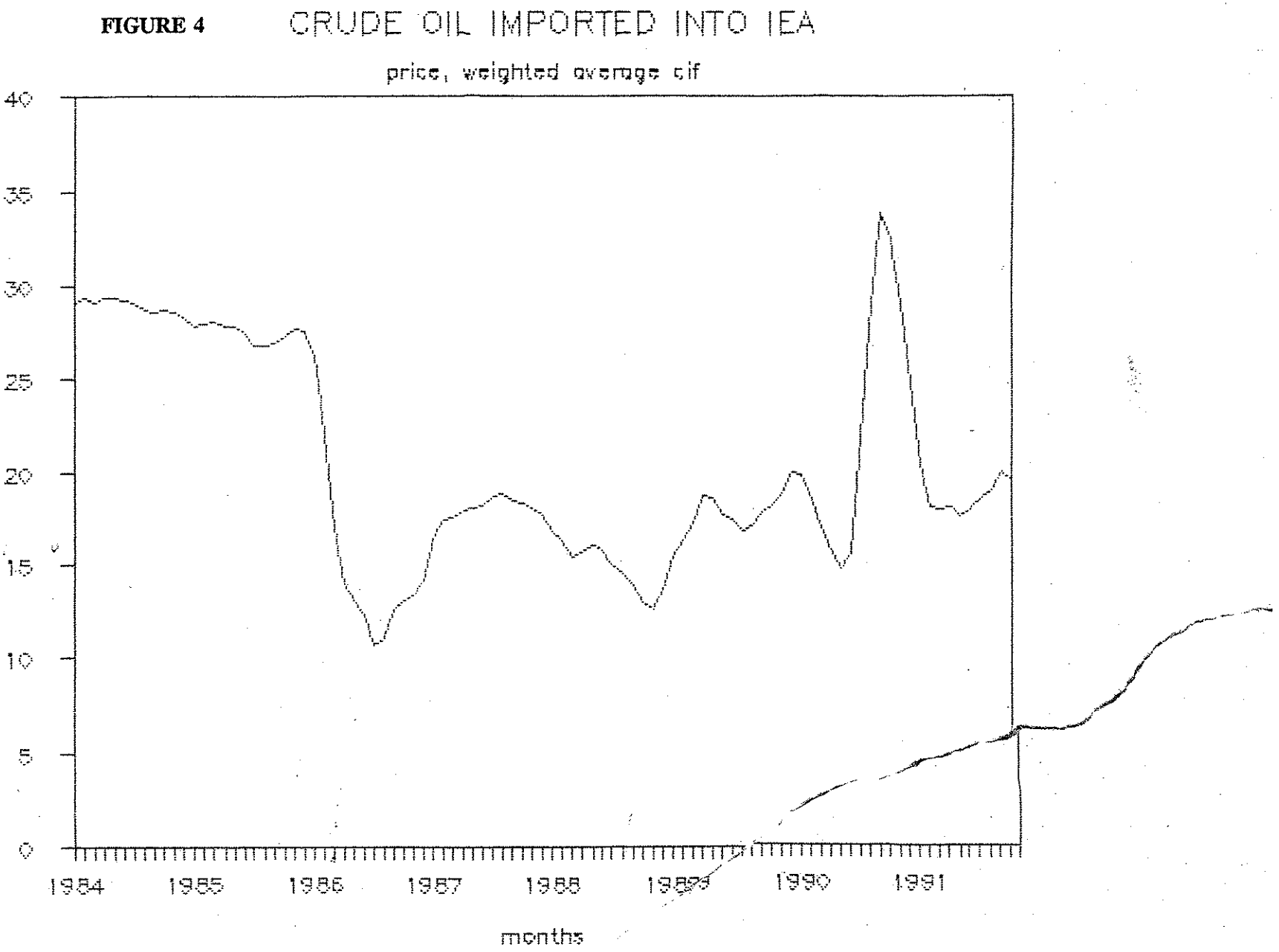
Over the next few years, crude prices generally remained in the range $15 to 20 per barrel (Figure 4) until August 1990 when Iraq's invasion of Kuwait temporarily sent the price of Brent crude to about $40 per barrel. However, crude prices then began to decline as the size of the supply increase by Saudi Arabia and other OPEC producers became apparent. On the outbreak of hostilities, the Brent price fell to about $20 again and went still lower as hopes of an end to the Gulf War rose and the war was then ended.

Oil product prices also declined sharply in 1985-86 and then remained relatively stable. The delivered price of heavy fuel oil to large industrial consumers was £181 per tonne early in 1985: by the third quarter of 1986 it was down to £54 per tonne (a 70 per cent decline). Over the same period the delivered price of gas oil more than halved to £112 per tonne. Although there was subsequently some recovery in prices, in the third quarter of 1990 the fuel oil price was still only about £70 per tonne and the gas oil price about £140 per tonne. Gasoline prices also fell from 41.6 pence per litre (4 star) in January 1986 to 38.4 pence a year later: not until early 1990 was the price of gasoline back to its early 1986 level.

Under the stimulus of much lower product prices than in the early 1980s, oil consumption began to revive. In 1990, as explained in section 2.3 above, despite some decline in oil sales late in the year as oil product prices increased, UK oil consumption was about 5 per cent higher than in 1985. Growth in oil consumption in the late 1980s was a consequence of much faster growth, compared with 1973-85, in oil products used for transport partly offset by continuing decline in sales of other products (Table 2).

