Chapter 2

Energy Supply

by

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1. Arab restrictions on petroleum production and shipment, and the industrial
dispute in the coal mines, have led to Government restrictions on industrial
and commercial activity (the 'three-day week'). There are also fears that
national output, or G.D.P., could be constrained by physical shortages of
energy over a longer period. In this chapter we first examine the medium
term prospect and conclude that the risk of a shortfall in energy supply
after 1975 is remote. We then turn to the immediate prospect for the next
year or two. It appears that energy shortages may persist over this period;
but that restriction of direct consumer uses of energy could probably eliminate
the need for cut-backs in industrial and commercial activity. Finally we
examine the likely costs of oil imports to the balance of payments; we find
that the import bill is likely to rise from £1,700 million in 1973 to about
£3,600 million in 1974, falling gradually thereafter to around £2,600 million
in 1977 as the volume of imports declines.

Energy requirements in the medium term

2. The average annual growth of total energy consumption (expressed in coal
equivalents) over the period 1951 to 1973 was only 1.75%. This growth is the
net outcome of two processes - rising demand for energy-intensive products
and services, partly offset by increasing efficiency in the use of energy
inputs.

3. A regression equation for the period 1960-73 shows the trend growth of
energy consumption (temperature adjusted) as 2.15% per year, with an elasticity
of variation in response to deviations of national output from trend of about
0.4. The equation is sufficiently well-determined to provide reasonably firm
projections of the future requirement in the medium term. To assess the risks
of shortfall in supply, we assume a fast growth of national output (3½% per year);
on this basis total inland energy consumption would be expected to rise just under
2½% per year between 1973 and 1977.

4. The energy supply system as a whole contains considerable technical flexibility.
The main sources of this are the possibilities for substitution between alternative
fuel inputs in electricity generation (especially in off-peak periods), and con-
siderable variation in the pattern of output of petroleum products made possible
by modern refining techiques. The technical flexibility of the system can only be
fully exploited through effective management and price-fixing on the part of the
Government. Provided this is forthcoming, it seems legitimate to project the likely
supply of coal, natural gas and lesser fuel sources and then derive petroleum
requirements as a residual.

5.   Table 1 shows past and projected inland energy consumption and supply, treating future petroleum input as a residual and making no allowance for the present restrictions on energy use and shortfall in coal production. The rise in coal input projected for 1974 as compared with 1973 reflects the fact that last year coal stocks were building up as production exceeded input. The assumption that coal input could in future be held at its present normal level is perhaps optimistic, given the past trend decline, and implies a successful outcome of last year's decision to invest heavily in the coal industry. Projections for natural gas and nuclear electricity are based on various official statements.

Table 1   Inland energy consumption

	Coal	Natural gas	Nuclear and hydro electricity	Petroleum	Total
			(million tons of coal equivalents)		
1965	184.6	1.2	8.3	102.8	296.9
1966	174.7	1.1	10.2	111.7	297.7
1967	163.8	1.9	11.6	119.3	296.6
1968	164.5	4.3	12.3	125.9	307.0
1969	161.1	8.4	12.5	135.7	317.7
1970	154.4	16.0	12.0	145.6	328.0
1971	138.7	25.8	11.5	147.3	323.3
1972	120.9	36.7	12.5	157.8	327.7
1973	130.5	38.6	12.4	160.8	342.3
Projected					
1974	138.0	44.4	13.5	155.6	351.5
1975	138.0	50.2	15.0	156.2	359.4
1976	138.0	56.7	17.0	155.9	367.6
1977	138.0	64.2	19.5	154.1	375.8

Sources: 1965-72 Monthly Digest of Statistics

1973   Estimated from first three quarters, ignoring effects of end-year emergency, etc.

1974-77 Projected as described in text, with petroleum treated as a residual.

6.   The table implies that the past trend increase in petroleum input can henceforth be halted, and that the new level may possibly be slightly lower than that obtaining in 1973.

7.   To project other inland requirements for petroleum, (mainly as an input to the chemical industry) we use a regression equation for the period 1965-72; the trend growth rate is estimated at 7.7% per year and the elasticity of variation in response to fluctuations in national output is 1.5. Table 2 shows total requirements for inland deliveries of petroleum products both for energy and for other uses, expressed in million tons of petroleum (rather than coal equivalents).[1] With additional allowances for exports, bunker facilities and stock-building, the table also shows total projected disposals of petroleum.

