DEPARTMENT OF ENERGY

Development of the oil and gas resources of the United Kingdom

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A Report to Parliament by the Secretary of State for Energy
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Summary

This report describes the exploitation of the United Kingdom's oil and gas resources in 1976 – the first year in which substantial quantities of North Sea oil came ashore. It covers an eventful year which firmly established the United Kingdom as an important oil producer well on target for self-sufficiency by 1980.

The year was marked by seven main developments:

1 The rapid build up of oil production as five more oilfields came onstream, to a rate at the end of the year of nearly half a million barrels a day (equivalent to 25 million tonnes per annum); however, some of the field start-ups were delayed so that production for the whole year at 12 million tonnes was below the forecast.

2 The realisation, for the first time, of substantial economic benefits from oil worth about £700m in terms of balance of payments and £44m in royalties: if gas is also valued at the cost of imported energy it replaced, the total balance of payments saving was around £3 billion (thousand million) and royalty income from oil and gas totalled over £66m.

3 The rapid development of the British National Oil Corporation (BNOC) both as a Government agency and commercial force; within a year of its formation it had become operator for the Thistle field and secured access in the 1980s to between 35 and 40m tonnes of oil – a third or more of the nation's expected requirements – from equity stakes, participation arrangements and royalties.

4 The conclusion of agreements or understandings on State participation with virtually all the oil companies having United Kingdom Continental Shelf interests in commercial oil-fields found under the first four licensing rounds.

5 A new – fifth – round of licensing which attracted keen interest among oil companies and provided for majority State participation in all licences, including a BNOC operational interest in six blocks.

6 The formation of a company, made up of public and private sector partners, to reach an early conclusion on the possibility of bringing ashore by pipeline large amounts of gas found in association with oil in the Northern Basin of the North Sea which would not otherwise be economically recoverable.

7 An increase in employment directly or indirectly related to offshore work to at least 100,000 jobs, including in mid-1976 56–65,000 in Scotland; the total includes an increase of 50 per cent in the offshore labour force to about 10,000, plus several thousand more on pipe-laying and crane barges, and supply boats; however, there were redundancies in some platform yards during the year.

These achievements underline the progress made in 1976 in consolidating Government policies after the major legislation of 1975, and the growing importance of offshore oil, together with the well established gas industry, in the economic and industrial life of the country.

Other notable features of 1976 were:

– twelve oil and two gas discoveries, bringing the total since offshore exploration began in 1964 to 73 (45 of oil and 28 of gas or gas condensate);

– maintenance of the success ratio for exploration drilling at about 1 in 5, and an exceptional 1 in 2 east of Shetlands, compared with a worldwide ratio for offshore exploration of about 1 in 20;

– a reduction, as expected, in the level of exploration and appraisal drilling activity from 27.7 rig years in 1975 to 21.2 in 1976

as work programmes under fourth round licences near completion; there were some disappointments in drilling west of Shetlands and in the Celtic Sea;
– a sharp increase in development drilling activity which produced a record overall level of drilling with 140 holes drilled compared with 136 in 1975;
– a small increase of 30 million tonnes in the estimate of proven oil reserves;
– an increase in the total estimated reserves from existing oil discoveries of 210m tonnes (to 2500m tonnes) – an increase almost equivalent to the reserves of the Forties field;
– progress with planning the development of several new fields, though no new development plans were brought forward during the year;
– a record share for UK industry and commerce of offshore investment, which represented a quarter of all UK industrial investment in 1976, and the development of our offshore supplies export potential;
– further progress on the provision of regulations for safety and health offshore; there was a small increase in fatality rates, including that for divers, in 1976 though the serious accident rates decreased;
– conclusion of the first international convention, involving nine countries in North West Europe, providing for compensation for pollution resulting from offshore oil and gas activities.

These and other matters are dealt with in more detail in Parts I and II of this report and in the extensive appendices.

Prospects

For 1977 and further ahead the prospects are bright. The main points are:
– two more oilfields and the Frigg gasfield are expected to come onstream in 1977; the Frigg field will eventually raise total gas supplies available to the UK by about 40 per cent;
– by the end of the year oil production should be at a rate equal to half or more of UK consumption;
– a more rapid build up of oil production in 1977–78 than forecast last year; production in the 1980s remains in the range 100–150m tonnes;
– the estimated range of oil reserves remains 3,000–4,500m tonnes, but now takes into account all areas expected to be in the UK Continental Shelf; it may not be possible to narrow this range with confidence for several years;
– the net oil import bill which came to nearly £4,000m in 1976 despite oil production worth around £700m, will be eliminated by 1980;
– the revenue from taxes and royalties on oil and gas will total around £5½ billion between now and 1980; thereafter they will be worth up to about £4¼ billion a year;
– reasonable prospects of a further 4–5 orders for oil production platforms up to mid-1978 and perhaps other orders for smaller production systems in the same period;
– extension of the exploration of the UK Continental Shelf into new areas of the English Channel and West of Scotland;
– the maintenance of the momentum of exploration drilling at around the 1976 level – one well suited to the controlled exploration of the nation's oil and gas resources;
– the development of plans for petrochemical investment which should spread the benefits of oil and gas, especially in Scotland.

North Sea oil provides the opportunity for a substantial improvement in the country's economic outlook over the next few years. How far its benefits will help us to solve our economic problems will depend on how wisely we use them.

Part I: Production and reserves

Oil production

By the end of 1976, seven of the fourteen fields described as "commercial" in last year's Brown Book were in production. Argyll and Forties had come into production during 1975. During 1976 Auk, Montrose, Beryl, Brent and Piper successively came onstream; the dates of first production are given in Appendix 2. Each of these fields encountered some delays in start-up; Beryl was hindered by an accident to the offshore loading tower and Auk by damage to the platform; Piper was held up by piling operations in difficult seabed conditions, and Brent also suffered technical delays. Despite these difficulties, production was running at a rate of over half a million barrels per day (equal to 25 million tonnes a year) at the end of 1976. However, total production for the year was 12 million tonnes, rather than the 15–20 million tonnes envisaged in last year's Brown Book. The 12 million tonnes includes 400,000 tonnes of Natural Gas Liquids, and 100,000 tonnes of oil produced from landward areas.

The Flotta terminal in the Orkneys, built to receive oil from Piper and from Claymore when it starts producing later this year, was inaugurated by the Chairman of Occidental and the Secretary of State for Energy, on 11 January 1977. Work at the Sullom Voe terminal in the Shetlands, which will handle oil brought ashore from the Ninian and Brent pipeline systems, is going ahead with a view to bringing the first oil ashore in 1978. By the end of the decade half or more of the United Kingdom's oil production, from a total of seven fields, will be handled by Sullom Voe. Two more fields, Thistle and Claymore, are expected to come onstream in 1977 and the five remaining commercial fields from last year's list should be brought into production during 1978/1979.

Because of the geological and technical complexities involved and the need to apply the lessons on costs learned during the early 1970s, as well as the scale of managerial and other resources already committed by many operators to existing developments, the licensees are adopting a more deliberate approach to the appraisal of discoveries. As a result, development did not start on any new field in 1976, although it seems likely that work may start on several during the next year. Design contracts have already been let for the platform and topside facilities for Murchison.

All these factors, together with the increased estimate of production from Forties, which is now expected to produce at a peak rate of some 500,000 barrels per day from the end of 1977, are reflected in the latest forecasts of oil production for the next five years at Table 1. The rate of production will continue to increase during 1977 and total production for the year is expected to fall within the range of 40–45 million tonnes, equivalent to nearly half United Kingdom demand. The United Kingdom should achieve net self-sufficiency in oil by 1980, although the estimated range of production for that year is 5 million tonnes lower than last year's forecast, because of the longer period of appraisal before decisions are taken to develop new fields. Thereafter production during the early 1980s is still expected to lie within the range 100–150 million tonnes a year. But the uncertainties surrounding the number of fields which will be in production, both those already identified and those not yet found, make it

Table 1 Forecast of United Kingdom Continental Shelf oil production

Year	1977	1978	1979	1980	1981
Forecast production (m. tonnes)	40–45	60–70	80–95	90–110	100–120

unrealistic to attempt to estimate within narrower limits.

Oil reserves

The possible total of reserves from fields in production or under development (directly comparable to last year's category of commercial fields) has increased from 1170 million tonnes to 1260 million tonnes. The estimates for other significant discoveries not yet fully appraised show a rise of 120 million tonnes reflecting both the new discoveries of 1976 which have entered this category and lower reserves estimates resulting from appraisal of some earlier finds. Together these figures represent the possible total from known discoveries which is up from the 2290 million tonnes estimate in the 1976 Brown Book to 2500 million tonnes. Table 2 shows that the likely range for the recoverable reserves from all the fields so far discovered is between 2000 million tonnes (on the assumption that only the proven and probable reserves can be recovered) and 2500 million tonnes (on the optimistic assumption that all the possible reserves are also recovered).

Future finds are necessarily much more speculative. A comprehensive analysis of all the available geophysical and geological data, the likely stratigraphy, petrophysical characteristics and success ratios has led to a revised estimate of the likely range of reserves of oil remaining to be discovered in the presently licensed area including that licensed in the 5th Round. This range is now believed to be 350–700 million tonnes. The range of all oil reserves in the licensed area therefore lies between 2300 million tonnes and 3200 million tonnes, the same range as that quoted in the 1976 report, although within that range there is now a shift in the balance between what has already been discovered and what is still to be found; also the range now relates to a larger area, ie that covered by 5th Round licences as well as those in the 1st–4th Rounds.

Total estimated reserves remain in the range 3000–4500 million tonnes, taking account of areas designated but not yet licensed. The higher end of the range now includes an allowance for areas not yet designated but expected to fall to the United Kingdom when the dividing lines between the United Kingdom and other countries such as France, Norway and Ireland are fully determined.

Earlier estimates of reserves have therefore been broadly borne out by the results of exploration and development, but with some changes both in what we

Table 2 Estimated oil reserves in United Kingdom licensed area (million tonnes)

	Proven*	Probable	Possible	Possible total
1. Fields in production or under development	1070	110	80	1260
2. Other significant discoveries not yet fully appraised	310	460	470	1240
Total present discoveries	1380	570	550	2500
	1950			
Expected discoveries present licences (including 5th round)	—	350	350	700
Total presently licensed areas (including 5th round)	1380	920	900	3200
	2300			

* The terms 'proven', 'probable' and 'possible' are given the internationally accepted meanings in this context of:

(i) Proven – those which on the available evidence are virtually certain to be technically and economically producible.

(ii) Probable – those which are estimated to have better than a 50 per cent chance of being technically and economically producible.

(iii) Possible – those which at present are estimated to have a significant but less than 50 per cent chance of being technically and economically producible.

are reasonably sure will be developed (where the estimates are increased) and what may possibly be the ultimate total of our reserves (where the estimates are lower). Previous assumptions about the potential contribution of oil to United Kingdom indigenous energy supplies remain valid. But the width of the ranges quoted reflects the uncertainties which still exist. The amount of oil in the category of possible reserves is by definition especially uncertain. Further exploration and indeed further licensing will be necessary before the ranges can be narrowed.

Gas production

It is ten years since the first North Sea gas came ashore from the Southern Basin. Since then supplies by the gas industry to the country have increased four-fold. Last year 39.4 billion cubic metres of natural gas from the Continental Shelf was sold to the British Gas Corporation, accounting for about 98 per cent of the United Kingdom's gas requirements. Appendix 8 gives a breakdown of this figure and details for each individual field.

This year, for the first time, gas will be coming ashore from the Northern Basin for sale to British Gas. In the Autumn, gas under contract to British Gas from the UK/Norwegian Frigg field should be delivered via the completed gas pipeline to St Fergus, and should be sufficient to build up to an annual production rate of at least 15 billion cubic metres, or about 40 per cent of current supply.

Small quantities of gas from the Forties oil field will become available to British Gas this Spring, and when the Brent field gas pipeline system is completed, it will bring larger quantities of associated gas ashore.

Total reserves under contract to British Gas, including gas from the Norwegian part of the Frigg field, will support an average production rate of about 170 million cubic metres a day (6,000 mcfd) by the 1980s. Further contracts and discoveries are likely to prolong this level of gas production.