A substantial part of the variation in oil product sales since 1950 is attributable to very large variations in fuel oil consumption (Table 2). After the rapid growth of the 1950-73 period and the sharp decline from 1973 to the early 1980s, fuel oil consumption showed no clear upward or downward trend in the later 1980s. Sales, which had dropped very fast from 41 million tonnes in the peak year of 1972 to just over 12 million tonnes in 1983, were also around 12 million tonnes in 1990. They did, however, fluctuate considerably

FIGURE 4


CRUDE OIL IMPORTED INTO IEA
price, weighted average cif
40
35
30
25
20
15
10
5
0
$ per barrel
1984
1985
1986
1987
1988
1989
1990
1991
months

from year to year. In 1984, and to a lesser extent 1985, they increased sharply because of much greater power station use during the miners' strike.

Subsequent smaller year-to-year variations around an approximately constant trend may be because, in reaction to the energy crises of the 1970s, a higher proportion of consumers now has the capacity to burn more than one fuel. Moreover, the two recently privatised electricity generators (see 5.3 below), which are subject to less political interference than in the past, already appear more responsive to changes in relative fuel prices than was the nationalised Central Electricity Generating Board. Since they have large multi-fuel systems, they are able quickly to vary the proportions in which they use fuels as market conditions change. Such variations have a considerable impact on total fuel oil sales since, in the last few years, almost half of fuel oil deliveries have been to power stations.

4. Analysis of supply trends

The two most significant supply-side trends in the postwar British energy market have been the decline of the British coal industry and the rise of North Sea oil and gas production. The decline of coal was primarily a demand-led phenomenon. Coal has inherent disadvantages as compared with liquid and gaseous fuels - for instance, associated labour and land costs are relatively high (see 3.2.1 above). But, assuming those disadvantages remained approximately constant during the postwar years, it was presumably relative price movements which resulted in the widespread displacement of coal by oil and natural gas. It did not appear possible in the old, established British coal industry for a sufficient supply-side response to occur - in terms, for example, of cost-reducing technological change which would have led to more competitive prices - to halt the decline.

As British coal production was declining, however, new energy investment opportunities emerged in the British sector of the North Sea. Development of the North Sea was remarkably fast[11]. The necessary legislative framework was set by the Continental Shelf Act of 1964 and exploration began soon thereafter in the southern basin of the North Sea. Success came early with British Petroleum's discovery of a relatively small gas field (West Sole) late in 1965. In the next three years several larger fields were found and, on the basis of these discoveries, consumer appliances and the whole of Britain's gas supply system were converted from manufactured gas to natural gas. The gas industry became one of the fastest growing sectors of the British economy, almost quadrupling its sales between the mid-1960s and mid-1970s.

Even more significant were the discoveries of oil in the northern part of the British North Sea (offshore mainland Scotland, Orkney and Shetland) which came from 1969 onwards. In the next six years, exploration was extremely successful: about every fifth well struck oil and about half of those discoveries appeared to be exploitable at a profit. It was in this period that most of the big fields in the British sector of the North Sea were discovered.

Exploration for oil, and investment to bring into production discoveries which were made, took place in an environment of sharply rising crude oil prices. Costs inevitably rose too, partly because of general inflation but also because oil production is itself energy-intensive and because of the pressure of demand on the industries supplying oilfield equipment and services. Nevertheless, a substantial margin of price over cost opened up during the 1970s and early 1980s which increased the expected profitability of North Sea oil investments and was undoubtedly an important reason for the very speedy development of the area (Figure 2). There were other factors as well. For instance, British governments were very anxious for indigenous oil reserves to be brought into production quickly to reduce expensive crude oil imports, to safeguard against the perceived insecurity of imported oil and to bring in additional tax revenues so as to reduce public borrowing. So, in the early days, the tax system and other aspects of government policy were conducive to investment in the British North Sea as compared with other oil-producing regions of the world. However, the remarkably rapid expansion of the North Sea oil industry was essentially market-driven; had crude oil prices remained at their pre-1970 level, it is very unlikely that there would have been so much investment concentrated in so short a period in a comparatively high-cost oil production area such as the British North Sea.

Economic theory suggests that the supply curve for North Sea oil is likely to be upward-sloping. The story of rapid development in an environment of much higher prices than in the earlier postwar period appears to confirm the positive relationship between price and the willingness to supply. There are, however, a number of complications in analysing the supply curve for a depletable natural resource which can be illustrated from British experience.

The link between supply and price is neither immediate nor direct[12]. Supply cannot react quickly to price variations in a new oil production area. Before there can be any supply at all, exploration must take place. Then, if there are discoveries, they have to be appraised. Following appraisal, if the tests are satisfactory, for a large or medium-sized field, there will be several years of investment as wells are drilled, production platforms are

designed, constructed and placed in position and as a pipeline or a tanker loading system is installed. Several years are likely to elapse (generally at least five) from the time when the market first signals, via an increase in price, that there are profitable investment opportunities in oil production to the time when some additional supplies reach the market. Such time lags on the supply side are inherent in all fuel markets. Sometimes, they are longer than for offshore oil. For example, if fuel-producing facilities are located onshore, delay may be caused by public opposition to the proposed site. Moreover, if the technology in question is one which arouses more general public opposition (as in the case of nuclear power) the supply time-lag may be very long.

Price declines also have lagged effects on output, as was made plain in 1985-86. Despite the sharp fall in prices between November 1985 and July 1986 (see 3.2.3 above), production of oil from the British North Sea in 1986 was almost identical with 1985 output - 127 million tonnes compared with 127.6 million tonnes.

