CHAPTER 4
AN ECONOMIC ASSESSMENT
OF THE NORTH SEA
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The extraction of oil and gas from the UK sector of the North Sea is a major factor in the long-term prospects for the UK economy. Its significance has been much increased by the rise in world oil prices. This chapter presents estimates of the probable value of North Sea operations to the UK in the next few years.

The first stage in this assessment is the preparation of a set of accounts for the North Sea economy itself. These accounts provide the material for estimates of the contribution of North Sea operations to the UK national income and balance of payments. It will be shown that by 1978 the gain to national income is likely to reach £2 billion at 1974 values, or 2¼%.

Accounts for the North Sea

Appendix 4.1 gives a full set of accounts for the North Sea at current and constant prices, estimated for each of the years 1964 to 1978. These accounts, modelled on conventional national income and balance of payments tables, regard the North Sea as an 'economy' with no residents, whose domestic product consists entirely of property income payable abroad in the form of taxes or profits due to oil companies. Exports from the North Sea consist of deliveries of oil and gas, while imports comprise all capital and current inputs of goods and services, whether for exploration, development or production.

The North Sea accounts are based on an analysis of operations, field by field, taking account of Government tax proposals so far announced and of the distribution of investments between UK and foreign companies. The technical details and sources of information are described in Appendix 4.2.

Expenditure on each field consists, in the early years, of investment in exploration and development financed by long-term capital put up by companies investing in the field. This capital has to provide for trade credit in the form of advance and progress payments to contractors. Once oil or gas starts to come on stream, the field yields gross trading profits equal to the value of deliveries less operating costs. These gross profits then divide into tax revenue payable to the Government and profits net of tax payable to the companies which have invested in the field.

Tax revenue will be collected in three forms:
(a) royalties at 12½% of the value of deliveries,
(b) Petroleum Revenue Tax (PRT) charged on profits net of royalties and capital allowances (up to 150% of exploration and development costs), and
(c) Corporation Tax charged on profits net of royalties, PRT and the normal 100% capital allowances.

The estimates in the Appendix are based, arbitrarily, on a 65% rate for PRT and assume that the world oil price remains at its 1974 level in real terms (after adjustment for world inflation). It is also assumed that the UK share of finance for North Sea investment remains at about 35%, and the foreign share at 65%. Estimates of the possible effects of 51% participation by the UK Government will be given below, but they are extremely uncertain as no detailed proposals have yet been announced.

On all the above assumptions, a typical oil field will, in the first year or two of production, pay little tax other than royalties as capital allowances are used up and the initial investment is amortized by accruals of profit to the companies which have financed exploration and development. Thereafter, profits net of tax will fall off and the tax yield will rise to absorb most of the gross profits. Averaged over the whole life of a field, and assuming a 10% real return on investment, the rough breakdown of proceeds per barrel of oil would be as follows:

Sale value	$12.50
Operating costs	$ 1.00
Gross profit	$11.50
Capital costs	$ 2.00
Royalties and taxes	$ 8.50
Net profit	$ 1.00

This would be an average breakdown. The figures for individual fields may vary considerably depending on costs of extraction and the life of the field.

For the UK sector of the North Sea as a whole, the year-by-year pattern of deliveries, profits and Government revenue is estimated as follows:

	(£ million, 1974 values)				
	1974	1975	1976	1977	1978
Deliveries	161	301	823	1893	2766
Operating costs	50	59	92	163	224
Gross profit	111	242	731	1730	2542
Government revenue	20	38	112	493	1216
Capital costs and net profit	91	204	619	1237	1326

The value of deliveries is expected to rise rapidly in 1976-78, enabling the UK to reduce its net imports of oil from other sources. By 1978 the Government would start to receive a substantial share of the revenue because of the exhaustion of capital allowances on some of the larger fields.