All North Sea oilfields produce associated gas in varying quantities. With the exception of the Brent field, no proven oil field in the United Kingdom sector has yet shown a sufficient quantity to justify a separate gas pipeline to shore. In some cases it may be possible and worthwhile to re-inject the gas into the reservoir provided that the geological formations are suitable. When the field is served by an oil pipeline it is possible to transport some gas dissolved in the oil. On most fields some associated gas is used for power generation on the platforms. But gas which cannot safely be recovered or conserved by any of these methods will have to be flared. Associated gas from the producing North Sea oilfields totalled around 860 million cubic metres in 1976. Of this, about 12 per cent was either sold or used at the field, and the remainder flared. Gas flaring is especially likely in the early stages of production in advance of the installation of offshore compression equipment, the commissioning of gas-driven utilities, or the completion of pipeline or onshore handling facilities. As development work is completed the percentage of gas used, transported or sold should increase. An example of this is the Brent field, where the commissioning of the re-injection compressors and utilities, the Sullom Voe terminal, and the gas pipeline to St Fergus will ultimately mean the full utilisation of all associated gas.

Under model Clause 21 of the terms of the petroleum production licences the Secretary of State's approval is required for flaring or re-injection of gas. Applications to flare and/or re-inject gas must be made at least two years before flaring or injection is due to start. The aim is to minimise the wastage of gas. Consents have been issued, to ensure continued oil production, for the seven oilfields currently onstream. Details for each of these fields — Argyll, Auk, Beryl, Brent, Forties, Montrose and Piper — are given in Part III ("Field by field progress"). These consents are limited, in case circumstances change, with the exception of the Argyll and Auk fields where the Government is satisfied that the quantities of gas to be produced are too small for delivery to be practical.

Gas reserves

Remaining proven gas reserves at the end of 1976 were 809 billion cubic metres (28.6 trillion cubic feet), compared to last year's figure of 815 bcm (28.7 tcf). 1976 consumption of 39.4 bcm (1.4 tcf) was therefore largely offset by an increase of 33.4 bcm (1.2 tcf) in estimates, mainly of associated gas reserves in the northern North Sea. Taking the Southern Basin on its own, 1976 production was also partly offset by new discoveries, the net decrease in Southern Basin reserves being only 20 bcm (0.7 tcf); see Table 3.

The reserve figures do not include allowances for fields which, though significant discoveries, have not yet reached the development planning stage. No allowance is included for prospective reserves from future discoveries, which will undoubtedly be made in the northern North Sea and to a lesser extent in the southern North Sea.

The economics of the recovery and transportation of associated gas involves many factors. In September 1975 the Government commissioned Williams-Merz (consulting engineers) to produce a feasibility study examining whether there was a case for an economically viable gas-gathering system in the Northern Basin of the North Sea. Their report suggested that their preferred system could bring ashore up to 1,500 million cubic feet a day (or 40 million cubic metres a day) of methane, and 6 to 9 million tonnes a year of heavier gases. The Government considered the report and the many comments received from interested parties upon it, and decided that further extensive studies costing several million pounds were needed to establish the economic viability of such a system.

A joint public/private sector study company, Gas Gathering Pipelines (North Sea) Ltd, has therefore been set up by British Gas and BNOC with four private sector companies, to finance and be responsible for the further studies. Gas Gathering Pipelines Ltd has been asked to submit an initial report by the end of 1977 and to update the information by March 1978. If the project proves viable Gas Gathering Pipelines Ltd will recommend a suitable pipeline configuration for Government consideration.

Table 3 Estimated United Kingdom Continental Shelf gas reserves (remaining in known discoveries at 31 December 1976)

Totals in billion cubic metres (figures in brackets trillion cubic feet)*

	Proven	Probable	Possible	Total
Southern Basin				
Fields under contract to British Gas	462 (16.3)	14 (0.5)	25 (0.9)	501 (17.7)
Other discoveries believed commercial but not yet under contract to BGC	51 (1.8)	65 (2.3)	—	116 (4.1)
Other discoveries	—	34 (1.2)	40 (1.4)	74 (2.6)
Total Southern Basin	513 (18.1)	113 (4.0)	65 (2.3)	691 (24.4)
Northern Basin				
Fields under contract to British Gas	178 (6.3)	—	6 (0.2)	184 (6.5)
Other significant finds† (gas and condensate)	40 (1.4)	102 (3.6)	198 (7.0)	340 (12.0)
Other associated gas with oil	79 (2.8)	56 (2.0)	93 (3.3)	228 (8.1)
Total Northern Basin	297 (10.5)	158 (5.6)	297 (10.5)	752 (26.6)
Total UK Continental Shelf	809 (28.6)	272 (9.6)	362 (12.8)	1443 (51.0)

* The conversion factor assumed is 1 tcf (10^{12} cubic feet) = 28.317×10^9 cubic metres.

† Including reserves found in Liverpool Bay.

Part II: Progress and prospects

A: ECONOMIC AND INDUSTRIAL IMPACT

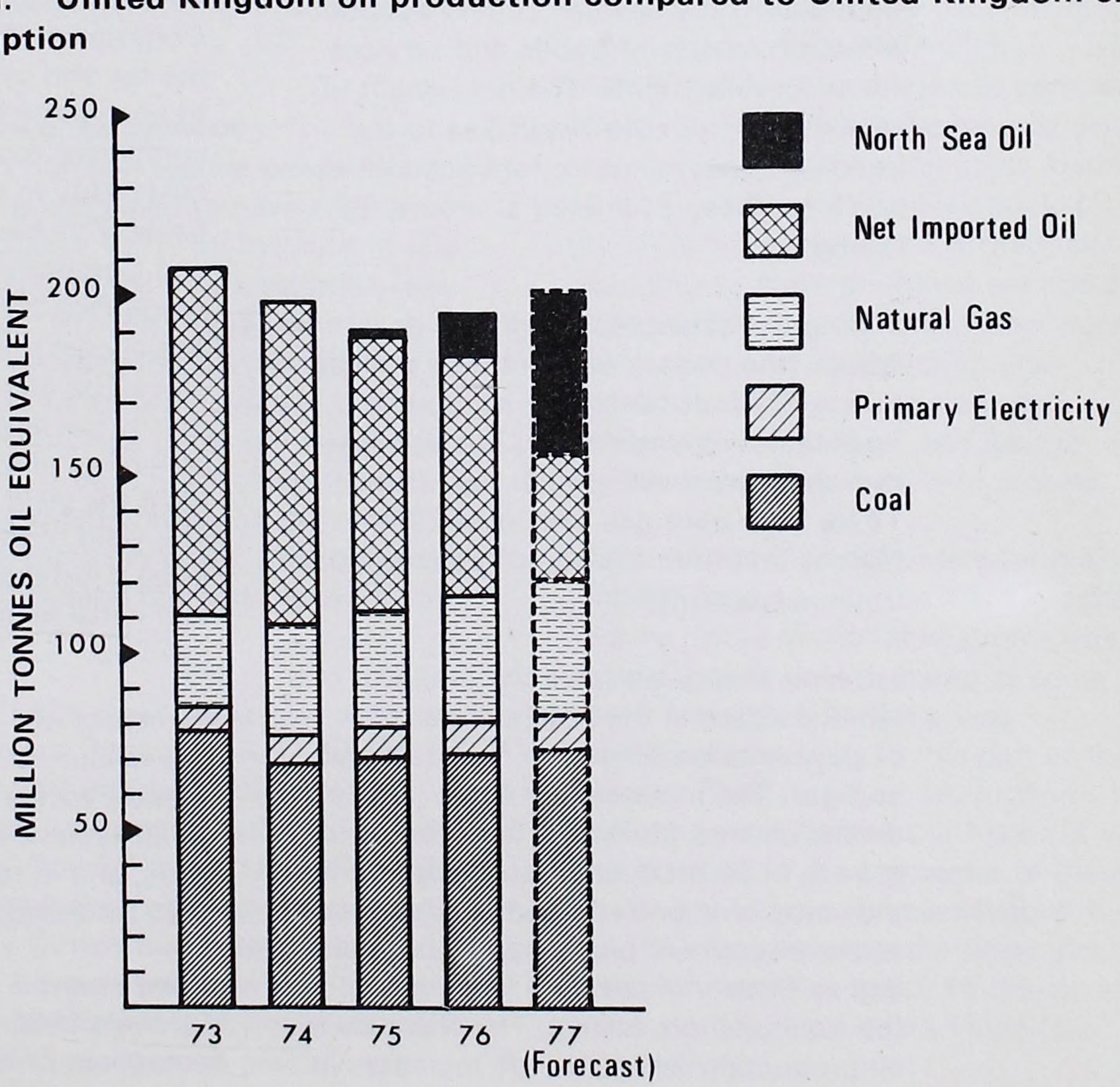
Contribution of North Sea oil and gas to United Kingdom energy supply

Figure 1 shows the contribution of indigenous oil and gas* production towards meeting UK demand for primary fuels (energy uses only). Not all North Sea oil will be used in the UK, as imports and exports of different qualities of crude oil, and of some products, will be used to balance supply with refinery and end-use demand. In 1977 North Sea oil production could correspond to about 20 per cent of primary fuel demand, and this should increase to about 50 per cent in 1980. By the end of 1977 gas could also be meeting some 20 per cent of all our primary fuel consumption, predominantly from indigenous sources.

Taking all our oil and gas reserves together, they could have a gross value to the nation of over £300 billion.

* A small amount of natural gas was imported throughout the period shown; in 1976 this was less than 3 per cent of total gas supply, and negligible in terms of figure 1.

Figure 1. United Kingdom oil production compared to United Kingdom energy consumption



Balance of payments benefits

The North Sea oil and gas industry will clearly be of great benefit to the economy and potentially to the current balance of payments through the import-saving and export-earning value of the production. The benefit to the current balance of payments, however, is offset in the early stages of the development of the industry by imports of goods and services connected with the programme, and will later be partially offset by outflows of interest, profits and dividends accruing to overseas residents from North Sea activities.

Although production of gas from the Southern Basin has been making a major contribution to the economy for several years, the benefit to the balance of payments current account has, until now, been offset by imports of goods and services for the oil programme. In 1976, however, oil was produced from the North Sea which would have cost in the region of £600–700 million if it had been purchased at ruling prices in the international market. So for the first time, oil production itself went a long way towards neutralising the adverse current account effect of imports of goods and services for oil developments. The net benefit of oil and gas from the North Sea to the balance of payments current account in 1976 has been estimated at around £2 billion.

Taking the balance of payments as a whole (the current account plus the net inflow of funds on capital account to finance new investments), it is estimated that there were still greater benefits in 1976, from both gas (just over £2 billion) and from the oil programme (just under £1 billion).

Looking ahead, we have the prospect of a rapid increase in the potential balance of payments benefits from North Sea oil and gas. The increase will come largely on the oil side, stemming from the rapid growth in oil production and a decline in the value of imported goods and services as the investment phase passes its peak and as British firms take a larger share of the total offshore market. This increase in oil production will outweigh increases in the outflow of interest, profits and dividends accruing to overseas residents and net repayments on capital account of money borrowed to finance offshore development.

The overall picture is therefore bright. It has been estimated that we can look forward to potential balance of payments benefits from oil and gas production around the end of the decade equivalent to about 5 per cent of the gross national product at that time, with massive benefits continuing long after that. This potential benefit must not be frittered away, and we need to run substantial current account surpluses in order to repay overseas debts and create conditions favourable to investment which will strengthen the economy. There is also a case for using some part of the benefit for the development of alternative energy sources.

Exchequer revenue

Revenue from oil and gas production up to the end of 1980 is expected to amount to some £5½ billion at 1976 prices, rising to around £4¼ billion a year in the early 1980s, including royalty, PRT, and Corporation Tax. The structure of the tax and royalty system is designed to encourage development by allowing companies to recover their heavy capital costs early in the productive life of oil fields. This means that receipts of PRT and Corporation Tax in respect of 1976 oil production will be negligible. Similarly the actual cost of conveying and treating the oil can be offset against liability for royalty payments, so that although collection of royalties on oil began in 1976 the yield was only £44.2 million. The yield of royalty and taxes will rise to more substantial levels as fields mature, and initial allowances against cost are used up.

In respect of 1976 gas production some £15 million of Corporation Tax will be payable by the North Sea licensees. Gas royalties have been collected for some years, and in respect of 1976 amounted to £22.4 million.

Investment

Between 1965 and 1976 capital investment of the order of £5,000 million

will have been spent on existing North Sea oil and gas developments, and a further £2,000 million remains to be spent. An additional £3,000 million may be spent on new developments up to 1980.

In 1976, offshore-related investment amounted to about 25 per cent of total industrial investment (all industries) and to about 10 per cent of Gross Domestic Fixed Capital Formation. The North Sea will continue to provide an important contribution to the United Kingdom's industrial regeneration.