The key to understanding how supply can be so inelastic with respect to price in the short run lies, as on the demand side, in the distinction between avoidable and unavoidable costs. Consider a company which is producing oil from a field when the price falls sharply as it did in 1986. A high proportion of the discounted value of its costs will be sunk - embodied in the capital equipment in which it invested to develop the field. Since these costs are bygones and since most of the equipment is specific to the field (unless a floating production facility is in use) and therefore is unlikely to have any alternative uses, the company should treat the sunk costs as irrelevant to its decisions about whether to continue in production and how much to produce. Provided price exceeds avoidable cost, each unit produced will make some contribution to fixed costs and so producing is better than not producing. In the British North Sea in 1986 when the price of Brent crude sank temporarily to $8 per barrel, producing was preferable to shutting down in virtually all fields because avoidable production costs were around $5 per barrel or less.

However, there is also the longer term supply reaction to be considered. If the price decline alters companies' long term price expectations, they will reduce spending in two areas - exploration and the development of fields already discovered. Such spending is much more sensitive to changes in view about prices than is spending on fields already in production because a much higher proportion of costs is avoidable and therefore relevant to decision-making. In the case of exploration, all costs are avoidable and so companies may decide - if their long run price expectations are depressed - to cut exploration spending substantially. As far as the development of new fields is concerned, if a field has been found

but there has been little investment in it, most of its costs lie ahead and most of its costs can be avoided if long term price expectations are sufficiently depressed.

For such reasons, there are long time lags with respect both to price declines and to price increases. The drop in crude prices in 1986 had virtually no immediate effect on North Sea oil output. It did, however, cause a substantial cut in oil company exploration budgets (typically of around 30 per cent)[13] which, assuming that the cancelled exploration would have found some oil, means less British oil production at some time in the future - probably in the second half of the 1990s.

The other effect of lower oil prices and their impact on expectations was to stop or delay the development of some finds which had already been made. It now seems that the principal effect was to postpone rather than to stop development of most of these fields because it turned out that field costs were partly a function of the expected price level. Prior to 1986 development plans had been made at a time when crude oil prices were expected to increase or at least not to fall significantly below about $30 per barrel. When it was demonstrated in 1986 that crude prices could fall well below $20 per barrel, oil companies began to search for lower cost methods of production and they were surprisingly successful (or, putting the point another way, they must have been operating well above minimum cost curves before 1986). Estimated development costs for some of the fields the development of which was postponed in the mid-1980s were cut by 30 per cent or more compared with the original plans.

5. Government energy policies

The demand and supply trends outlined above took place against a background of government policy measures which affected the energy industries. At times - as in the mid 1960s - there was a fashion for issuing White Papers which set out the energy policy of the government of the day. At other times, even though no such statements of policy were made, there were still many measures taken by governments - taxes, subsidies, direct controls and attempts to influence the actions of state and private corporations - which had significant effects on the energy market. Indeed, since three of the energy industries (coal, gas and electricity) were nationalised for most of the postwar years and since governments set financial targets and intervened extensively in the pricing and investment decisions of all the nationalised industries, it is obvious that governments were one of the main forces attempting to shape events in the British energy market.

5.1 From 1945 to the late 1960s: protecting British coal and promoting nuclear power

Apart from general control over the activities of nationalised industries, the principal element in the energy policies of successive governments was the support which they gave to the nationalised British coal industry. The origin of this support was in the very early postwar years when planning was in vogue, following Britain's wartime experiences when the economy had been extensively planned[14]. Coal accounted for almost 90 per cent of fuel consumption in 1950 (Table 1) and it evidently seemed at the time to be the only likely source of large energy supplies for the British economy. The Labour government of the day, concerned both about the balance of payments statistics and about energy security, was anxious to avoid dependence on imported coal.

The British coal industry had been starved of resources during the war: production had fallen from about 230 million tonnes in 1938 to only 187 million tonnes in 1945. Energy policy in the early postwar period consisted of efforts to expand the industry and, for a few years, those efforts had some success. By 1952 production of deep-mined and opencast coal reached its prewar level of 230 million tonnes. But that proved to be the postwar peak of British coal output (Figure 1).

Despite the efforts of the planners, consumers were beginning to turn away from coal for the reasons given in section 3 above. Between 1952 and 1957, coal output and home consumption of coal were fairly constant at a time of increasing energy consumption. But, from 1957 onwards, unsold stocks began to mount and output and consumption went into clear decline. In 1960, coal production was only 198 million tonnes and coal consumption was 199 million tonnes (Table 1).

At this time, the National Coal Board (NCB) and the National Union of Mineworkers (NUM) were powerful organisations in political terms. There were over 700,000 miners who enjoyed a good deal of public sympathy, principally because of their working conditions. It is hardly surprising that governments of both major political parties decided, when the postwar decline began, that the industry should be protected from the competition of other fuels.

Both the NCB and the NUM wanted governments to commit themselves to a minimum coal production target of 200 million tonnes a year. No government was willing to make such a commitment: nevertheless, Labour and Conservative administrations did provide support for coal on an increasing scale from the late 1950s up to the late 1980s in an attempt to moderate the rate at which output and employment were falling[15].