Effects on UK national income and balance of payments

As a net oil importer, the UK would at present secure an immediate gain from any reduction in world oil prices. By the 1980's, as a net exporter of oil, the U.K.'s interest will lie in a high world price for oil, while at the cross-over point in 1980-81 the world price of oil will temporarily be of little consequence for the UK. But an

assessment of the effects of North Sea operations alone will always show a larger benefit from a higher oil price. It is important to remember that until the UK becomes a net exporter of oil, any North Sea gains from a high oil price will be more than offset by the cost to the UK of imports from other sources.

It is convenient to consider the possible effects of North Sea operations on the UK economy in three parts:

(a) the effects of UK *jurisdiction*, i.e. those effects which would not arise if the North Sea operations were outside UK national boundaries and were under the jurisdiction of a foreign tax authority.

(b) the effects of UK *commercial involvement*, i.e. the value of sales of goods and services from the UK to the North Sea, and the flows of capital and profit associated with UK investment.

(c) the possible effects of 51% UK *Government participation* in capital invested in the North Sea.

UK jurisdiction means, principally, that tax revenue from the North Sea is payable to the UK Government.[1] This represents a straightforward gain to the national income and the balance of payments. The balance of trade on goods and services benefits by the amount of gross profits *less* North Sea imports of investment goods and services; the current account benefits by the amount of tax revenue *less* North Sea imports of investment goods and services; and the balance on long-term capital and trade credit benefits by the amount of finance for North Sea imports of investment goods and services. Table 4.1 shows estimates of these effects for 1974-78 in column (1).

UK commercial involvement increases the gain to national income by the amount of profits (net of tax) due to UK companies; it increases the gain to the balance of trade on goods and services by the UK share of North Sea purchases of imports; and it reduces the gain to the balance on long-term capital by the UK share of finance for North Sea investment. These effects are shown in column (2) of the table.

The possible effects of 51% UK Government participation shown in column (4) are estimated on the assumption that payments of compensation for prior investment are spread out over the three years 1975-77, that from 1975 onwards the UK Government provides 51% of the finance for new investment, and that the respective financial involvement of UK and foreign companies is reduced pro rata. There would then be a further gain to national income and the balance of payments current account equal to the UK Government's share of profits net of tax (assumed to build up in line with the UK Govern-

ment's stake in operations). But the UK surplus on long-term capital would be reduced by the amount of payments of compensation and of Government subscriptions of new capital in lieu of foreign sources of finance.

The maximum estimate of the gain to national income in 1978 (shown in column (5) of the table) is about £2.2 billion (at 1974 values). This is composed of £1.2 billion Government revenue in the form of royalties and tax receipts, £0.4 billion profits due to UK companies (before allowing for any state participation) and £0.5 billion profits due to the UK Government (on a 51% state share) which would otherwise have accrued to foreign companies.

Prior to 1976 the estimated effects on the balance of payments current account are negative because imports to the North Sea from non-UK sources of supply exceed the value of oil and gas deliveries. But from 1976 on there is an increasing net gain to the current account as profits and tax revenue due to the UK build up rapidly. The maximum estimate of the gain to the current account in 1978 comprises:

	(£ billion, 1974 values)
Royalties and tax revenue	1.2
less North Sea investment	−0.8
plus Value of UK supplies to North Sea	0.5
plus Profits due to UK companies (before state participation)	0.4
plus Saving on profits due abroad (as a result of 51% participation)	0.5
Total gain to current account	1.9

The gains on the basic balance of payments (current account plus long-term capital flows) exceed gains on current account by the amount of the inflow of foreign capital (net of any compensation payments). The maximum estimate for 1978 is about £2.1 billion at 1974 values.

The provisional conclusion is that the North Sea will contribute about 0.5% per year to the average growth of real national income between 1974 and 1978, and that by 1978 it should provide a net gain of about £2 billion (at 1974 values) to the balance of payments. Although these estimates would be altered by any future changes in the world oil price (adjusted for inflation), additional gains or losses in the North Sea would by 1978 be largely offset by losses or gains to the rest of the economy arising from the change in the cost of oil.

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[1] The other consequences are all accounting adjustments, due solely to the implied location of national boundaries.