In 1976 the Government published the North Sea Costs Escalation Study analysing the reasons for the cost escalation experienced by operators between 1973 and 1975. The Study Team and their consultants concluded that costs should now follow a more stable pattern than during the early years of development.

Including development and operating costs, and interest, the cost of producing oil from existing fields ranges from $3–9 per barrel at 1976 prices, substantially below world market prices for crude oil.

Offshore employment

The work-force in regular employment offshore is estimated to have risen to some 9,200 in 1976, an increase of about 50 per cent on last year's estimate (see Appendix 10). This figure includes those working on such installations as rigs and platforms, which are governed by the Mineral Workings (Offshore Installations) Act 1971. It does not include those working on pipe-laying barges, crane barges and supply boats; they may add several thousand more to the work-force, especially in summer.

In June 1976 most provisions of the Employment Protection Act 1975 so far in force, and other employment legislation, were extended by Order-in-Council to the United Kingdom Continental Shelf. The services of the Advisory Conciliation and Arbitration Service are therefore now available to offshore employers and employees, and trade union recognition procedures, membership, and other activities are safeguarded. Employees also have protection against unfair dismissal, and the right to receive details of their terms and conditions of service.

The isolated position of offshore installations presents problems for trade unions in recruitment and continuing contact with the work-force. As a result a Memorandum of Understanding was agreed in August 1976 between the Department and bodies representing the interests of unions and operators, by which the operators undertake to facilitate reasonable union access to offshore installations when requested by designated union officials. The text of the Memorandum is at Appendix 14. Agreement to the Memorandum was one of the factors taken into account in the consideration of applications under the Fifth licensing round, and all prospective Fifth Round licensees agreed to the Memorandum.

Offshore supplies market

As in 1975, the offshore supplies market was worth over £1,000 million in 1976, and UK industry continued to compete effectively in both the capital and service sectors, consolidating the gains made in 1975. The offshore supplies market on the UK Continental Shelf is gradually changing as more platforms are completed and installed. In addition to continued exploration and construction and installation work, production-well drilling, field operation, and maintenance are becoming major areas of activity.

The continued lack of orders for major platform structures made 1976 a difficult year for some of the fabrication yards, and redundancies were declared at some yards. Nevertheless, there was considerable activity in this part of the industry. Two major oil production platforms were floated out from UK yards and installed in the UK sector of the North Sea and the first concrete platform built in the UK was placed on the Frigg gas field. A further five major structures are under construction in UK yards (see Appendix 9).

There are now encouraging signs that the ordering position is improving. As further orders arise UK industry, with a range of concrete and steel platform yards able to construct a variety of the designs favoured by the oil operating companies, will be well placed to win contracts both for the North Sea and in export markets.

For all sectors of the industry, the Memorandum of Understanding and the associated Code of Practice agreed with the UK Offshore Operators Association in November 1975 is proving a valuable means of securing for United Kingdom industry a full and fair opportunity to compete for business.

During 1976, the Department of Energy's Offshore Supplies Office took a special interest in exploration drilling, maintenance, and underwater engineering and encouraged action towards the preservation, development and strengthening of UK capability in these market sectors.

Following experience gained in providing equipment and services for the development of North Sea oilfields, British industry is now active in offshore markets overseas. During the year a Scottish-based platform yard won a contract for a steel jacket for a Brazilian oil production platform and another for a small gas platform for the Dutch sector of the North Sea. A British oil company won a contract for exploration off Brazil. In addition, British companies won offshore consultancy contracts in India and contracts for technical support to Petrobras.

The Government is encouraging this activity through the Offshore Supplies Office, who promote it in consultation with trade associations and with a range of oil companies, contractors, fabricators and manufacturers, consultants and financial interests. In 1976 the Department of Energy was represented at international offshore exhibitions in Singapore, Houston and Stavanger and assisted in a British marine/offshore presentation in Rio de Janeiro. OSO personnel visited a number of overseas countries with offshore prospects.

The value of North Sea oil to the UK economy lies not only in its obvious benefits to the balance of payments, and through tax and royalty payments, but also in its indirect contribution to British industrial capability including the employment it provides onshore, particularly in the Assisted Areas.

A recent survey showed that in mid-1976 56–65,000 people in Scotland were employed directly and indirectly in work related to offshore development. No precisely comparable estimate has been made for the United Kingdom as a whole, but the figure is probably at least 100,000. This includes about 10,000 people working offshore.

Offshore technology, research and development

During the year the Offshore Energy Technology Board continued to advise the Department on its research and development programme on offshore oil and gas technology. One of the Board's first priorities was to define an overall strategy to be adopted. This has now been done and the Board's proposals, which have been accepted by the Government, were published in July 1976*. The paper defined priorities for future work in the three main areas of interest to the Department;

(i) the acquisition and analysis of geophysical, geological and reservoir engineering data to enable an appreciation to be made of our likely hydrocarbon reserves.
(ii) the determination of the necessary standards to be laid down by the Department in pursuance of its statutory responsibilities for the safety of offshore operations.
(iii) assistance in the development of the offshore supplies industry in the United Kingdom.

* The Offshore Energy Technology Board; strategy for research and development. Energy Paper Number 8 available from HMSO price 90p.

The last of these is especially important. To meet the rapid changes in technology the Government is collaborating in shared-cost development programmes, with the industrial partner undertaking the work. If successful, such projects strengthen the role of UK firms in developing the resources of our own Continental Shelf as well as their export potential in worldwide offshore markets. The general flow of information to industry on the results of Government-sponsored research and development has also been improved.

The Government's commitment to the safe and effective exploitation of our offshore resources, and to a continued viable and advanced offshore supplies industry, is emphasised by the increased budget allocated to R and D work on offshore technology, and expenditure in the financial year 1976/77 is expected to reach some £10 million.

Downstream activities

Unlike Southern Basin gas which is mainly methane, the Northern Basin associated gas is rich in heavy natural gases, ethane, propane and butane, which have uses as petrochemical feedstock as well as fuel. These are key materials for growth in the United Kingdom petrochemical industry. Outlining Government strategy on 10 November 1976, the Secretary of State for Industry said that the Government endorsed the Report of the Industrial Strategy Working Party on Organic Chemicals which foresaw the construction for four new ethylene crackers by 1985 in addition to one already under construction, explaining that ethane was a premium feedstock for ethylene manufacture and that much will depend on the systems which are installed in the North Sea for collection of the gas.

Ethylene has traditionally been produced from naphtha or, to a lesser extent, gas oil. But considerable problems in obtaining feedstock supplies may lie ahead if the petrochemical industry continues to base its growth on naphtha and, within the next decade, the industry may be forced to adapt to alternative forms of hydrocarbon feedstock. Ethane, which is believed to be present in substantial quantities in the North Sea fields, could lead to the development in the UK and especially in Scotland of a petrochemical industry with distinct advantages in terms of feedstock availability provided that the Gas Gathering Pipelines report is favourable and a decision is made to construct a gas gathering pipeline network.

One development which is not dependent on the construction of a gas gathering network is that announced in December 1976 by Shell and Esso, the licensees of the Brent Field. Gases, which are known to be present in the field in substantial quantities, will be brought ashore by the Brent/St Fergus gas pipeline. At St Fergus, the methane will be extracted for supply to British Gas, and it is planned to take the other gases to a heavy natural gas separation plant to be constructed by Shell at Mossmorran, Fife, with associated marine terminal facilities at Braefoot Bay; an outline planning application for the project was submitted to the Fife Regional Council in January 1977. In February 1977 Esso (Chemicals) also submitted an outline planning application for the construction of an ethylene cracker adjacent to, and fed by ethane from, the separation plant. The cracker, with an output of 400,000 to 600,000 tonnes a year, depending on the availability of ethane from the Brent Field, is estimated to require investment of some £200 million and would be a major spin-off from oil development by Shell and Esso in the North Sea. The Secretary of State for Scotland has called in both applications for his decision.

B: OPERATIONAL ASPECTS

Offshore licensing

In September 1975 the Secretary of State announced his intention to hold the Fifth Round of offshore licensing during 1976. A consultative document was published on 27 May 1976 outlining the

Government's proposals for licensing arrangements, and following consultations with the United Kingdom Offshore Operator's Association, the Confederation of British Industry and the Trade Unions, the Petroleum (Production) Regulations 1976* were laid before Parliament on 29 July. On 20 August applications were invited for 71 blocks and part-blocks, and extracts of the notice which appeared in the London, Edinburgh and Belfast Gazettes are at Appendix 13. These show the main conditions of application and the criteria on which consideration of the applications was based.

In order to avoid the violent fluctuations in work-load for the offshore supply industry which followed the award of 282 blocks in 1972, and to maintain overall activity at a more stable level in the future, the Government had decided to license smaller amounts of territory at more frequent intervals. The Fifth Round was the first of this type. The most important change in the licence terms, compared with those for previous Rounds, is that BNOC or BGC will receive a majority interest in all blocks, paying their share of expenses as they are incurred.

The response to the offer of blocks was comparable to that in previous Rounds and amply confirms the continued interest of the international oil companies in the development of the Continental Shelf oil resources. One hundred and thirty-three companies were involved in 53 applications. After detailed appraisal of the applicants, the Secretary of State announced on 9 February 1977 his intention to offer licences for 44 blocks to a total of 65 companies subject to agreement of a compulsory minimum exploration programme with the potential licensee and the conclusion by each group of an operating agreement satisfactory to the Secretary of State. The licences will probably be formally awarded during the summer of 1977.

* The Petroleum (Production) Regulations 1976, S.I. 1976 No. 1129. Available from HMSO price 95p net.

International matters

Negotiations on the division of the Continental Shelf with neighbouring states continued during 1976. The United Kingdom's Continental Shelf boundaries with Norway (south of 61°44′12″), Denmark, The Federal Republic of Germany and the Netherlands have already been settled and that with Belgium agreed in principle. Talks are in progress with the Norwegian Government on settling the boundary north of the present limit. The international Court of Arbitration considering the delimitation of the Continental Shelf between the United Kingdom and Channel Islands and France started its oral hearings in January 1977 and a decision is expected during 1977. The United Kingdom and Irish Governments have in principle to submit their differences over Continental Shelf boundaries to an independent settlement disputes procedure.

Article 4 of the United Kingdom/Norway Continental Shelf Delimitation Agreement of 1965 requires the two countries to agree on the way in which cross-median line fields should be exploited most effectively and how their reserves should be apportioned. In accordance with this, an agreement was signed on 10 May 1976 for the unitisation of the Frigg field and this is due to come into force in 1977. Discussions are in progress between the two Governments on the unitisation of the Statfjord field. It was also established in 1976 that the Murchison field extends into Norwegian waters, and the field will (like others straddling the median line) be developed as a single unit. Discussions have started on the drawing up of a unitisation agreement between the licensees, who are the same as for the Statfjord field, and on an agreement between the two Governments on the development of the Murchison field. The major part of the field lies in the United Kingdom sector of the Continental Shelf.

In September agreement was reached in London between the Secretary of State for Energy and the Norwegian Minister for Industry, Mr Bjartmar Gjerde, on the establishment of a UK/Norwegian

Co-ordinating Committee on Offshore Oil and Gas. The Committee is intended to stimulate collaboration in a number of offshore areas of mutual interest, such as safety, research and development, gas collection from smaller fields, and access to markets for capital equipment, services and supplies.

Another UK/Norwegian committee met most recently in January 1977 to consider joint action on pollution both from accidental spills and operational discharges. Joint contingency planning for emergencies is in hand and joint research programmes on equipment are being arranged.

Training

As part of its programme to improve training in underwater working, the Training Services Agency (TSA) has published a second training standard, covering mixed gas diving. Up to the end of 1976 some 270 trainees had successfully completed approved courses at various diving training schools under the National System of Certification for Trainee Divers; 24 of them the Mixed Gas course and the remainder the Basic Air Diving and Underwater Working courses.

The Underwater Training Centre (UTC) at Fort William which was set up by the Manpower Services Commission, started regular mixed gas (deep) diving courses in November following the completion of two pilot courses held between April and August 1976. Sponsorship of trainees by employers has been at a low level despite the availability of grants from Industrial Training Boards and the TSA. In addition to providing Basic Air and Mixed Gas Courses, the Centre is available for specialist training; for example, for diving supervisors or to meet individual companies' needs. These specially designed courses are now being developed both at UTC and elsewhere.

Training in fire fighting methods has an important contribution to make in improving offshore safety and the Fire Fighting Centre under development at Montrose will fulfil a much needed role in this field.