Politicians were for many years unwilling to state openly that coal, at the time Britain's only large indigenous fuel supplier, had resumed its long-term decline and that there was little governments could do to arrest that decline. Governments therefore acted, as they frequently do, with a series of instant responses to coal industry problems which, in the 1950s and 1960s, appeared urgent. No attempt was made to formulate a coherent strategy. Ministers probably felt that publication of an explicit fuel policy - which would inevitably have contained forecasts of continued decline in coal - would have caused them serious embarrassment. It was not until publication of two White Papers on Fuel Policy[16], one in 1965 and the other in 1967[17], that any effort was made to justify the policy of protection for coal which had been in operation for the previous ten years. By that time the long term nature of the decline in coal was quite obvious.

The two White Papers were essentially ex post justifications for a haphazard collection of measures affecting the fuel industries which had accumulated since the late 1950s. Neither took a new look at policy. The principal instrument which affected the terms of competition among the fuel industries was a tax on fuel and heating oils (equivalent, when first imposed in 1961 at 0.83 pence per gallon, to over 30 per cent of the pre-tax price of heavy fuel oil). This tax protected coal from oil competition but, whether intentionally or not, also gave some protection to nuclear power vis-a-vis oil in electricity generation and to natural gas which, by the late 1960s, was being produced from the British North Sea. The confusion which surrounded energy policy can be appreciated from the remark made by the then Chancellor of the Exchequer (Selwyn Lloyd) in introducing the fuel oil tax in his 1961 Budget that it was purely a "revenue duty"[18].

Other measures, primarily intended to protect British coal, were a ban on coal imports, a virtual ban on Soviet oil imports and preference for coal in the power generation and local authority markets. The nationalised coal industry's debts were written down in 1965 and assistance was provided for miners displaced by the contraction of the industry. Later, as natural gas production began, governments let it be known that the Central Electricity Generating Board (CEGB) would not be permitted to burn more than token volumes of natural gas in its power stations. The virtual ban on gas sales for power generation was principally intended to protect coal in its main market.

Several important steps affecting civil nuclear power were also taken in the 1950s and 1960s[19]. Governments of both major parties promoted nuclear power programmes, supporting the technology with large sums of money, presumably because it appeared to them to be a means of filling the "energy gap" which they foresaw and of diversifying fuel

supplies. The Atomic Energy Authority (AEA), formed in 1954, was a strong pressure group which succeeded in persuading the government that Britain should embark on a nuclear power programme based on Magnox reactors (which used carbon dioxide as a coolant and graphite as a moderator). The first nuclear power programme, announced in 1955, was aimed at building twelve stations with a total capacity of between 1500 and 2000MW by 1965. Within two years, following the 1956 Suez crisis and an upsurge of optimism about the prospects for nuclear power, the programme was approximately tripled in size to 5000-6000MW. However, following numerous technical problems, the CEGB became disillusioned with Magnox: the programme was reduced in size to 5000MW and extended in time to 1968.

Despite the problems with Magnox, a second nuclear power programme followed, after a 1965 appraisal which purported to demonstrate that the British designed Advanced Gas Cooled Reactor (AGR) was superior on technical and economic grounds to the US Boiling Water Reactors with which it was compared. The AGR was an AEA design which was essentially a more advanced version of Magnox which used enriched uranium and operated at higher temperatures. The target for the second programme, announced in 1965, was 8000MW of AGR capacity by 1975; in 1978, two more AGRs with a combined capacity of about 2500MW were added. However, the plans fell far behind schedule. Construction times were greatly in excess of those anticipated, operating problems arose and costs turned out to be much greater than originally predicted. By 1990 about 7300 MW of AGR capacity was in commission.

By the late 1960s, it was plain that British energy "policy", directed first at sheltering the nationalised coal industry and second at promoting nuclear power, had produced various unfortunate side effects. The protective regime raised energy prices in Britain and provided an environment in which competition among the fuels was limited. In the electricity supply industry, fuel choices were heavily influenced by government: the insistence on using British coal and British designed nuclear power plant clearly increased generating costs which were passed on to consumers by the monopoly generator (the CEGB). Taxation of oil blunted competition from the oil companies not only for coal and nuclear power but also for the emerging natural gas industry. Even the oil companies were to an extent sheltered from competition by the exclusion of Soviet oil and overseas coal. Policy provided something for everyone, though there is no doubt that British coal was favoured above others.

5.2 The late 1960s to the mid-1980s

For several years after publication of the 1967 White Paper, there were no very significant changes in British energy policy although the trend towards increasing support for indigenously-produced fuels continued. The fuel oil tax was increased to 1 p per gallon in 1968, the NCB's accumulated deficits were written off after miners' strikes in 1972 and 1973-74, the value of the Board's assets was written down again in 1973 and a Coal Industry Act in 1973 provided for £720 million in grants over the subsequent five years.

However, Britain's fuel situation was changing towards what the 1967 White Paper described as a "four fuel economy". Nuclear power was the third fuel (after coal and oil); more important, natural gas discoveries in the North Sea had provided a new source of indigenous energy supply from 1968 onwards which governments wished to exploit rapidly.

Even more significant were the oil discoveries in the northern North Sea made from 1969 onwards (see 4 above). Discovery of the major British North Sea fields in the first half of the 1970s coincided with a period of rapidly rising crude oil prices. It was a time of general concern about future energy shortages and unease about dependence on imported oil. Consequently, just as the internal energy situation was changing fundamentally, the energy environment within which Britain operated also became radically different. Public awareness of energy matters was greatly enhanced from 1973 onwards as the news media concentrated on events in the oil market, treating the oil producers of OPEC and the industrialised countries as adversaries. Shortages of gasoline, electricity and other fuels focussed attention on the energy market.