Table 4.1   Estimated effects of the North Sea on the U.K. national income and balance of payments, 1974-78

(£ million, 1974 values)

	Effects of UK jurisdiction (1)	Effects of UK commercial involvement (2)	Total effects under present arrangements (3)=(1)+(2)	Possible effects of 51% UK Government participation (4)	Total effects with 51% Government participation (5)=(3)+(4)
National Income					
1974	20	28	48	—	48
1975	38	75	113	23	136
1976	112	278	390	138	528
1977	493	569	1062	378	1440
1978	1215	425	1640	517	2157
Balance of payments current account					
1974	−325	156	−169	—	−169
1975	−612	366	−246	23	−223
1976	−720	745	25	138	163
1977	−279	1044	765	378	1143
1978	459	925	1384	517	1901
Balance of payments on current account, long-term capital and trade credit					
1974	20	−59	−39	—	−39
1975	38	78	116	−432	−316
1976	112	480	592	−302	290
1977	493	786	1279	−61	1218
1978	1215	660	1875	234	2109

See text for assumptions. Figures are based on Tables 4A1.1 and 4A1.2.

APPENDIX 4.1   THE ACCOUNTS OF THE NORTH SEA ECONOMY 1964 TO 1978

Table 4A1.1   **National Accounts of the North Sea Economy**

		1964	1965	1966	1967	1968	1969
Gross National Product: Expenditure at current prices							
1.	Gross fixed capital formation	1	7	20	64	69	85
2.	Exports of goods and services	–	–	–	4	14	25
3.	Imports of goods and services	1	7	20	64	71	89
3a.	from U.K.	0	2	6	19	22	28
3b.	from ROW	1	5	14	45	49	62
4.	G.D.P. at factor cost	–	–	–	3	12	21
5.	Net property income paid abroad	–	–	–	3	12	21
6.	Gross National Product	–	–	–	–	–	–
Gross National Product: Expenditure at 1970 prices:							
1.	Gross fixed capital formation	1	8	23	74	77	92
2.	Exports of goods and services	–	–	–	2	9	22
3.	Imports of goods and services	1	8	23	74	79	96
3a.	from U.K.	0	2	7	22	24	30
3b.	from ROW	1	6	16	52	55	66
4.	G.D.P. at factor cost	–	–	–	2	7	17

(1) These forecasts are based on assumptions underlying the variant 'Import restriction; low inflation; see Statistical Appendix, table F.

Table 4A1.2:   **Balance of Payments Accounts of the North Sea Economy**

		1964	1965	1966	1967	1968	1969
1.	Exports of goods and services	–	–	–	4	14	25
2.	Imports of goods and services	1	7	20	64	71	89
2a.	from U.K.	0	2	6	19	22	28
2b.	from ROW	1	5	14	45	49	62
3.	Balance of goods and services	–1	–7	–20	–60	–57	–64
4.	U.K. taxes	–	–	–	1	2	3
5.	IDP to U.K.	–	–	–	3	8	8
6.	IDP to ROW	–	–	–	–	3	9
7.	Current balance	–1	–7	–20	–64	–69	–85
8.	Long-term capital from U.K.	0	2	14	30	25	30
9.	from ROW	1	4	26	55	46	56
10.	Net increase in trade credit	0	0	20	21	1	2
11.	Total investment and capital flows	1	7	20	64	69	85
12.	Currency flows	–	–	–	–	–	–

(1)   See note to table 4A1.1

					Forecast [1]			
1970	1971	1972	1973	1974	1975	1976	1977	1978
67	81	128	155	345	757	1110	1133	1162
47	80	117	133	161	351	1098	2779	4253
77	98	154	189	395	825	1233	1374	1507
25	33	52	64	128	339	622	697	769
52	65	102	125	266	486	610	676	738
38	62	91	98	111	282	976	2539	3908
38	62	91	98	111	282	976	2539	3908
—	—	—	—	—	—	—	—	—
67	73	105	95	142	268	340	309	295
47	79	115	125	147	179	301	546	743
77	89	128	121	172	303	394	404	422
25	30	43	41	58	125	197	202	211
52	59	85	80	114	178	197	202	211
38	63	92	100	117	144	247	451	616