During 1976 the Drilling Technology Training Centre run by the Petroleum Industry Training Board at Livingston New Town continued to develop its range of courses to meet the specialised needs of the industry and showed an improvement in the utilisation of the training facilities available. The basic rig crew course was supported by trainees under the TSA Training Opportunities Scheme and these courses proved very successful, particularly in reducing the level of rapid turnover on the rigs. The industry has reaffirmed its support for the services offered by the centre, and the Petroleum Industry Training Board is arranging for the transfer of the facilities to Montrose, where they will form a single complex with the fire-fighting centre. The costs of this move are being borne by the industry, and the TSA will continue to provide financial support to develop the facilities of the Drilling Training Centre.

Offshore safety regulations

Following a review of Government responsibilities for the health and safety of workers involved in offshore oil and gas operations, the Prime Minister announced on 30 July 1976 that the application of the Health and Safety at Work etc. Act 1974 would be extended by Order-in-Council to cover workers engaged in the offshore oil and gas industry, including divers. The Health and Safety Commission will therefore assume policy responsibility for occupational safety matters offshore while the Department of Energy will remain responsible for structural safety requirements and safe production of oil. The Petroleum Engineering Directorate of the Department of Energy are responsible for the enforcement of all regulations relating to offshore installations. The Department of Trade's responsibilities for the safety of ships and seafarers are unchanged. In recognition of the need to continue to ensure effective co-ordination of government activities offshore the Inter-Departmental Committee on Marine Safety was established under the chairmanship of the Department of Trade.

Three further sets of safety regulations were made, the tenth and eleventh under

the Mineral Workings (Offshore Installations) Act 1971 and the first under the Petroleum and Submarine Pipe-lines Act 1975.

The Offshore Installations (Operational Safety, Health and Welfare) Regulations 1976 provide the framework for the safety of day-to-day operations. The Offshore Installations (Emergency Procedures) Regulations 1976 require that adequate procedures are prepared for dealing with emergencies. The Submarine Pipe-lines (Diving Operations) Regulations 1976 extend existing diving safety requirements to operations carried out in connection with submarine pipelines and associated works. Three further sets of regulations are being prepared. Two sets, to be introduced under the 1971 Act, will be concerned with the life-saving appliances and fire-fighting systems and equipment to be provided on offshore installations. One other set will be introduced under the 1975 Act and will deal with the powers of inspectors, and the reporting of accidents and dangerous occurrences in relation to pipeline activities.

Certification of offshore installations

The Offshore Installations (Construction and Survey) Regulations 1974 require each offshore installation to have a valid Certificate of Fitness, issued by one of the certifying authorities appointed by the Secretary of State. The original five certifying authorities were; American Bureau of Shipping, Bureau Veritas, Det Norske Veritas, Germanischer Lloyd and Lloyd's Register of Shipping.

When these five Certifying Authorities were appointed, the Secretary of State indicated that he would consider making a limited number of further appointments from among consulting engineers. The Association of Consulting Engineers set up an independent committee of representatives of the principal engineering institutions, led by Professor Sir Owen Saunders, which drew up a short-list of possible candidates. Following detailed appraisal of the short-listed firms, the Secretary of State decided to appoint one new Certifying Authority. This was The Halcrow, Ewbank and Associates Certification Group (a consortium formed by Sir William Halcrow and Partners Limited, Harris and Sutherland, Burness, Corlett and Partners Limited and Messrs Sandberg).

When the Construction and Survey Regulations came into force in 1975, certain of the older gas platforms did not comply with the new requirements. The Secretary of State therefore granted exemptions from the relevant requirements to allow time for the necessary modifications to be identified and carried out. All modifications were completed by the due date, 31 August 1976, and since that date the platforms previously exempted have had Certificates of Fitness.

The Secretary of State's Advisory Committee on Fixed Offshore Installations continued work on problems associated with the development of standards for the design and construction of fixed offshore installations. The original membership of the Committee included representatives of the Department of Energy, the engineering professions, the Certifying Authorities for offshore installations, and the oil companies. The membership was reviewed during the year and a member was also appointed to represent Trade Union interests.

Protection of installations

The Armed Forces provide surveillance and deterrent patrols around the offshore oil and gas installations and are ready to react at short notice to assist an installation threatened with an emergency.

During 1976 the ship patrols were undertaken by *HMS Jura* and, until August, *HMS Reward*, backed up by frigates as opportunity allowed; aerial patrols were flown by several types of RAF aircraft.

Exercises were held to practice reaction to emergencies, and valuable lessons were learned as a result of which procedures for dealing with all types of incidents have been improved.

HM Ships assisted in the tow-out of the gas treatment platform TP1 in May and the Thistle 'A' jacket in August.

Towards the end of the year the special arrangements announced by the Government in 1975 to protect UK offshore resources (including fishery protection) began to come into effect. The first of the five new ships of the *Island* Class of offshore patrol vessels, *HMS Jersey*, began her first patrol on 22 November 1976, and the second, *HMS Orkney*, is now operational. The remainder will be accepted into the Royal Navy during 1977, the last becoming fully operational early in 1978: frigates have been filling the gap in the meantime. From 1 January 1977, the *RAF Nimrod* long range maritime patrol force has provided surveillance effort equivalent to that of four aircraft.

Offshore accidents and dangerous occurrences

In 1976 20 people died amongst those working offshore on the development of oil and gas.* Details on accidents related to offshore installations are given in Appendix 10. In summary the figures are as follows:

Workers on Offshore Installations (mainly rigs and platforms);		10
Divers working around offshore installations	6	7
Divers working on pipelines	1	
Workers on barges and other construction vessels		2
Workers on supply vessels near offshore installations		1
		20

* Accidents on or around rigs and platforms covered by the Mineral Workings (Offshore Installations) Act 1971 must be reported to the Department of Energy. Under the Petroleum and Submarine Pipe-lines Act 1975, Regulations are in preparation on the reporting of accidents in the course of work on pipelines; at present there is no requirement to report. In addition, there are foreign registered vessels such as crane barges and derrick barges on which reliable information would be impossible to collect, and in connection with which there is no obligation to report accidents. Finally, deaths on British registered supply vessels must be reported to the Department of Trade, although again reliable information on all supply vessels, including accidents associated with them, is not available.

In addition there were 57 serious accidents as compared to 50 in 1975.

These accidents were in a year when the number of large Northern North Sea platforms continued to increase and the work force on the installations expanded rapidly. It is estimated that the average numbers employed on offshore installations increased from about 6,300 in 1975 to about 9,200 in 1976 (excluding the work force engaged in pipe-laying and also those employed on crane ships and barges). The 10 deaths were from a work force of approximately 8,700 people (ie excluding the divers), giving a fatality rate of approximately 1.1 per 1,000 (1975: 1.0 per 1,000). The single death caused by a helicopter accident occurred in a year when tens of thousands of flights were made and the passengers carried amounted to hundreds of thousands.

The seven diving deaths were from a work force of approximately 1,000, giving a fatality rate of 7.0 per 1,000 (1975: 6.0 per 1,000). Every effort is being made to reduce this rate by new diving safety regulations made in 1976 under the Petroleum and Submarine Pipe-lines Act and through improved training (see "Training" page 13).

No estimate is available of the number of seamen employed on attendant vessels and so no comparable statistics can be calculated for the single fatality which occurred on them.

The post-installation construction periods for individual platforms are proving longer than most licensees' original estimates. The production phase work force is also larger than most original estimates and the platform accommodation is being increased to match. Platforms with a work force of 400 men during this period are common. The work force and its composition varies considerably as the platforms go from the purely construction phase to construction and drilling and then on to production.

Safety in the operation of cranes continues to be a source of concern although, despite the continued expansion of activity

offshore, the frequency of accidents has declined compared with 1975. The Department of Energy has now imposed a requirement for a crane survey every six months by an independent expert. The fitting of a variety of safety devices should reduce some types of crane incidents. For those incidents related to snatch-loading from an attendant vessel, manufacturers are active in a number of directions to provide equipment designed to reduce crane stress and aid the crane operator. Once these are installed there should be a further reduction in crane incidents.

Environmental aspects

Compensation for oil pollution damage from offshore operations

At a Conference sponsored by the United Kingdom and held in London in December 1976, the United Kingdom, together with France, Germany, Belgium, the Netherlands, Norway, Sweden, Denmark and Ireland, agreed on the text of an international Convention under which compensation will be payable by offshore operators for oil pollution damage caused by their activities in the waters off the coasts of countries which join the Convention. This Convention is the first of its kind in the world.

The maximum amount available for compensation will be at least $35 million per incident from May 1977 (when the Convention is to be opened for signature), rising to $45 million five years later. Operators will be required to insure against the bulk of their liability. Liability will be on a "strict" basis, that is, there will be no need for a person suffering damage to prove any fault by the operator to enable him to claim. Once the Convention is in full operation, a victim of pollution caused by offshore oil operations will be able to bring a claim, and receive compensation, either in the courts of the country where damage is suffered, or in the courts of the country which licensed the installation concerned.

To come into effect, the Convention requires at least four of the countries concerned to ratify it. Legislation will be necessary for the United Kingdom ratification.

Controls on discharges from platforms and shore terminals

The Secretary of State for Energy has the power to exempt oil operators from certain parts of the Prevention of Oil Pollution Act 1971, as amended by the Petroleum and Submarine Pipe-lines Act 1975, so allowing them to discharge water into the sea which contains small amounts of oil obtained during oil production and processing, up to a limit specified in the exemption. Operators are normally required to maintain the oil content of any discharge below an average of 40–50 parts per million (ppm), and below 100 ppm for 96 per cent of the time. The precise level of the limit imposed is related to the volume of the discharge. Large platforms capable of discharges in excess of 100,000 barrels per day are required to maintain an average oil content in their discharge of less than 40 ppm. Smaller platforms capable of discharges of between 1,000 and 100,000 barrels per day will be required to maintain oil content below 50 ppm average. Operators are required to take samples at least twice a day, analyse them by an approved method and submit their findings to the Government each month. In addition, samples are taken by Government inspectors from time to time and analysed separately. Similarly, limited exemptions stating precise limits have been issued to the land terminals at Flotta, Dalmeny, Phillips North Sea Oil Terminal and Shell Teesport. Exemptions, also with precise limits, have been issued to offshore platforms Auk, Argyll, Brent B, Brent Spar Buoy and Montrose. A temporary exemption has been issued for Beryl.

The Central Unit on Environmental Pollution published in 1976 a paper* on the separation of oil from water for North Sea operations. A Seminar on the same theme was held at Herriot-Watt University, which published a report on the proceedings in collaboration with the Department of Energy and the Department of the Environment. A follow

* Pollution Paper No 6: The Separation of Oil from Water for North Sea Operations: DOE(CUEP): HMSO 1976.

up seminar is proposed at Herriot-Watt early in 1978.

Each operator has been asked to submit oil spill contingency plans to the Department of Energy. The majority of these plans have already been collected and are currently being examined by the Department in collaboration with the Department of Trade (Marine Division) to ensure their adequacy, and compatibility with Government plans.

A report* by an interdepartmental working party chaired by the Central Unit on Environmental Pollution on accidental oil pollution of the sea was published in 1976. The report contained a number of conclusions and recommendations on who should be responsible for clearing any spills, on the organisation of arrangements for spill clearance and on the level of resources and the methods to be used.

In 1976, nine spills from offshore installations were reported to the Department of Energy, the total accidental spillage from all of them not exceeding 60 tonnes. There was one spill of around 600 tonnes in January 1977, but this was successfully dealt with. The spill was treated with 5,000 gallons of dispersant using three of the operator's own vessels, and no pollution of the coast resulted from the incident.

* Pollution Paper No. 8: Accidental Oil Pollution of the Sea: DOE(CUEP): HMSO 1976.

Part III: Field by field progress

Summary of activity
Development activity increased in 1976.
In the Northern North Sea, platform drilling activity expanded from the 1.1 rig years of 1975 to 7.9, compared with a 1976 Brown Book forecast of 8.0. It may well double in 1977 to give 16.0 rig years of activity, with 19 rigs operating by the end of the year. In the Southern Basin, development drilling was at a low level. Development drilling on the Rough field was completed, and Hewett and Viking platform drilling was suspended by the end of the year. In 1977, a further development programme will start on a new Indefatigable platform and some work-over activity will maintain rig use in the Southern Basin at approximately the 1976 level.