Table 2   Petroleum disposals

					(million tons of petroleum)	
	Inland deliveries		Bunkers	Stock-building [2]	Exports [3]	Total disposals [1]
	Energy	Other uses [1]				
1965	60.5	6.4	5.2	0.8	10.8	83.7
1966	65.7	6.8	4.9	1.4	12.5	91.4
1967	70.2	7.9	5.0	0.2	12.1	95.7
1968	74.0	8.8	5.3	1.3	14.3	103.7
1969	79.8	9.5	5.5	2.0	14.4	111.2
1970	85.7	9.6	5.4	0.5	18.3	119.5
1971	86.7	9.5	5.6	4.3	18.2	124.3
1972	92.7	9.8	5.1	-1.1	19.0	125.5
1973	94.6	10.0	5.5	4.8	19.5	134.4
Projected						
1974	91.5	13.1	5.6	0.9	18.0	129.1
1975	91.9	14.2	5.7	0.6	19.6	132.0
1976	91.7	15.4	5.8	0.2	21.9	135.0
1977	90.6	16.7	5.9	0.1	24.3	137.6

[1] Including refinery fuel but excluding refinery losses.

[2] Estimated as residual, 1965-73.

[3] Shipments basis; includes crude as well as products.

Sources: 1965-73 see table 1

          1974-77 inland energy input from table 1,
                  other items projected as described in text.

[1] It is assumed that 1 ton of petroleum is equivalent to 1.7 tons of coal for energy purposes.

8. Export projections, in particular, are hazardous. Table 3 therefore shows import requirements both on a gross and on a net basis. Either way, the required volume of imports starts to fall rapidly after 1975 even under our rather conservative (but inevitably highly uncertain) projections of North Sea oil arrivals. By 1977 imports should be little more than half their 1973 level.

Table 3   Petroleum supply

(million tons of petroleum)

	North Sea oil	Imports		Total supply (1)	Exports		Net imports	
		Crude	Products		Crude	Products	Crude	Products
1965	-	64.4	19.8	84.2	0.1	10.7	64.3	9.1
1966	-	70.4	21.3	91.7	0.1	12.4	70.3	8.9
1967	-	72.5	23.5	96.0	0.7	11.7	71.8	11.8
1968	-	81.9	22.3	104.2	0.1	14.2	81.8	8.1
1969	-	91.7	20.2	111.9	0.3	14.1	91.4	6.1
1970	-	100.5	19.8	120.3	1.2	17.1	99.3	2.7
1971	-	106.0	18.8	124.8	1.5	16.7	104.5	2.1
1972	-	106.0	20.1	126.1	3.5	15.5	102.5	4.6
1973	-	135.0		135.0	19.5		115.5	
Projected								
1974	1.2	128.6		129.8	18.0		110.6	
1975	15.0	117.7		132.7	19.6		98.1	
1976	37.5	98.2		135.7	21.9		76.3	
1977	60.0	78.3		138.3	24.3		54.0	

(1) Differs from total disposals in table 2 on account of refinery losses.

Sources: 1965-73 see table 1

1974-77 projected as described in text.

9. The projections suggest that the U.K. need not suffer from energy shortages in the medium term even if, despite North Sea oil arrivals, total petroleum consumption has to be held down to the 1973 level. By 1977 arrivals of North Sea oil should be well on the way to eliminating dependence on imports altogether.

Energy supply in the short term

10. The projections described above imply, in the absence of restrictions on energy use and limitations on coal production, an average monthly net import requirement for petroleum of 9.2 million tons in 1974 falling to 8.0 million tons in 1975. The present shortfall in coal production due to industrial action is about 35%, or 4 million tons of coal per month, equivalent to 2.4 million tons of petroleum. Thus if the coal shortfall were to be made good by petroleum imports, the 1974 average net import requirement would rise to about 11.6 million tons per month.

11. In winter months inland energy consumption is normally about 15% higher than the annual average. Additional consumption in the first quarter of 1974 might therefore be expected, in the absence of restrictions, to be about 4.4 million tons of coal equivalent, or 2.6 million tons of oil equivalent, per month. Run-down of present coal and oil stocks to 'minimum' levels could cover about 3 months of this additional winter consumption.