					Forecast [1]			
1970	1971	1972	1973	1974	1975	1976	1977	1978
47	80	117	133	161	351	1098	2779	4253
77	98	154	189	395	825	1233	1374	1507
25	33	52	64	128	339	622	697	769
52	65	102	125	266	486	610	676	738
−30	−18	−37	−56	−234	−475	−135	+1405	+2746
6	10	15	17	20	44	149	724	1869
10	16	24	26	28	88	372	835	653
22	36	52	56	63	150	455	980	1387
−67	−81	−128	−155	−345	−757	−1110	−1133	−1162
25	39	47	91	215	336	353	379	408
46	72	88	169	399	623	656	704	757
3	31	8	105	269	202	−101	−51	3
67	81	128	155	345	757	1110	1133	1162
—	—	—	—	—	—	—	—	—

The activities of exploration, development and production of resources in the North Sea are assumed to take place in a separate economy. This economy is assumed to have no residents so that the entire gross domestic product is paid as property income as UK taxes and profits to UK and foreign companies. The estimates make no allowance for the effects of a possible government participation by, for instance, an acquisition of 51% of the equity (see page 30 for some discussion of this point). The accounts for this economy are presented in two tables, one for the expenditure on the gross national product and the other giving the balance of payments accounts. The estimates for the future are based on assumptions underlying the variant projection 'Import restriction, low inflation'; for a description, see table F in the Statistical Appendix.

A description of the definition and coverage of each series shown in the accounts for the North Sea is given below, together with the relevant identities; all series are for activities in oil and gas fields combined.

Table 4A1.1 Gross National Product

1. Gross domestic fixed capital formation:
    all exploration and development expenditures and investment in productive capacity.
2. Exports of goods and services:
    all gas and oil extracted and piped or brought in by tanker, valued c.i.f.
3. Imports of goods and services:
    all investment (as in item 1) plus operating inputs including offshore services, disaggregated by origin, (a) from UK and (b) from the rest of the world (ROW). Investment and operating inputs are allocated separately.
4. Gross domestic product:
    this item ($\equiv 1 + 2 - 3$) is the value added in the North Sea. By identity, it equals exports of goods and services less operating inputs.
5. Net property income paid abroad:
    taxes and royalties paid to the UK government and all (post-tax) profits of UK and foreign companies. Because the North Sea has no residents, this item is identically equal to the gross domestic product.
6. Gross National Product:
    by identity, equal to zero.

Table 4A1.2 Balance of Payments

1. }
2. } as in items 2, 3 of table 4A1.1

3. Balance on goods and services:
    this item is the value of production less gross investment expenditures and operating costs.
4. UK taxes:
    revenue from the PRT, Corporation Tax and royalties paid to the UK government.
5. IPD to UK:
    post-tax profits of UK companies.
6. IPD to ROW:
    post-tax profits of foreign companies.
Note: the sum of items 4, 5 and 6 is identically equal to item 5 in table 4A1.1.

7. Current balance:
    this item ($\equiv 3 - 4 - 5 - 6$) is identically equal to gross investment expenditures treated as an import.
8. Long-term capital flow from the UK:
    UK financed share of payments for investment goods; differs from UK share of investment by amount of capital raised abroad.
9. Long-term capital flow from ROW:
    Foreign financed share of payments for investment goods.
10. Net increase in trade credit:
    the difference between the advance and progress payments made for investment goods (item 8 plus 9) and the deliveries of investment goods (item 1 in table 4A1.1).
11. Total investment and capital flows:
    this item ($\equiv 8 + 9 - 10$) is equal to gross fixed capital formation, by treating the deliveries as additions to assets. It is an exact offset to the current balance.
12. Currency flow:
    this item ($\equiv 7 + 11$) is identically zero.