A steady programme of appraisal was maintained. Exploration drilling overall had reached a peak under 4th round licences in 1975, but as forecast last year was reduced in 1976. Sixty-nine holes remained to be drilled under 4th round licences which expire in March 1978. The average number of mobile rigs (the best indicator of rig activity), dropped from 27.7 in 1975 to 21.2 (compared with a 1976 Brown Book forecast of 20–25). The total number of exploration wells drilled was 86.

Taking exploration appraisal and development wells together, 140 wells were drilled during 1976, bringing the total since exploration began in 1964 to 936.

As operators under existing licences approach the end of the period during which they must complete their obligatory drilling programmes, there should be a higher level of activity to the West of England and Wales, and West of Shetlands, despite some unsuccessful exploration wells there in 1976. Other areas are expected to have virtually the same exploration activity level as 1976 and the average number of rigs active in United Kingdom waters could be up to 25.

Taking exploration and appraisal drilling and development drilling together, 1977 will see considerably more drilling activity than 1975 and 1976.

The good weather during Summer 1976 helped the offshore construction programme and pipe-laying operations. During the pipe-laying season a total of 345 miles of pipeline were laid in the United Kingdom sector of the North Sea. This was slightly lower than the figure for 1975. The laying of the Ninian and Cormorant lines was nearly completed. De-watering and drying of the Frigg lines is planned for early 1977.

Development and production programmes
Under model clause 15 of the terms of the Petroleum Production Licences, licensees cannot develop a field or produce petroleum without the consent of the Secretary of State or his approval of a development and production programme. Pending establishment of programmes under model clause 15, temporary consents were issued to cover 1976.

On 24 December 1976, an approval was given for the development and production programme in respect of the Argyll field. The programme covers the period to the end of 1981 and contains details of the offshore facilities to be used and a maximum and minimum quantity of petroleum to be produced in each year.

At the end of 1976 further temporary consents were issued for other fields to enable development and production to continue pending the establishment of their

development and production programmes. Further temporary consents have also been given for gasfields that are producing or under development.

Pipeline authorisations
Under section 20 of the Petroleum and Submarine Pipe-lines Act 1975, which came into force on 1 January 1976, pipelines may not be constructed or used in UK territorial waters or the UK Continental Shelf except in accordance with an authorisation from the Secretary of State.

During 1976 the Secretary of State agreed to authorise the trunk line to carry gas from the Brent field to St Fergus, the line from Thistle to Dunlin, the line from Heather to the Ninian central platform and several lines within the Brent and Thistle fields. Other applications under consideration relate to lines within the Brent and Indefatigable fields.

Landward operations
Three petroleum exploration wells were drilled, and an existing one deepened to investigate a lower horizon. An appraisal well was drilled at Malton in Yorkshire to evaluate the commerciality of a gas discovery. No development wells were drilled.

Following the grant of further exploration licences in 1976 there should be an expansion of preliminary exploration activity during 1977. Drilling activity under existing production licences will also continue, and appraisal drilling and related development work is likely to show an up-turn. In particular, work to bring onstream the Wytch Farm oilfield in Dorset is likely to reach an advanced stage. This work should be completed in 1978.

As predicted there was a small decline in production from United Kingdom landward oilfields in 1976 to just below the level of 100,000 tonnes. There is unlikely to be any increase in this general level until the Wytch Farm field comes onstream.

To assist an investigation into the harnessing of geothermal energy, the Department of Energy and the Natural Environment Research Council have jointly drilled a well at Winterbourne Kingston in Dorset. This well will also serve to give general stratigraphic information about the Hampshire Basin. Data from the well will be released as soon as practicable.

Oilfields in production
ARGYLL (Hamilton Group block 30/24)
The field began production in mid-1975. No further drilling took place in 1976 though one well was worked over and completed, and new seismic data has been obtained. Four wells were in production at the end of 1976.

As the quantities of gas produced with the oil are too small for delivery to be practical, consent to gas flaring has been given for the life of the field.

AUK (Shell/Esso block 30/16)
Development drilling continued during 1976, and should be completed before the end of 1977. At the end of 1976 three wells were in production.

As the quantities of gas produced with the oil are too small for delivery to be practical, consent has been given to the flaring of gas for the life of the field.

BERYL (Mobil Group block 9/13 extending into Conoco Group block 9/18)
The loading tower broke away from its mooring in December 1975 and was reinstalled during June 1976.

Development drilling continued during 1976, and production via the single buoy mooring started in June 1976. The two drilling rigs will continue to operate throughout 1977 on the A platform. By the end of 1976 four platform wells and a subsea completion had been brought into production.

Production was reduced by some problems with the subsea equipment, which was damaged by a trawler. The accident occurred outside the safety zone in December, when the control cable to the subsea well-head was fouled by the trawler's nets. The well, which was producing at some 6,000 barrels per day, or about a quarter of average daily production from Beryl at the time, was shut down until April 1977.

A consent has been issued for the flaring of excess gas from the field for one year from start-up, and re-injection for three years from start-up.

BRENT (Shell/Esso block 211/29 extending into Texaco block 3/4)

Development drilling began on platform B during the year and was followed by production in November, which built up rapidly thereafter. Tanker loading is by single buoy mooring from the SPAR storage system. Drilling also started on platform D, which was installed in July 1976, and will continue on both platforms during 1977. The A platform was installed in May and the C platform is due for installation in 1978. A substantial programme of work is planned for the field this Summer.

A consent has been issued for the flaring of gas from Brent B until July 1977; this consent was given after studies by consultants and the Department had shown that there were no suitable alternatives to flaring. Once gas compression equipment is installed gas will be re-injected until the pipeline is ready to bring gas ashore to the St Fergus Terminal.

The Sullom Voe terminal, designed to handle oil from the Brent and Ninian systems, is now entering the mechanical engineering phase of construction. The terminal is expected to be operational in 1978, and will be handling about half of North Sea Oil production in the early 1980's.

FORTIES (BP block 21/10 extending into Shell/Esso block 22/6)

Development drilling took place from all four platforms during 1976, and will continue in 1977. Twenty-four wells were in production at the end of the year.

A consent was issued for two years from 1 January 1976 for the flaring of gas above the quantity which can be safely transported in the oil pipeline. In view of the changed production profile for the field, a revised consent has been issued running only until April 1977, at which time the position will be reviewed.

MONTROSE (Amoco Group block 22/18 extending into block 22/17 – also Amoco Group)

Development drilling began in 1976 and will continue through 1977. At the end of the year three wells were in production.

A consent has been issued to flare gas for two years from the start of production in June 1976.

PIPER (Occidental Group block 15/17)

Development drilling began in 1976, and will continue on the A platform using two rigs throughout 1977. Production started through the pipeline to Flotta in December 1976 and the first tanker was loaded from Flotta in January 1977. Production built up rapidly thereafter.

A consent has been issued to flare gas at the field and the Flotta terminal until the end of June 1977. Proposed gas disposal plans for Piper, in conjunction with Claymore, are currently being studied and are under discussion.

Oilfields under development

CLAYMORE (Occidental Group block 14/19)

The platform was installed in July 1976. Development drilling from it using two rigs will start in 1977. Production will be by spur line to the Piper-Flotta pipeline and should start in mid-1977.

CORMORANT (Shell/Esso block 211/26)

The 'A' platform for Cormorant, which will also form the gathering platform for the Brent pipeline system, is under construction at Ardyne Point; it will be completed in Norway, and is due for delivery in 1978. Production from Cormorant itself should start in 1979, although pumping operations for the Brent system will start in 1978.

DUNLIN (Shell/Esso block 211/23 extending into Conoco Group block 211/24)

The platform will be completed at Stord in Norway and installed in 1977. The first conductor strings of casing for drilling from the platform should also be installed during the year.

An appraisal well was drilled on 211/24 in 1976. Two fault blocks to the west of Dunlin were also drilled.

HEATHER (Unocal Group block 2/5)

No further appraisal drilling took place in 1976. Drilling operations from the platform

should start in late 1977 following platform delivery.

NINIAN (Chevron Group block 3/3 extending into BP/Ranger Group 3/8)
No further appraisal drilling took place in 1976, although a fault block to the west of Ninian was drilled during the year. The Ninian Central and South platforms are due for float-out and installation during 1977.

In February 1977 Chevron announced plans for a third platform for Ninian. This platform would develop the Northern part of the Ninian field.

STATFJORD (Mobil Group, Norway, extending into United Kingdom waters Conoco Group Block 211/24)
No further appraisal drilling took place in UK waters. (See "International Matters" page 12).

THISTLE (BODL Group block 211/18 extending into Conoco Group block 211/19)
No appraisal drilling on the Thistle field was carried out in 1976. The Thistle platform was installed in August 1976. Some problems were encountered during installation, so that drilling has not yet commenced but is expected to start early in 1977. Production start-up is expected towards the end of the year.

Oilfields under appraisal

ALWYN AREA (Total Group blocks 3/9a and 3/14a)
No further work was undertaken in 1976 in block 3/14a. A discovery in block 3/4 was proved to extend into 3/9a and a further appraisal well was drilled on this extension in 1976. The area is complex and still being examined for the likely extent of reserves.

BERYL NORTH (Mobil group block 9/13)
Appraisal drilling took place in 1976, and increased the proven acreage of oil. Further appraisal will take place in 1977.

BRAE (Pan Ocean Group block 16/7)
A total of four appraisal wells have now been drilled on Brae. The results of two of these have been disappointing, making it clear that further appraisal will be required before any decisions on development can be taken. A nearby separate discovery in block 16/7 has not been further appraised.

BUCHAN (Transworld Group blocks 20/5 and 21/1)
A possible development decision had to be postponed following drilling difficulties with the fourth well, which was closed in for the winter.

Further developments are expected in the near future but the character of the Buchan reservoir presents special difficulties in evaluating possible recoverable reserves.

CORMORANT NORTH (Shell/Esso block 211/21)
Two successful appraisal wells were drilled on this accumulation to the north of the Cormorant field during 1976.

HUTTON (Conoco Group block 211/28 extending into Amoco Group block 211/27)
Hutton is a highly faulted structure which is still being evaluated on the western side, where the eighth well on block 211/27 is now being drilled. One appraisal well was drilled in 1976. A further discovery was made in 1976 on a fault block between the 211/28 and 211/27 sections of Hutton.

MAGNUS (BP block 211/12)
Three appraisal wells were drilled in 1976; appraisal is continuing. The first well drilled in block 211/7 proved a northern extension of Magnus. Feasibility studies are in hand on possible development methods.

MURCHISON (Conoco Group block 211/19)
Murchison field was discovered in August 1975 and confirmed by delineation drilling in January 1976. Analysis of seismic and other data has confirmed that the field extends into the Norwegian Continental Shelf and the Department of Energy has acknowledged a Norwegian equity interest in it.

A single platform development is planned, and the contract for design of the steel-jacketed structure has been awarded. Contracts for fabrication of the platform and facilities are expected to be awarded in the Summer of 1977, on completion of design work. Start of construction in Summer 1977 with completion and float-out in Summer 1979 would allow

first production in Summer 1980. There is substantial gas in the field which could be re-injected until a sales outlet becomes available.

TARTAN (Texaco block 15/16)
Four out of seven appraisal wells have proved successful. Detailed studies for possible commercial development are in hand.

TERN (Shell/Esso block 210/25)
An appraisal well begun in 1975 was completed in 1976 and a third well is currently being drilled.

THISTLE NORTH (BODL Group block 211/18)
An appraisal well was drilled to the 1975 discovery in the north-west of block 211/18 and another discovery was made on a structure in the north-east of the block.

Block 2/10 (Siebens Group)
No further appraisal drilling took place in 1976, although a well started in December 1975 was completed.

Block 9/19 (Conoco Group)
There was a discovery in 1976 and another well was drilled further south.

Block 11/30 (Mesa Group)
Since the discovery well two further appraisal wells have been successfully completed. Plans for commercial development are under study.

Block 14/20 (Texaco Group)
No further appraisal was undertaken on the original discovery, but two further structures were drilled and one had an appraisal well drilled on it in 1976.

Block 15/13 (BP Group)
An appraisal to the 1975 discovery was drilled and proved dry.

Block 15/23 (Texaco Group)
A successful appraisal well was drilled near the site of the 1974 discovery. Further drilling will take place in 1977.

Block 15/27 (Phillips Group)
One successful appraisal well was drilled following the discovery on this block earlier in the year.

Block 16/17 (Phillips Group)
A dry appraisal well was drilled on this discovery made earlier in the year.

Block 21/02 (Zapex Group)
An appraisal well was drilled in 1976.

Other discoveries
No appraisal drilling took place on the remaining significant discoveries made up to the end of 1976, though appraisal work is planned for several of these in 1977.