In such circumstances, as the "energy issue" crossed the threshold of public awareness, politicians in Britain (and abroad) had an incentive to produce policies which would convince the electorate that they were active in dealing with the problems which had evidently emerged. The International Energy Agency was established in 1974 and the energy "crisis" assumed such political importance that world leaders met to discuss it at the Tokyo summit in June 1979.

In Britain, where North Sea discoveries and miners' strikes as well as the actions of OPEC received widespread media coverage, there was considerable government activity in the mid-1970s, much of it concerned with offshore oil[20]. An oil taxation regime was established by the Oil Taxation Act of 1975: as well as Corporation Tax and royalty, a new tax on production (Petroleum Revenue Tax) was applied. There were numerous changes to a rather complex system over the next few years but the general effect was that the marginal tax rate on profits from the fields developed in the 1970s was about 85 per cent.

State "participation" in the upstream oil industry also became an issue in Britain in the 1970s. The British National Oil Corporation, established by the Labour government's 1975 Petroleum and Submarine Pipelines Act, was intended to bring a state presence into the oil industry. It had certain privileges as compared with the private oil companies such as exemption from Petroleum Revenue Tax and representation on oilfield operating committees; 51 per cent state participation gave it the right to purchase over half the oil produced in the North Sea.

At about the same time, the Petroleum and Submarine Pipelines Act established a detailed mechanism for controlling the depletion rates of North Sea fields. In the mid-1970s, the government view was that production cuts and development delays might be necessary in the 1980s when indigenous oil production seemed likely to be well in excess of indigenous oil consumption. In the event, no production cuts were made and the development of only one field (Clyde) was delayed: even that development delay was probably not for depletion policy reasons, connected rather with an attempt to keep down public sector borrowing[21]. The absence of any significant depletion control measures was partly because Conservative governments from 1979 onwards were, in principle, against interference with oil company activities. More important, however, they were anxious to maximise tax revenues from oil production and to obtain other macro-economic benefits. In the peak year of North Sea tax revenues (1984/85), tax revenues from oil production amounted to about £12 billion which was equivalent to about two thirds of the yield from Value Added Tax in that year.

Policy towards the British coal industry also changed after the 1973-74 oil price increases, although the changes were modifications of existing measures rather than new departures. The government endorsed the National Coal Board's 1974 Plan for Coal[22] and its 1977 successor Coal for the Future[23] which aimed at expanding the industry. According to Coal for the Future, production of British coal would by the year 2000 increase by about 37 per cent to 170 million tonnes[24]. Coal subsidisation continued and the fuel oil tax was raised from 1 p per gallon to 2.5 p in 1977, 3p in 1979 and 3.5 p in 1980. The Conservative administration of 1979-83 at first seemed to want a progressive reduction in coal protection: it passed the 1980 Coal Industry Act which would have eliminated NCB deficit grants by 1983-84. However, after a threatened national miners' strike in February 1981, support for the coal industry was increased and coal imports for electricity generation were severely restricted.

Even though Mrs Thatcher's first administration did little to change Britain's energy policy, there were signs that it planned to do so in the future. The Department of Energy became very reluctant to publish energy forecasts and plans, emphasising instead the desirability of promoting competition in the energy market, allowing market forces to regulate supply and demand. Indeed, in the International Energy Agency's 1982 review of British energy policy, its rapporteur commented on the government's unwillingness to produce "most probable" supply and demand forecasts and to formulate "... a broad policy framework including a longer term supply picture"[25].

From 1982 onwards, several steps were taken which can now be seen as precursors of the energy privatisation programme which came in the Thatcher government's third term. The British Gas Corporation's monopoly and monopsony powers were reduced under the Oil and Gas (Enterprise) Act of 1982 and BGC's oil assets were sold as Enterprise Oil; BNOC's state trading arm was separated from its exploration and production activities which became Britoil and was later privatised; there were minor (and, as it turned out, ineffective) measures to facilitate private generation and distribution of electricity in the 1982 Energy Act; newspaper reports suggested that the electricity and gas industries might be candidates for privatisation; there seemed to be a threat to coal protection after publication of a critical Monopolies and Mergers Commission report[26].

But probably the most important event which affected energy policy in the mid-1980s was the miners' strike from March 1984 to March 1985, early in the second term of the Thatcher government. The result was generally perceived to be a victory for the government. During the strike and subsequently many pits were closed and many jobs were lost. From 180,000 on the eve of the strike the number of miners fell to only 60,000 at the end of 1990: the number of pits fell from 170 to 68. Although output from deep mines fell only about 20 per cent from 1983-84 (the year before the strike) to 1990-91, so that productivity rose substantially, the increase was insufficient to make British coal competitive with imports.

By the mid 1980s, the coal industry was no longer the economic, political and social force it had been in the earlier postwar period. Its lobbying power was diminished and the days of heavy protection for the industry seemed numbered. It is no coincidence that coal privatisation moved on to the political agenda around this time[27].

5.3 1985 to the present

In the last five years, British government policy towards the energy industries has been dominated by moves to denationalise the state energy corporations, selling them to private shareholders. However, towards the end of the period, it became clear that energy policy was increasingly being influenced by views, both in Britain and in the rest of the EEC, about environmental quality.

The privatisation programme as a whole dates back to 1981 when there was a 51 per cent flotation of shares in British Aerospace. The first act of energy privatisation was British Gas, sold to the public late in 1986.