Appendix 4.2

Background of assumptions underlying the North Sea Accounts [1]

Exploration for oil and gas in the North Sea began late in 1964 and gas was found in the West Sole field in 1965. But it was not until 1970 that BP made the first oil discovery on their Forties field. Nearly all of the gas fields (five of which are in commercial production) are in the Southern basin whereas all of the oil discoveries have been made in the Middle or Northern sectors (north of the 56th parallel). The northerly location of the oil fields has led to complicated technological problems since the finds have been in much deeper waters than the gas fields and these problems, together with more violent and variable weather conditions, have led to considerable slippage in the original development schedules for many fields. The forecasts for oil and gas offtake included in the accounts represent a summary of the position as it now appears; the estimates are more pessimistic than those made by the Department of Energy last May.

There are now about 16 proven finds which can support commercial production of oil which should come on stream by 1979, and about ten of these fields should have attained peak rates of production by

(1) The estimates made in this appendix are based on information drawn mainly from
1. "Production and reserves of oil and gas in the United Kingdom", Department of Energy, May 1974.
2. "Study of potential benefits to British industry from offshore oil and gas developments", a study for the Department of Trade and Industry by International Management and Engineering Group of Britain Limited, 1972.
3. "How much capital for North Sea oil?", Tony Parker, The Banker, October, 1974.
4. Five articles by Adrian Hamilton, appearing in the Financial Times on Dec. 11, Dec. 13, Dec. 19, Dec. 27 and Jan 6 (1974/5).

Reference was also made to numerous other press articles and journals of the petroleum industry.

Table 4A2.1   North Sea oil and gas production

(in million tons of petroleum
or equivalent)

	Gas	Oil	Total North Sea supply	
			Expected	Pessimistic
1967	0.4	—	0.4	
1968	1.6	—	1.6	
1969	3.9	—	3.9	
1970	8.6	—	8.6	
1971	14.3	0.1	14.4	
1972	20.8	0.2	21.0	
1973	22.5	0.3	22.8	
1974	26.5	0.3	26.8	
1975	27.5	3.6	31.1	30.0
1976	30.3	17.2	47.5	43.0
1977	34.5	45.2	79.7	70.9
1978	37.7	68.0	105.7	89.9

1980/81. There are 4 additional fields which are still being delineated and evaluated. The expected rates of development of the fields and extraction of oil and gas are shown in Table 4A2.1 for the period to 1978. Estimates incorporating a more pessimistic view about the development of the oil fields are shown in the final column.

In 1978 a very high proportion of oil production will come from three fields, Forties, Piper and Brent, providing in total about 800,000 — 850,000 barrels per day (about 40 million tons of petroleum per annum).

sites made available may be insufficient to meet the build-up of orders, particularly with the currently rather long production periods.

During recent public discussions about the likely future oil offtake pattern, the oil companies have suggested that they may slow down, or even halt, development schedules on some of the fields due to come on stream in the next five years. This is the result of rapidly rising capital costs and the uncertainties about tax arrangements for North Sea operations.

The value of production from the North Sea has

Table 4A2.2   Capital costs per daily barrel capacity for 15 fields

Cost range ($£10^3$ p.d.b.c.)	Number	Latitude	No. of fields	Total Reserves (m. barrels)	Capital costs ($£10^3$ p.d.b.c.) weighted by reserves
1.00–1.50	1	56–57°	2	175	1.45
1.50–2.00	5	57–58°	2	2060	1.66
2.00–2.50	6	58–59°	3	1400	2.27
2.50–3.00	0	59–60°	1	550	2.18
3.00 +	3	60–61°	2	2250	2.65
		61–62°	5	3150	2.18

All of this production and nearly all the remainder estimated for 1978 is to be produced using production platforms which are already constructed and installed (Forties) or under construction. Most uncertainties which remain relate to the difficulties involved in the installation of platforms or variations in weather conditions, such as have caused significant delays recently. A view about production starts in other fields is however subject to uncertainties about production schedules for additional platforms. Possibly the most important problem is the availability of sites for the fabrication yards; three new sites for yards have just been agreed but there is some public discussion about the planning procedure and new

been estimated by assuming that the price of North Sea oil is pegged to the world price (including a quality premium) and maintains its 1974 value in real terms; the price of gas from the North Sea (at about 1.2p per therm in 1974) is assumed to rise with domestic inflation. Assuming that the government pays this price for North Sea production, and assuming operating costs [1] in 1974 values of 43p per barrel for oil and 0.39p per therm for gas, the revenues accruing to the UK government and the oil companies can be obtained on assumptions about taxation and capital expenditure

(1)   A 50% share of which comes from the UK.

schedules.