Gasfields in production

LEMAN BANK
No further drilling took place in 1976, and no additional activity is anticipated for 1977. The compressors have been installed on three platforms to boost pressure on the trunk pipeline system to counteract the fall in field pressure caused by production of gas from the reservoir.

INDEFATIGABLE
No further drilling took place in 1976. Development drilling on a new platform, 'C', will start in 1977 and some rig activity is anticipated on existing platforms. The 'L' platform will be installed in 1977.

VIKING AREA
Development drilling on Viking satellite platforms was completed in 1976. One of the two compressors being installed on the large platforms has been commissioned. The second will be ready by mid-1977. A workover rig will be operated in 1977.

WEST SOLE
No further developments took place in 1976. A workover rig will be in operation in 1977.

HEWETT FIELD
Development drilling on 'C' platform was suspended in 1976. No further activity is anticipated during 1977.

ROUGH FIELD
Development drilling was completed in 1976, and production halted temporarily for repairs to the pipeline damaged in 1975.

Gasfields under development

FRIGG

An appraisal well was completed early in 1976. Setting of all surface casing strings on the Concrete Drilling Platform 1 was almost completed at the end of the year. On completion of sufficient work to allow a Certificate of Fitness to be issued, drilling to the reservoir will start early in 1977. The drilling platform on the Norwegian side is in place. The Treatment Platform 1 is in place and the Treatment Platform 2 will be installed in 1977. The accommodation platform and manifold concrete platform I (booster) will be ready so that production can start in 1977.

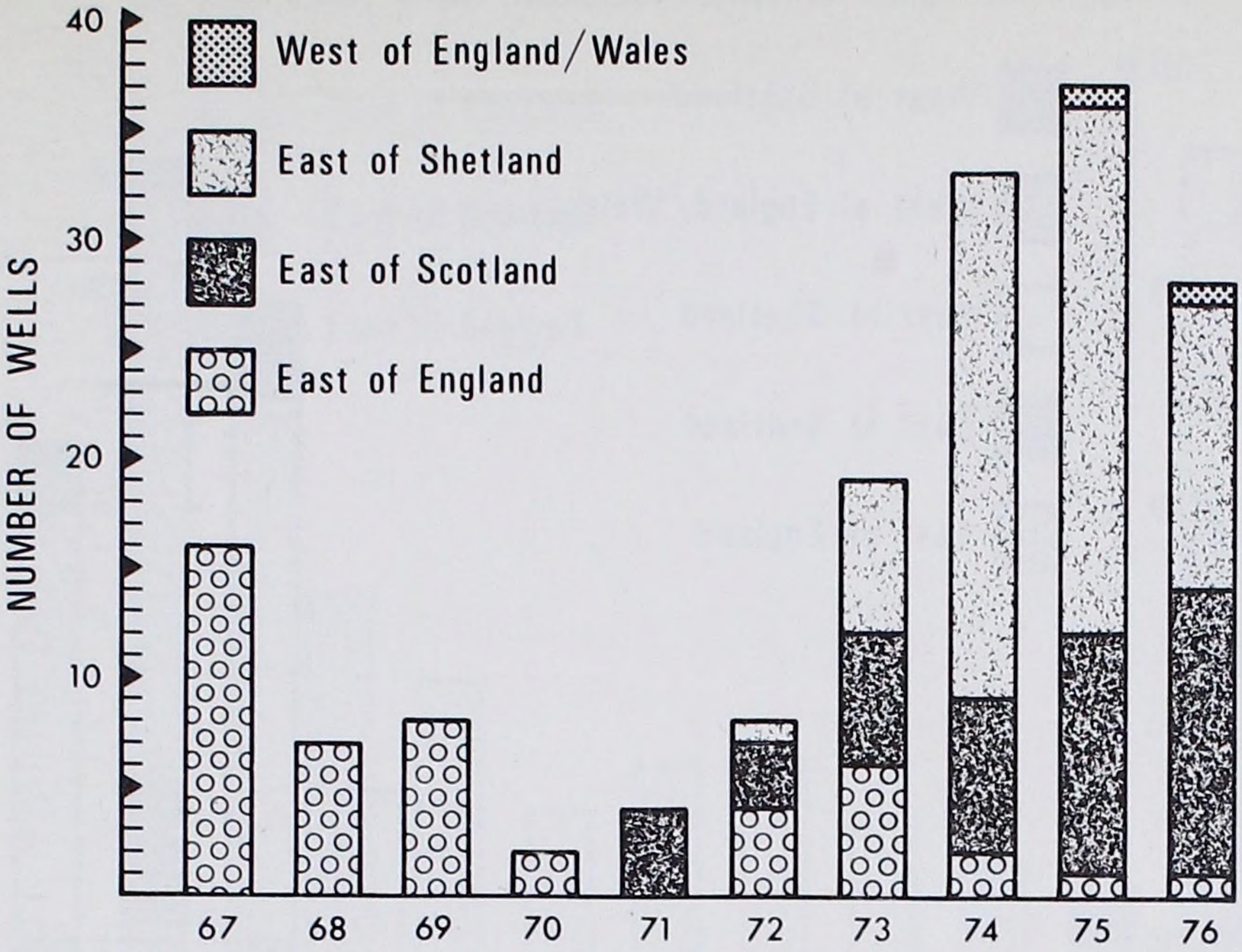
Gasfields under appraisal

The block 110/2 discovery in Liverpool Bay was appraised by a further well; no further appraisal work took place on any of the other gas or gas condensate discoveries, but appraisal of the block 15/30 gas condensate discovery is expected to start in 1977.