5.3.1 Gas privatisation

Gas privatisation was condemned by many economists because of its failure to liberalise the gas market. During its nationalised period British Gas had enjoyed a monopoly of gas distribution through pipes and virtual monopsony rights in the purchase of natural gas from producers in the North Sea. As a result the Corporation had a very strong entrenched position in gas supply and a powerful bargaining position vis-a-vis North Sea gas producers. It would have been possible, on privatisation, to have divided the corporation into a number of regional gas distributors and a national pipeline company[28]. Such a division would have encouraged oil companies with gas production in the North Sea to have begun direct supply to larger consumers via an open access pipeline network or by constructing their own pipelines. Competition in gas supply would thus have been established. Instead, British Gas (BG) was privatised in essentially the same form as its nationalised predecessor. Anyone wishing to enter gas supply in Great Britain therefore faced an extremely strong and long-established incumbent supplier which also controlled the pipeline network.

Within a year there were complaints that BG was abusing its monopoly position in the industrial market and it was referred to the Monopolies and Mergers Commission (MMC). The MMC's report in October 1988[29] did not suggest any structural changes but it made a number of recommendations which are just beginning to stimulate some competition in the industrial gas market. The three most important were:

i) BG should not be permitted to contract to purchase more than 90 per cent of the output of new North Sea gas fields

ii) it should publish a schedule of gas tariffs to contract customers

iii) it should publish rates at which it would be willing to transport gas for other suppliers through its pipeline system.

The object of these recommendations was to reduce BG's monopsony power, freeing some North Sea gas for suppliers other than British Gas; to allow entrants and potential entrants to gas supply to large consumers to see what rates were being charged by BG; and to provide access for those entrants to BG's extensive pipeline network. The MMC also said that if competition in gas supply failed to develop in the next five years (that is, by October 1993) it would need to consider the need for further change.

The Office of Gas Regulation (Ofgas), headed by Mr James McKinnon, which has the duty to promote competition, has been assiduous in insisting that British Gas makes it possible for entry into gas supply to take place. It has proposed that the company relinquish its rights to some already contracted gas in order to speed up the introduction of competition, with the aim that 30 per cent of the firm contract gas market (excluding sales to power generation) should be supplied by BG's competitors by 1993[30]. In response, in January 1991 BG offered to surrender to competitors 150 million cubic feet a day of gas (equivalent to about 10 per cent of the industrial gas market). The gas would be available until October 1992 and would have to be repaid over the next five years[31].

More radical proposals to enhance competition were contained in a report by the Office of Fair Trading in 1991, the essentials of which were accepted by the government[32]. The main proposals, which were still under discussion with BG towards the end of 1991, are that the company should separate its pipeline and storage system from the rest of its operations, either by selling it or at least placing it in a separate subsidiary; that some of its contracted gas supplies should be sold to competitors; that gas imports should be freed; and that the prohibition on supply by competitors to consumers of less than 25,000 therms a years should be eased, with a new threshold of 2500 therms a year and possibly no limits at all from 1996 onwards.

Whatever the outcome of the discussions with British Gas, an important principle has been established and now accepted by the company - that the supply of gas to larger consumers in Britain should be competitive. Indeed, it is possible that before long quite small consumers will also have a choice of supplier. Competition seems bound to grow in the 1990s though it will be very slow emerging compared with the speed with which it would have developed had the government adopted a liberal privatisation scheme in 1986.

In power generation (excluded from Ofgas' 30 per cent target market share), some competition has already appeared. The virtual ban on the use of natural gas for electricity generation which governments maintained for so many years (see 5.1 above) has now been quietly forgotten. Both existing and new electricity generators (see below) are anxious to

instal new Combined Cycle Gas Turbine plant, for compelling cost and environmental reasons: there is considerable pent-up demand now that the ban has been dropped. Under the new gas regime, generators can buy from BG, or direct from a North Sea producer or purchase via an intermediary. The degree of competition which will emerge is, however, unclear since, because of BG's monopsony rights in the past, there is a shortage of gas not already contracted to it. Throughout most of 1991, BG was in dispute with Ofgas, the government and some large consumers over its attempt in March 1991 to raise the price of gas for power generation in order to ration supplies[33].

The power generation market for gas is potentially very large. Up to 10000MW of new gas-fired plant is planned by existing and new generators: capacity of that size would consume around 5000 million therms per annum of natural gas which is approximately equivalent to the size of the existing industrial gas market. Although some of this plant may not be started in the 1990s, because of higher gas prices or because the government intervenes to restrict the use of gas again, a big increase in the share of natural gas in Britain's primary fuel consumption (at present 23 per cent, see Table 1) seems very probable in the next ten years.

5.3.2 Electricity privatisation

The government's intention to privatise the electricity supply industry was announced in the Conservative Party's election manifesto of May 1987[34]. Under the electricity privatisation plan for England and Wales, set out in a White Paper of February 1988[35], the Central Electricity Generating Board has been divided into a transmission company (the National Grid Company) and two large generators (National Power and PowerGen). Twelve Regional Electricity Companies (RECs), based on their predecessor Area Boards, have also been established to distribute and supply electricity, though supply to larger consumers is subject to competition from the generators. By 1998, in principle there will be competition to supply all consumers. In practice, smaller consumers are likely for many years to be supplied by their local RECs and they will be protected from exploitation of local monopoly power by the Office of Electricity Regulation (OFFER). Regulatory price control is based on the RPI-X+Y mechanism common to the privatised utilities in Britain[36].