Capital expenditures are obtained from estimates by Parker and Hamilton (Financial Times—Dec. 27); the timing of these expenditures for each field were estimated by reference to Hamilton and the IMEG report in 1972. Current estimates of capital costs average about £2000 per daily barrel of capacity in 1974 prices but there is some variation (see table 4A2.2 above). Year-by-year totals are given in Appendix 4.1. It is assumed that 40% of the investment is by UK companies (roughly equivalent to the UK share of field ownership) with 5% of this being financed by capital raised abroad, giving a total of 65% financed from abroad [1].

If Petroleum Revenue Tax is levied on the basis of announced Government proposals, and taking an arbitrary assumption of 65% for the rate of PRT, the average rate of tax (PRT and Corporation Tax) on trading profits (net of royalties) is estimated to be as follows: [2]

1975	0
1976	0.014
1977	0.172
1978	0.396

Because of the generous initial capital allowances, the tax receipts from individual fields will only rise after production equivalent to 1-2 years at the peak rate. Over the lifetime of fields, with the price of oil and capital costs fixed in real terms at their 1974 levels, the internal real rates of return (gross of depreciation) should be about:

cost of field (£p.d.b.c.)	Internal real rate of return (%)
1000	29
2000	18
3000	13

These returns should be quite competitive with alternative offshore projects.

The one factor which could severely reduce these returns is a fast rate of inflation of capital costs relative to the price of oil. If capital costs rose at a rate 20% per annum faster than the price of oil, a three year delay (approximately equal to the lag of the development of the Brent field behind the Forties field) could reduce the internal real rate of return from 23% to about 15% for an average field.

This analysis suggests that it should be possible for the UK government and the oil companies to come to an agreement on the tax proposals and that they should not hinder the expected rate of development and the likely pattern of offtake.

(1)   In the Balance of Payments accounts the IPD flows are allocated in the same proportions as the finance (65% to abroad).

(2)   These estimates are built up from a field-by-field analysis of the timing of trading profits against which capital allowances can be offset.

Appendix 4.3

The energy balance for U.K. to 1978

An analysis of the energy balance for the U.K. is conducted in two parts. Firstly, inland energy consumption, shown in table 4A3.1, is given in terms of primary fuel input. For the future, supplies of coal, nuclear and hydro electricity, and natural gas are predicted and it is assumed that these alternative fuels are consumed up to supply. A forecast of total inland energy consumption (dependent on output) is made and the requirements for petroleum are derived as a residual. The second part is an analysis of petroleum use and requirements. Together with the energy requirements of petroleum for inland energy consumption (the residual from table 4A3.1), the industrial uses, stockbuilding, bunkers and refinery fuel losses make up the total requirements. The domestic supplies to meet these requirements are small quantities from inland production and products marketed by the petroleum industry and the growing quantities to be extracted from the North Sea; the residual requirement is the net import requirement from the rest of the world. Individual primary fuel supply forecasts are:

i) coal: it is assumed that coal supply is maintained by the NCB undertaking the restructuring of existing faces and opening of new faces necessary to offset the loss in supply as existing faces run out. Net imports are assumed to be zero and stocks are expected to be held at around 6 million tons (consistent with a lower level of undistributed stocks). The situation is remarkably similar to the mid-1950's and the forecasts rely heavily on analyses by Laurie Handy of the DAE both for the mid 50's and the current position.

ii) electricity: increases in primary electricity generation are the result of the increased capacity of nuclear plant coming into commission in the next few years.