12. Although imports of crude oil reached the level of nearly 12 million tons per month last October, average net petroleum imports for the year would probably have been little more than 10 million tons per month even in the absence of the crisis provoked by Arab restrictions on production. For the moment trade in refined products between the U.K. and other industrial countries is probably negligible because of the ban on U.K. exports imposed in December. We are therefore dependent almost entirely on imports of crude. These fell to 9.7 million tons in November and may have fallen further since then. There is thus a real danger that petroleum supply will be inadequate to meet demand even if full coal production is resumed.

13. In these circumstances continued restriction of industrial and commercial activity could only be avoided if other energy uses are cut back. A 10% cut in electricity use through domestic restrictions and general economy measures would save the equivalent of over half a million tons of petroleum per month. Another 0.3 million tons per month could be saved by a 15% reduction in the use of gasoline and kerosene, mainly falling on motorists, aviation and domestic and office heating. Thus a stringent programme of reallocation might yield savings of nearly one million tons of petroleum per month without any significant cuts in industrial production.

14. The prospects for petroleum imports are still rather obscure. The above analysis suggests that net imports of less than 8½ million tons per month would make continued restriction of industrial activity inevitable; at 9.2 million tons per month, restrictions of any kind might just be avoided provided that full coal production is resumed. With a continued shortfall in coal, petroleum imports of over 10½ million tons per month would be needed to avoid restrictions on industrial production, or 11½ million tons to make restrictions of any kind unnecessary.

15. It must be remembered that these calculations about energy demand and supply as a whole conceal any problems caused by rigid requirements for fuels in particular forms. The most serious difficulty of this kind is perhaps the dependence of steel production on scarce supplies of coal suitable for coking.

The cost of oil imports

16. Since October 1973 the Arab Gulf producers have increased the posted price of their crude oil nearly fourfold. It is calculated (see Table 4) that this will have the effect of rather more than doubling the landed cost of Gulf light crude in the U.K. Other O.P.E.C. members have followed suit to a greater or lesser extent.

Table 4   Price of Arabian Light Crude
          ($ per barrel)

	1 October 1973	16 October 1973	1 January 1974
Posted price	3.01	5.11	11.65
Government take [1]	1.79	3.04	6.93
Production cost	0.13	0.13	0.14
Cost f.o.b. to oil companies	1.92	3.17	7.07
Freight, insurance and oil company margin	2.68	2.43	2.50
Price, c.i.f. U.K.	4.60	5.60	9.57

[1] Tax at 55 per cent of posted price plus royalty of 10 per cent.

17. While the future course of prices is uncertain, members of O.P.E.C. are known to believe that these increases have raised the cost of oil to a par with other forms of energy, so that unless the major producers decide to pursue a highly restrictive supply policy it can be expected that future increases will approximate to the general rate of inflation in industrial countries.

18. The implication of these increases for the average price of U.K. imports of crude oil and products is shown in the first column of Table 5. It is assumed that there is a time lag of about six weeks between a change in posted prices and its impact on the fuel import price index.

Table 5   Cost of Oil Imports, 1973-77

	Price index	Imports of crude oil and products	Imports at 1970 prices	Imports at current prices
	(1970=1.00)	(mn. tons)	(£mn.)	(£mn.)
1973	1.56[1]	135.0	1089	1698
1974	3.35	135.0	1089	3646
1975	3.60	117.7	949	3412
1976	3.86	98.2	792	3058
1977	4.15	78.3	632	2623

[1] Based on the implicit price deflator for fuel imports derived from the trade statistics, with an adjustment to allow for the October increase in c.i.f. prices shown in Table 4.

19. In view of the uncertainties about petroleum supply and requirements in 1974, imports for this year have been put at 135 million tons - unchanged from 1973. This of course represents an appreciable reduction from the scale of imports last October. It exceeds the projection of requirements for 1974 in Table 3 because, unlike the latter, it allows for abnormal demands brought about by the shortfall in coal production and its aftermath. Imports after 1975, when it is hoped that coal consumption can return to the level projected in Table 1, are in accordance with the projections in Table 3.

20. It can be seen that the oil import bill will start to decline quite steadily after 1974; by 1977 it will still be a little higher (even allowing for inflation) than in 1973.