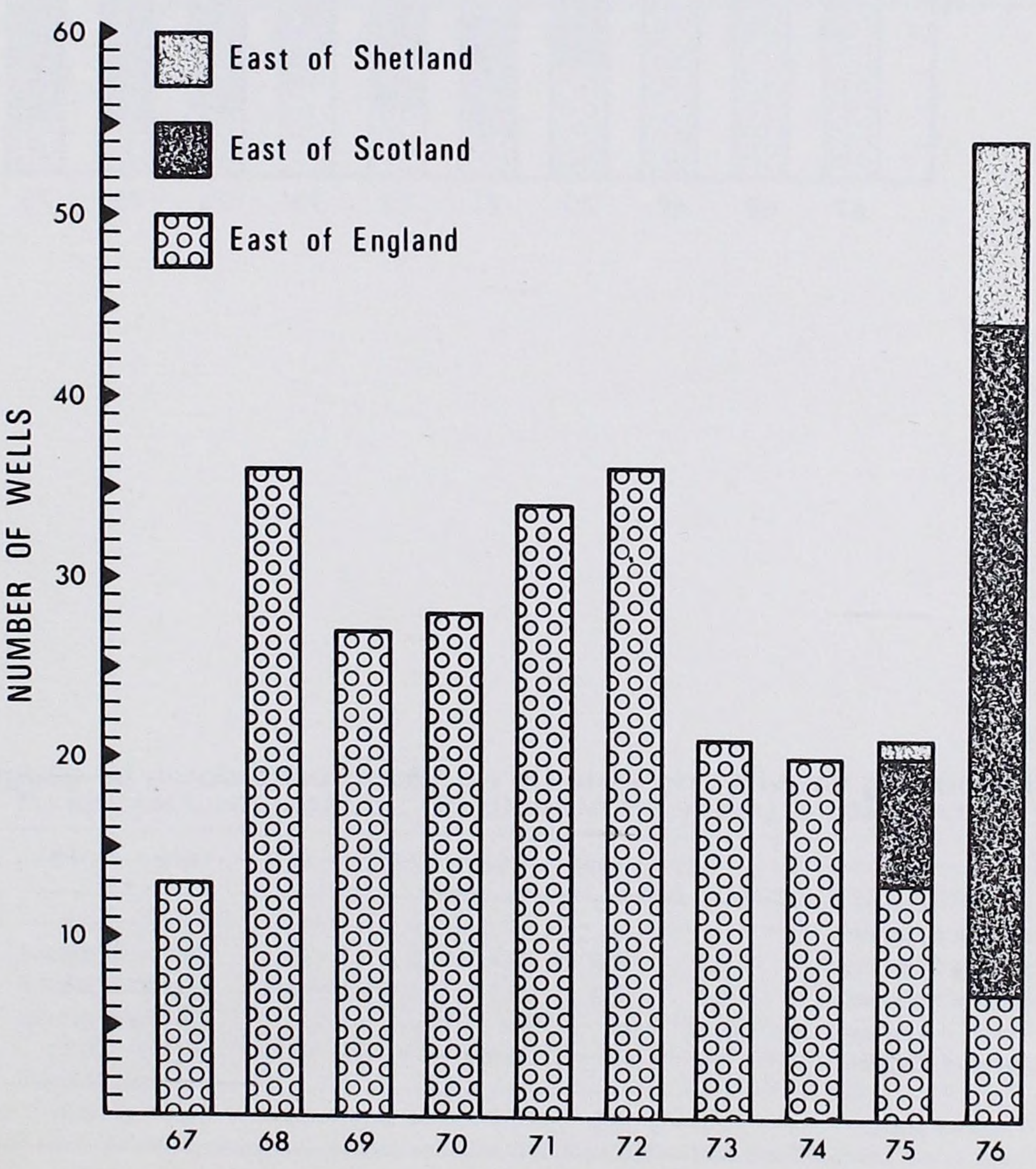
Appendix 1
Drilling activity

Exploration wells drilled each year 1967 – 76

Appraisal wells drilled each year 1967 – 76

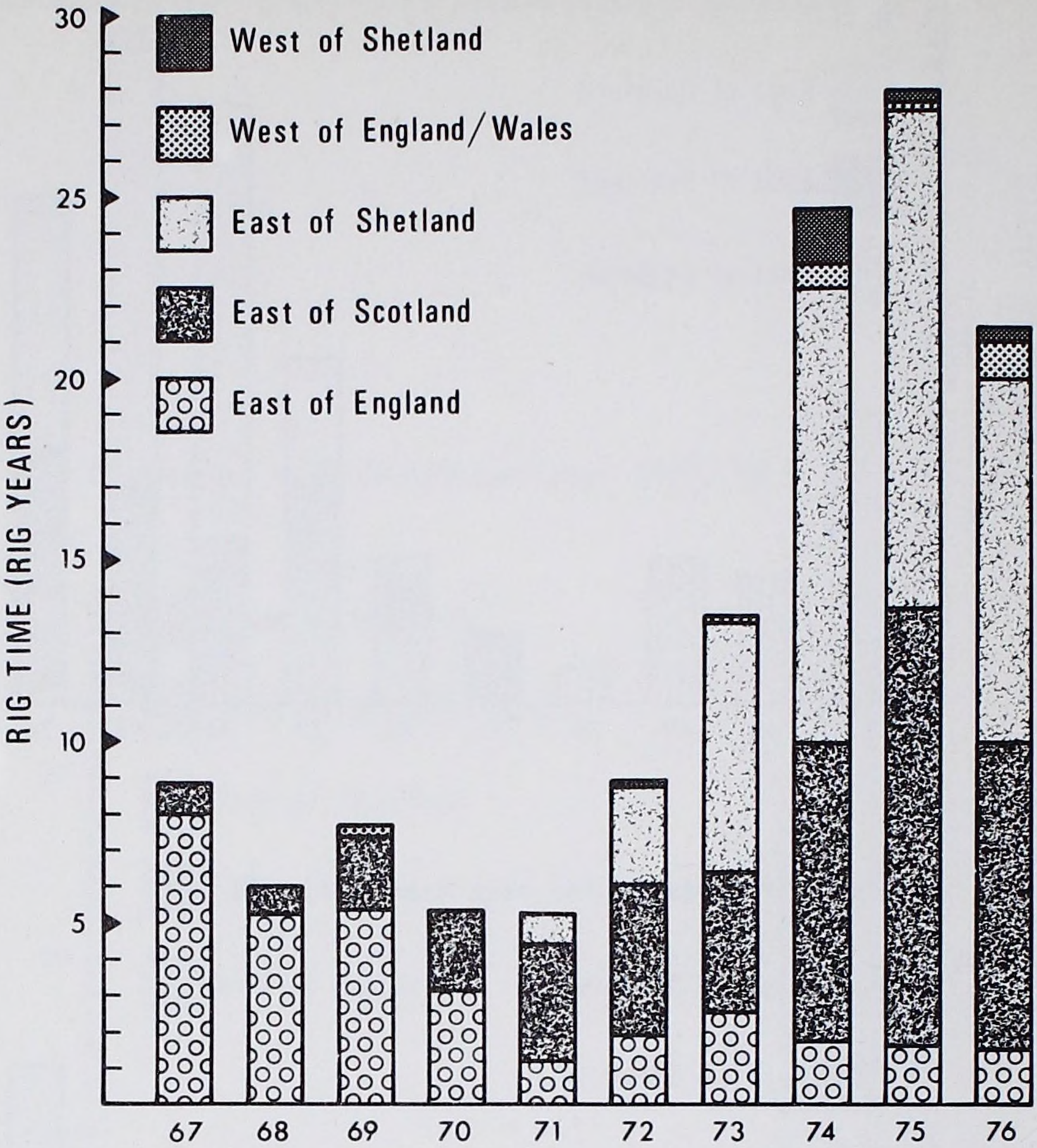


Development wells drilled each year 1967 – 76



Mobile rig activity

Rig time spent in UK Continental Shelf

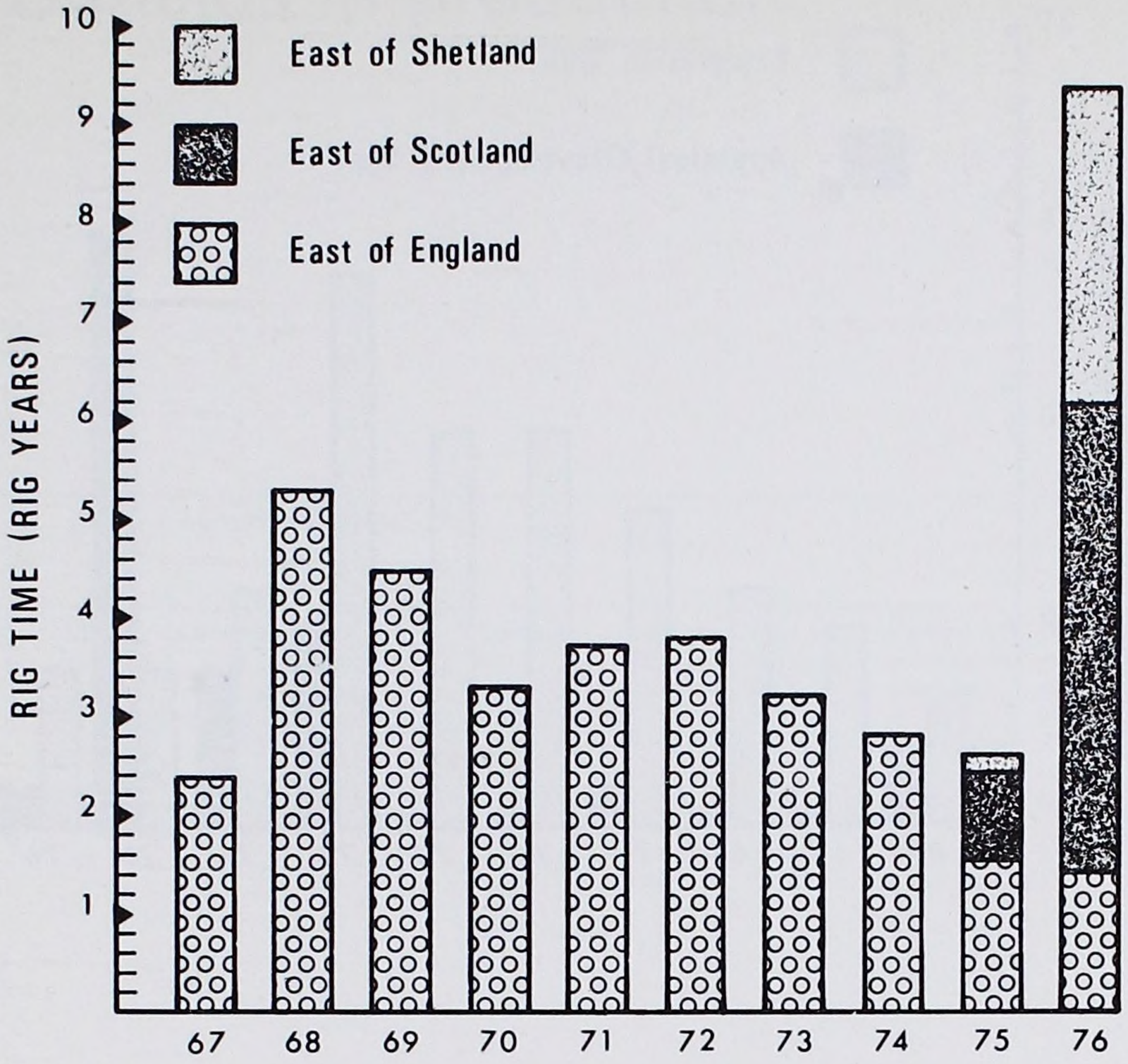


Mobile rig activity: rig time (in rig years) breakdown by geographical areas

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
East of Shetland	–	–	–	–	0.8	2.7	6.9	12.4	13.6	9.9
East of Scotland	0.8	0.8	2.1	2.2	3.2	4.1	3.8	8.2	12.0	8.4
East of England	8.0	5.2	5.3	3.1	1.2	1.9	2.5	1.7	1.6	1.5
West of Shetland	–	–	–	–	–	0.1	–	1.5	0.3	0.4
West of England	–	–	0.3	–	–	–	0.1	0.7	0.2	1.0
Total all areas	8.8	6.0	7.7	5.3	5.2	8.8	13.3	24.5	27.7	21.2

Fixed platform activity

Rig time spent in UK Continental Shelf

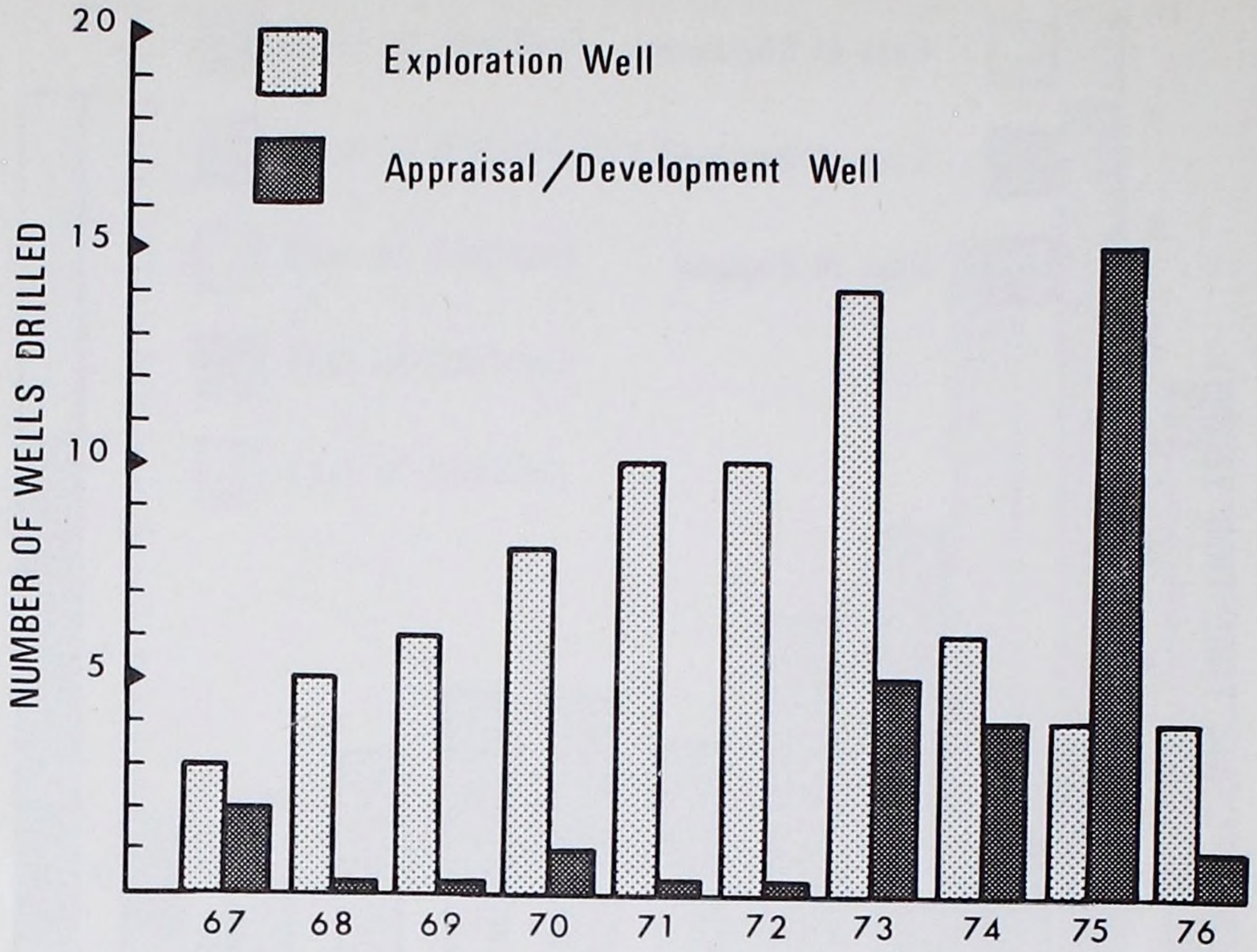


Fixed platform activity: rig time (in rig years) breakdown by geographical areas

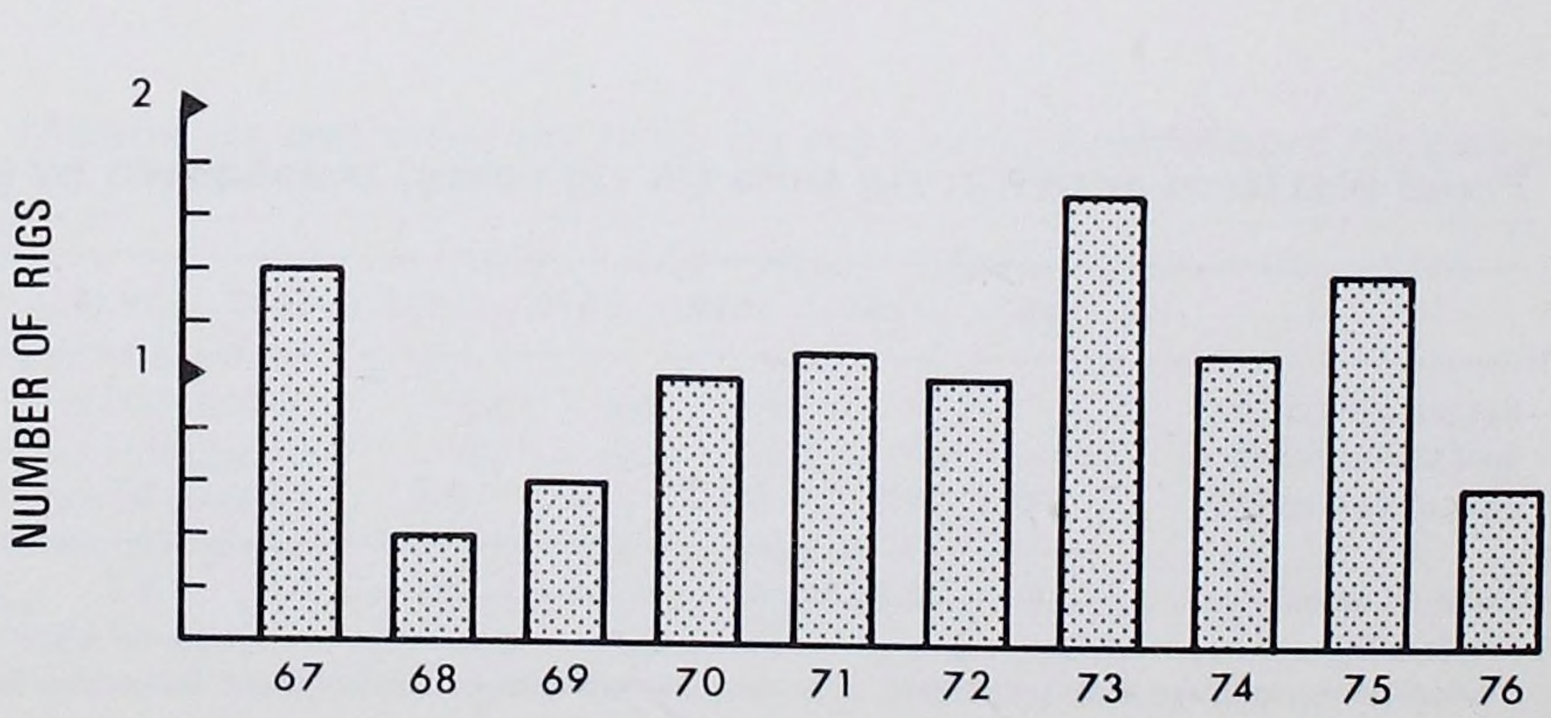
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
East of Shetland	–	–	–	–	–	–	–	–	0.2	3.2
East of Scotland	–	–	–	–	–	–	–	–	0.9	4.7
East of England*	2.4	5.3	4.5	3.3	3.7	3.8	3.2	2.8	1.5	1.4
Total all areas	2.4	5.3	4.5	3.3	3.7	3.8	3.2	2.8	2.6	9.3

* Most of this activity was associated with the development of the Southern Basin gas fields.