iii) Natural gas: the forecasts assume a steady output of gas from existing fields in the Southern Basin of the North Sea for 1975-78. Increased production comes partly from new fields coming into production (Rough and Frigg (UK)), from gas extracted as a joint product from the oilfields, and from imports from the Norwegian sector (in particular, Frigg (Norway)). The forecast of total inland energy consumption is obtained by a regression equation for the period since 1960. There is an apparent break in the time trend sometime in the mid-1960's and the forecasts are based on an equation derived from data for the period since the mid 1960's [1]:

$$\ln (IEC) = 5.3124 + 0.007\frac{Y - Y_t}{Y_t} + 0.0217\, t$$

where Y = compromise index of GDP (1970=100) and Y_t = a fitted logarithmic trend, and t = time trend = 1 in 1952. An alternative forecast for total energy consumption is shown which assumes that there is some energy saving in each year to 1978: 1975, 4%; 1976, 5%; 1977, 6½%; 1978, 8%. In the main

(1)   The growth of GDP assumed in these forecasts is 0.5% 1974/5, 3.0% 1975/6–1977/8. See footnote 1, p.37

Table 4A3.1:   **Inland energy consumption of primary fuels**

(million tons of coal or coal equivalent)

	Coal	Electricity Nuclear	Hydro	Natural gas [1]	Petroleum [2] (a)	(b)	Total [3] (a)	(b)
1960	196.7	0.9	1.7	0.1		65.5		264.9	
1961	191.8	1.1	2.1	0.1		71.0		266.1	
1962	191.2	1.5	2.1	0.1		78.6		273.5	
1963	194.0	2.5	1.8	0.2		85.3		283.8	
1964	187.2	3.2	1.9	0.3		93.3		285.9	
1965	184.6	6.0	2.3	1.2		102.8		296.9	
1966	174.7	7.8	2.4	1.1		111.7		297.7	
1967	163.8	8.9	2.7	1.9		119.3		296.6	
1968	164.5	10.1	2.2	4.3		125.9		307.0	
1969	161.1	10.5	2.0	8.4		135.7		317.7	
1970	154.4	9.4	2.6	16.0		145.6		328.0	
1971	138.7	9.7	1.9	25.8		147.3		323.3	
1972	120.9	10.5	2.0	36.7		157.6		327.7	
1973	131.3	9.9	2.0	39.7		159.4		342.3	
1974	115.0	12.0	2.0	46.2		149.8		325.0	
1975	129.0	13.0	2.0	47.9	154.7	140.8	346.6	332.7
1976	130.5	14.5	2.0	54.7	153.2	135.5	354.9	337.2
1977	132.0	15.5	2.0	65.9	147.9	124.3	363.3	339.7
1978	134.0	17.0	2.0	74.3	144.6	114.8	371.9	342.1

Notes: a) predicted by equation for log (inland energy consumption)
           b) with energy saving, 4% 1975, 5% 1976, 6½% 1977, 8% 1978.

(1)   including colliery methane, excluding natural gas liquids (condensate)
(2)   including natural gas liquids
(3)   1960-74, temperature unadjusted: projections 1975-78 on an adjusted basis.

analysis, it has been assumed that energy saving grows from 3% in 1975 to 5% in 1978. Some savings will come from speed limits and industrial heating restrictions already introduced, and quite considerable savings might be expected if restrictions on petrol consumption are introduced; inland energy consumption seems to be running 3-4% below expected levels at the present time.

The forecasts of petroleum requirements for inland energy consumption obtained from Table 4A3.1 are only a part of the total requirement of petroleum. A breakdown of the requirements and supply of petroleum is given in table 4A3.2; the units in this table are million tons of petroleum (the conversion factor is 1 ton of petroleum = 1.7 tons of coal equivalent).

The major part of inland deliveries is for energy consumption and this item corresponds to the figure in table 4A3.1; other uses, being industrial uses and process oils, are assumed to depend only on GDP[1][2] and to be unaffected by energy saving policies. Stock-building is obtained as a residual item for the past. For the future, it is assumed that the UK will maintain stocks equal to the EEC requirement of 90 days supply. Requirements of petroleum for bunkers are assumed to remain constant and refinery losses (defined as refinery throughput − refinery fuel − refinery output) are are assumed to be about 1% of total requirements.