RECs are also permitted to generate a small proportion of the electricity they supply though it is not intended that there should be any substantial degree of vertical integration except in Scotland where changes in industry structure will be less than in England and

Wales. Scotland will continue to have two vertically integrated power companies (Scottish Power and Scottish Hydro)[37].

Comparing electricity privatisation with the earlier gas privatisation, the government seems to have learned from some of its mistakes[38]. For instance, it has established a separate transmission organisation, provided for open access to both the transmission network and local distribution systems at specified use-of-system charges and split the CEGB rather than leaving it whole as it did with British Gas. Nevertheless, there has been considerable criticism of the privatisation scheme, centred on the duopolistic structure of generation in England and Wales. Despite competition for the two generators from Scotland and from France, the strength of the incumbents seems likely to make entry difficult[39].

Another criticism in 1988 and 1989 was that the government tried to privatise nuclear power by embedding existing nuclear plant in National Power (the larger generator) which was also given responsibility for the new programme of nuclear construction of four PWRs which was then planned. However, the attempt to privatise nuclear power failed. It was received very badly by potential investors (as represented by the City of London) who were reluctant to invest in a company exposed to the kinds of unforeseeable risks they perceived to follow from operating existing nuclear plant and constructing new stations. In July 1989, the government decided to keep the existing ageing Magnox stations in the public sector; a similar decision about the AGRs was made in November 1989. Two new state-owned companies were established - Nuclear Electric for the English and Welsh nuclear stations and Scottish Nuclear for the stations in Scotland. Only one PWR (Sizewell 'B') is under construction: the proposal to build three more PWRs was dropped though it may be revived if the government carries out its plan to review nuclear power prospects in 1994.

There are some novel features of the new structure of the electricity supply industry in Britain which may lead to more competition in the generation and supply of electricity than exists in other countries. Though it is difficult to enter electricity generation because of the power of the incumbent generators, nevertheless since entry used to be impossible the new regime is an improvement on the old. Ease of entry will be the crucial test of whether the new structure will provide benefits: actual entry and credible threats of entry would make the incumbents behave as though they were in a competitive market. Entrants would compete in generation and, using their access to the transmission and distribution networks, in supplying larger consumers. The number of generation schemes planned by potential entrants (all using combined cycle gas turbines - see 5.3.1 above) is encouraging, though how many will come to fruition now that gas prices have risen remains to be seen.

The new pooling system, under which generators bid for places in the "merit order" for their stations, should result in cost reductions if the present duopoly is replaced by a number of competing generators though at present the pool appears open to manipulation by the duopolists. In addition to any such cost reductions, which would increase productive efficiency, allocative efficiency will also increase if there is more competition to supply consumers and prices are more closely aligned with costs. Some competition in supply has already appeared (between National Power, PowerGen, the Scottish companies and the RECs) and, if there are a number of entrants to generation, it should increase.

However, the significance of electricity privatisation goes beyond the British government's decision to return to the private sector a particularly complex industry. Just as important are the implications for energy policy and, as a consequence, for the British energy market as a whole. As explained in 5.1 above, the electricity supply industry had over the postwar period become the focus for most of the protective measures in the British fuel market. It was unlikely that it could be moved from the public to the private sector without undermining that protective structure. Support for coal, already threatened by the "defeat" of the National Union of Mineworkers in the 1984-85 strike, was bound to be questioned as fuel choice decisions in electricity supply (coal's biggest customer) came to be made by private companies rather than by nationalised corporations subject to strong political influence. For similar reasons, the policy of promoting nuclear power was also endangered by the privatisation of electricity.

Electricity privatisation thus seems likely to be the occasion (though by no means the sole cause) of fundamental changes in fuel policy. It came in 1990-91 as the culmination of a number of prior events all of which pointed in the direction of a less protectionist regime in energy: the most significant of those events were the coal strike and its outcome, gas privatisation and its aftermath, the end of the ban on gas sales for power generation, the EC's environmental regulations and a more hostile attitude to nuclear power in Britain after some revelations about its costs during the electricity privatisation debates.

The old regime has left the newly privatised generators with a mix of power plant - dominated by coal-fired stations, as Table 7 shows - which they consider inappropriate to the circumstances of the 1990s and which makes it costly for Britain to meet the European Community's large combustion plant directive[40]. The directive gives generators an incentive to move away from dependence on relatively high-sulphur British coal and at present no new coal-fired power stations are planned. In order to meet the directive, National Power and PowerGen plan to retrofit flue gas desulphurisation equipment to a limited amount

TABLE 7

NATIONAL POWER AND POWERGEN POWER STATIONS AT VESTING DAY

by type of fuel

	National Power		PowerGen	
	GWso	% of total	GWso	% of total
COAL	19.5	66	11.6	62
COAL/OIL	2.6	9	1.9	10
OIL	5.9	20	4.0	21
GAS TURBINE	1.6	5	1.2	6
HYDRO	0.1	-	0.1	1
TOTAL	29.7	100	18.8	100

Source: CEGB Statistical Yearbook, 1988-89, Table 11B

of existing plant (about 8GW). But both existing generators and entrants to generation intend to build new gas-fired plant (see above) and to import much more coal[41]. There seems little prospect of any more nuclear plant unless the government, after a review expected in 1994, revives the policy of nuclear promotion by the state[42]. By 1991 it seemed that the old fuel policy regime - devoted to the support of coal and nuclear power - was crumbling fast.

5.3.3 Privatising coal

Attention is now turning to privatisation of the coal industry which has been urged for many years by economists but which has only recently moved on to the political agenda[43]. It is reported that the Conservative party will include coal privatisation in its next election manifesto, fulfilling the pledge made several years ago that, if returned at the next General Election, it would privatise the British coal industry.

British Coal has been greatly reduced in size in the last six years as has the main mining union (the NUM). As explained in 5.2 above, the industry is no longer the political and economic force it used to be. Nor are there any natural monopoly elements in the industry to complicate the task of privatisation, as they did in the cases of gas and electricity. Nevertheless, there are some awkward issues to be faced[44].

First, there is the question of liabilities from the past - such as pension payments to miners already retired and subsidence from mining operations - which are large relative to the present size of the industry because of its rapid postwar contraction. Such liabilities may have to be assumed by the state.

Second, there is the issue of structure. All state monopolies which have so far been privatised have tried, with varying degrees of success, to retain as much monopoly power as possible by avoiding break-up. British Coal's management is also likely to try to have the corporation transferred intact to the private sector, arguing that actual and potential imports provide a sufficient threat for the gains from competition to accrue even if there is only one large British coal producer. Whether the government will be persuaded by such arguments remains to be seen.

Third is the matter of whether the corporation should be floated on the stock market for sale to private investors or whether it should be sold to one or more trade buyers. Clearly, given all the adverse publicity British Coal (and the NUM) have received in recent years, shares in the corporation are likely to appear a much less attractive proposition to individual investors than were shares in British Gas (which was sold as a monopoly) or the

Regional Electricity Companies with which investors could more easily identify. A sale to trade buyers, such as international mining companies, may therefore be the more likely route to privatisation.

Another awkward issue is whether, given the duopsony power of the electricity generators, the government should intervene to secure for British Coal or its successors long term contracts from the generators for greater quantities of British coal than they would freely take. British Coal's existing contracts (partly government-inspired), under which the two major generators agree to take 70 million tonnes a year for two years and 65 million tonnes for another year, expire in March 1993. If the generation duopoly remains, the government may be inclined to press the generators to renew their contracts (probably for smaller quantities) to reduce the rate at which the coal industry declines and to make privatisation easier.

5.3.4 Political uncertainties

Whether coal is privatised and the gas and electricity industries remain in their present forms depends partly on the result of the General Election of 1992. If Labour were to be returned, coal privatisation would almost certainly move off the agenda so long as the party was in power, there would probably be some changes in the gas and electricity supply industries and there might be some revival of coal protection. However, Labour is more opposed to nuclear power than are the Conservatives so there would be no resumption of nuclear building.

The principal changes would probably be in electricity supply. Labour has said that it would take back the national grid into some form of state ownership; because of the central place of the grid in the newly privatised electricity supply industry such a move would allow a considerable degree of state intervention in the affairs of the industry if the government so chose. Labour has also hinted that it might insist on a special place for British coal in the industry's fuel supplies which it could achieve, for instance, by limiting the use of gas in power generation and by persuading the generators to contract for large volumes of British coal. A future Labour government would be able to intervene extensively in the industry's affairs should it wish to do so because only 60 per cent of each generator has so far been sold to the public; the government is retaining 40 per cent of each for at least two years after the initial flotation, evidently in the hope that it will in the future be able to realise a higher price for its stake.

6. Some conclusions

The British energy market has experienced many upheavals in the last forty years. Up to 1973 consumers were becoming increasingly dependent on oil, supplemented by rising use of natural gas. Then there was a period of falling consumption of energy and especially oil, as oil prices rose sharply. Most recently, energy and oil consumption have shown signs of recovery and energy consumption per unit of GDP has been falling more slowly than in the energy "crisis" years.

Such trends in consumption are common to many industrial countries. What has been different in Britain is that new large-scale indigenous energy resources have been discovered and developed rapidly. Although the old-established coal industry resumed its decline in the late 1950s, finds of North Sea gas (in the 1960s) and oil (in the 1970s) laid the basis for a big increase in indigenous production of energy. Although North Sea oil production is probably past its peak, the British sector of the North Sea now provides oil and gas equivalent to about two thirds of Britain's indigenous energy output.

Energy policy, which until the late 1980s was principally concerned with protecting the nationalised coal industry and with promoting nuclear power, is also changing - generally in a more liberal direction. Privatisation of the energy industries has been an important driving force. Although the privatisation scheme for British Gas was not at all liberal, subsequent events have stimulated some competition in the gas market which may spill over into the electricity market since gas-fired generation is now perceived to be the lowest cost alternative for new generating plant. Moreover, it provides a low-cost means of escape from the environmentally damaging fuel mix which past government policies imposed on the electricity supply industry.

Electricity privatisation is particularly important from the viewpoint of energy policy since the old protective regime, which was operated principally through electricity supply, is unlikely to be able to survive privatisation. Government funding for civil nuclear power has been reduced and only one nuclear plant is under construction. Nor is there any longer such a commitment to state support for coal though some protection might continue under the Conservatives (via power generation coal contracts) and a Labour government would be more protective towards the industry. If the Conservatives are returned at the next Election, however, the chances are that coal will be privatised. If it is, by the mid- 1990s - fifty years after nationalisation - all the British energy industries will be back in private hands and there will be a less interventionist regime in energy than in the earlier postwar period.

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