The supply of oil is the sum of North Sea production (including natural gas liquids (condensate), which have been landed since 1970), inland production, products marketed by the petroleum industry and net imports from abroad. The projected offtake is discussed in appendix 4.2. These estimates imply an appreciable substitution of other primary fuels (particularly natural gas) for petroleum. However, the actual configuration of use and supply may well be different since it will be quite possible for the UK to enter into trade in primary fuels, say natural gas for oil.

The results of the analyses are that the UK should become self-sufficient in energy requirement by 1979 or 1980 and can then become a net exporter of primary fuels. The non-energy uses of petroleum, for industrial uses, bunkers and refineries, are a significant requirement and mean that the UK will probably not become self-sufficient in petroleum until about a year later. If significant energy savings are not achieved on petroleum use or it proves impossible to achieve much substitution of gas for oil, self-sufficiency in petroleum may lag further behind self-sufficiency in energy.

(1)   ln (other uses) $= 0.9349 + 0.025 \dfrac{Y - Y_t}{Y_t} + 0.06144t.$

(2)   See also footnote 1 on previous page.

Table 4A3.2   **Petroleum requirements and supply**

Requirements :						
	Inland deliveries Energy [1]		Other [2]	Stock [3] building	Bunkers	Refinery losses [4]
	(a)	(b)	uses			
1960		38.6	4.2	1.0	5.4	0.9
1961		41.7	4.3	1.4	5.1	0.7
1962		46.2	4.7	1.4	4.7	0.6
1963		50.2	5.5	−0.3	4.8	0.7
1964		54.9	6.3	1.3	4.9	0.8
1965		60.5	6.4	0.8	5.2	1.0
1966		65.7	6.8	1.4	4.9	0.8
1967		70.2	7.9	0.2	5.0	0.8
1968		74.0	8.8	1.3	5.3	0.9
1969		79.8	9.5	2.0	5.5	1.0
1970		85.7	9.7	0.5	5.4	1.2
1971		86.7	9.5	4.3	5.6	0.9
1972		92.7	9.8	−1.1	5.1	1.2
1973		93.8	11.0	0.7	5.4	1.3
1974		88.1	11.1	8.0	5.5	1.2
1975	91.0	82.8	11.4	−1.6	5.5	1.3
1976	90.1	79.7	12.2	0.5	5.5	1.3
1977	87.0	73.1	13.0	−1.0	5.5	1.2
1978	85.1	67.5	13.9	0	5.5	1.2

Notes: (a) and (b); see table 4A3.1
(1)   ≡ column 'Petroleum,' table 4A3.1, ÷ 1.7 (1 ton petroleum = 1.7 tons coal equivalent).
(2)   for equation, see text
(3)   Obtained as a residual; for projection, see text

Table 4A3.2 continued

		(million tons of petroleum)			
		Supply:			
Total Require-ment		North Sea Production [5]	Other indigenous supply[6]	Net imports	
(a)	(b)			(a)	(b)
	50.1	—	0.5	49.5	
	53.2	—	0.5	52.7	
	57.6	—	0.4	57.1	
	60.9	—	0.5	60.5	
	68.2	—	0.5	67.6	
	73.9	—	0.5	73.4	
	79.6	—	0.4	79.2	
	84.1	—	0.4	83.7	
	90.3	—	0.4	89.8	
	97.8	—	0.3	97.5	
	102.5	—	0.3	102.1	
	107.0	0.1	0.3	106.6	
	107.7	0.2	0.3	107.1	
	112.2	0.3	0.3	111.6	
	113.9	0.3	0.3	113.3	
107.6	99.4	3.6	0.3	103.7	95.5
109.6	99.2	17.2	0.3	92.1	81.7
105.7	91.8	45.2	0.3	60.2	46.3
105.7	88.1	68.0	0.3	37.4	19.8

(4) ≡ refinery (throughput-fuel-output).
(5) including natural gas liquids.
(6) inland production and products marketed by the industry.