Number of exporation and appraisal/development wells drilled each year



Mobile rig activity in rig years



Appendix 2
Oilfields in production

Proven Oil Fields		Extension into other UK Blocks								
Field name (Block number)	Licensees/Company interest in block (%) in 1976	Block number	Licensees	Company interest in block (%) in 1976	Date of discovery	Date of production start-up	Operator's estimate of first year of peak production	Operator's estimated peak production (million tonnes per year)	Operator's estimate of proven recoverable reserves for the field[1] (million tonnes)	1976 Oil production (million tonnes)
Argyll (30/24)	Hamilton Brothers Oil Co (Great Britain) Ltd/28.8 Hamilton Brothers Petroleum (UK) Ltd/7.2 RTZ Oil and Gas Ltd/25 Blackfriars Oil Co Ltd/12.5 The Trans-European Co Ltd/2.5 Texaco North Sea UK Ltd/24	–	–	–	Oct 1971	June 1975	1976	1.1	–[2]	1.0
Auk (30/16)	Shell/50 Esso/50	–	–	–	Feb 1971	Feb 1976	1977	2.5	8[3]	1.2
Beryl (9/13)	Mobil Producing North Sea Ltd/50 Amerada Exploration Ltd (Amerada)/20 Texas Eastern (UK) Ltd (Texas Eastern)/20 British Gas Corporation/10	–	–	–	Sept 1972	June 1976	1977	4	70[4]	0.4
Brent (211/29)	Shell/50 Esso/50	3/4	Texaco North Sea UK Ltd	100	July 1971	Nov 1976	1982	23[5]	230[3,5]	0.1
Forties (21/10)	BP Oil Development Ltd/100	22/6a	Shell UK Ltd (Shell) Esso Petroleum Co Ltd (Esso)	50 50	Nov 1970	Nov 1975	1977	24	240	8.6
Montrose (22/17)	Amoco UK Petroleum Ltd (Amoco)/30.77 British Gas Corporation/30.77 Amerada/23.08 Texas Eastern/15.38	22/18	Amoco British Gas Corporation Amerada Texas Eastern	30.77 30.77 23.08 15.38	Sept 1969	June 1976	1978	2.4	20	0.1
Piper (15/17)	Occidental Petroleum (UK) Ltd/36.5 Getty Oil International (England) Ltd/23.5 Allied Chemical (Great Britain) Ltd/20 Thomson North Sea Ltd/20	–	–	–	Jan 1973	Dec 1976	1978	12	85	0.1

Offshore oil production	11.5
Condensate production	0.4
Landward oil production	0.1
Total production	12.0

Appendix 3
Oilfields under development

Proven Oil Fields		Extension into other UK Blocks							
Field name (Block Number)	Licensees/Company interest in block (%) in 1976	Block number	Licensees	Company interest in block (%) in 1976	Date of discovery	Operator's estimated date of production start-up	Operator's estimate of first year of peak production	Operator's estimate of peak production (million tonnes per year)	Operator's estimate of Proven Recoverable Reserves for the field[1] (million tonnes)
Claymore (14/19)	Occidental Petroleum (Caledonia) Ltd/36.5 Getty Oil International (England) Ltd/23.5 Allied Chemical (Great Britain) Ltd/20 Thomson North Sea Ltd/20	–	–	–	May 1974	1977	1979	8.5	57
Cormorant (211/26)	Shell/50 Esso/50	211/21	Shell Esso	50 50	Sept 1972	1979[6]	1981[6]	3[6]	20[3,6]
Dunlin (211/23)	Shell/50 Esso/50	211/24	Conoco Ltd (Conoco) Gulf Oil (Great Britain) Ltd (Gulf) BNOC (Exploration) Ltd	33⅓ 33⅓ 33⅓	July 1973	1979	1982	7.5	80[3]
Heather (2/5)	Unocal Exploration & Production Co (UK) Ltd/31.25 Skelly Oil Exploration (UK) Ltd/31.25 Tenneco Great Britain Ltd/31.25 The Norwegian Oil Co DNO (UK) Ltd/6.25	–	–	–	Dec 1973	1978	1980	2.5	20
Ninian (3/3)	Chevron Petroleum Ltd/24 BNOC (Ninian) Ltd/30 Imperial Chemical Industries Ltd/26 Murphy Petroleum Ltd/10 Ocean Exploration Co Ltd/10	3/8	BP Petroleum Development Ltd Ranger Oil (UK) Ltd Scottish Canadian Oil and Transportation Co Ltd London & Scottish Marine Oil Co Ltd	50 20 7 23	Jan 1974	1978	1981	16.5	140
UK Statfjord (211/24)	Conoco/33⅓ Gulf/33⅓ BNOC (Exploration) Ltd/33⅓	211/25	Conoco Gulf BNOC (Exporation) Ltd	33⅓ 33⅓ 33⅓	April 1974	1979	1985	4.2	58.6[7]
Thistle (211/18)	BODL Ltd/5 Burmah Oil (Exporation) Ltd/8.15 BNOC (Thistle) Ltd/10.85 Deminex UK Exploration and Production Ltd/22.5 Deminex Oil and Gas (UK) Ltd/20 Sante Fe (UK) Ltd/22.5 Tricentrol Thistle Development Ltd/10 Charterhouse Petroleum Development Ltd/1	211/19	Conoco Gulf BNOC (Exploration) Ltd	33⅓ 33⅓ 33⅓	July 1973	1977	1979	10.1	76

Approximate conversion factors 1m barrels per day = 50m tonnes per year, 1 tonne = 7.4 barrels.

Notes to Appendices 2 and 3

1 The reserves figures quoted may not be precisely comparable with each other and with other figures quoted in this report since differences exist in the procedures and assumptions adopted by different companies and by the Department of Energy.
2 Currently under re-assessment.
3 Total discovered reserves, that is, proven plus suitable discounted figures for probable and possible reserves.
4 Proven plus prospective.
5 Stabilised crude, excluding NGL, for block 211/29.
6 These figures refer to production from block 211/26.
7 Estimated UK sector reserves; discussions are in progress on the unitisation of the field.

Appendix 4
Other significant* oil discoveries announced by the end of 1976

Field name	Block number	Discovered by	Date discovered
Maureen	16/29	Phillips Group	February 1973
–	3/15	Total Group	July 1973
Hutton	211/28	Conoco/BNOC/Gulf Group	September 1973
Alwyn	3/14a	Total Group	November 1973
Magnus	211/12	BP	June 1974
Andrew	16/28	BP	June 1974
–	9/13	Mobil Group	June 1974
Buchan	21/1	Transworld Group	August 1974
–	15/23	Texaco	October 1974
–	3/11	Amoco Group	December 1974
–	2/5	Union Oil Group	December 1974
–	15/16	Texaco	December 1974
–	14/20	Texaco	February 1975
–	9/12	Union Oil Group	February 1975
Crawford	9/28	Hamilton Group	February 1975
–	3/4	Texaco	March 1975
Tern	210/25	Shell/Esso Group	April 1975
–	2/10	Siebens Group	April 1975
Brae	16/7	Pan Ocean Group	April 1975
–	211/27	Amoco Group	April 1975
Beryl North	9/13	Mobil Group	May 1975
–	21/2	Zapata Group	June 1975
–	3/2	Conoco/BNOC/Gulf Group	June 1975
–	211/13	Shell/Esso Group	July 1975
–	16/21	Sun Oil Group	August 1975
–	3/4	Texaco	August 1975
–	16/7	Pan Ocean Group	August 1975
Murchison	211/19	Conoco/BNOC/Gulf Group	September 1975
–	211/18	BODL Group	September 1975
–	15/13	BP Group	October 1975
–	3/9	Total Group	October 1975
–	15/21	Monsanto Group	October 1975
–	211/13	Shell/Esso Group	December 1975
–	23/27	Ranger/Scot Group	March 1976
–	23/26a	BP	March 1976
–	15/27	Phillips Group	April 1976
–	14/20	Texaco	April 1976
–	211/27	Amoco Group	May 1976
–	9/19	Conoco/BNOC/Gulf Group	May 1976
–	211/16	Shell/Esso Group	May 1976
–	14/20	Texaco	June 1976
–	3/7	Chevron/Canada Northwest Group	June 1976
–	16/17	Phillips Group	July 1976
–	211/18	BODL Group	July 1976
–	11/30	Mesa Group	September 1976

* The description "significant" relates to the flow rates achieved in well tests, and this is not necessarily an indicator of the potential commerciality of the find.

Appendix 5
Participation agreements

The Government's policy for securing majority State participation in commercial oilfields on the United Kingdom Continental Shelf, discovered under licences issued before the Fifth Round, is set out in the White Paper "United Kingdom Oil and Gas Policy", published in July 1974 (Cmnd 5696).

By 28 February 1977, agreement had been reached, by the Government and BNOC, with 25 companies on terms for majority State participation in those companies' interests in commercial oilfields. Four of the agreements (those with Gulf, Conoco, Tricentrol and Ranger) are definitive agreements. The remainder, currently in the form of outline agreements, are being developed into detailed definitive agreements.

Each agreement is tailored to the individual circumstances of the company concerned and secures our objectives whilst leaving the companies financially neither better nor worse off as a result. For the majority of companies this has meant an entitlement for BNOC to take up 51 per cent of petroleum produced from fields on the UKCS. For certain companies, however, existing UK investment and jobs have depended on the continued access by the companies to more than 49 per cent of their UKCS petroleum. In these cases, agreements have provided for the sale-back to the companies of a proportion of the petroleum taken by BNOC (up to 100 per cent in some cases). The exact circumstances in which sale-back provisions will operate vary from Agreement to Agreement and will in most cases follow a thorough appraisal of the company's operations from year to year by the Government, with BNOC acting as adviser. In other cases BNOC will sell back a proportion of the UKCS petroleum it elects to take in exchange for petroleum from other sources.

The companies with whom participation has been agreed are set out below, together with the oilfields either in production or under development, in which they have an interest.

Company	Field
Gulf Oil Corporation Continental Oil Company	Thistle Dunlin UK Statfjord
Tricentrol Thistle Development Ltd	Thistle
Ranger Oil (UK) Ltd	Ninian
British Petroleum	Forties, Ninian
Occidental Petroleum (UK) Ltd Getty Oil International (England) Ltd Allied Chemical (Great Britain) Ltd Thomson Scottish Petroleum Ltd	Piper, Claymore
Unocal Exploration and Production Company (UK) Ltd Skelly Oil Exploration (UK) Ltd Tenneco Great Britain Ltd The Norwegian Oil Co DNO (UK) Ltd	Heather
Chevron Petroleum Ltd	Ninian
Santa Fe (UK) Ltd	Thistle
Shell (UK) Ltd	Auk, Brent, Cormorant
Esso Petroleum Co Ltd	Dunlin
*Deminex (UK) Exploration and Production Ltd *Deminex Oil and Gas (UK) Ltd	Thistle

Company	Field
Mobil Producing North Sea Ltd	Beryl
Amerada Exploration Ltd	Beryl
Texas Eastern (UK) Ltd	Beryl
Texaco North Sea UK Ltd	No field yet in production or under development
Imperial Chemical Industries Ltd	Ninian
Murphy Petroleum Ltd Ocean Exploration Co Ltd	Ninian

* As both these companies are subsidiaries of Deminex-Deutsche Erdoelversorgungsgesellschaft, they are counted as one for the total number of companies who have agreed to majority state participation.

Appendix 6
Gasfields in production or under development

Proven Gas Fields	Main Block			Extension into other UK Blocks				
Field name	Block number	Licensees	Company interest in block (%)	Block number	Licensees	Company interest in block (%)	Date discovered	Date of production start-up
West Sole	48/6	BP Petroleum Development Ltd	100	–	–	–	October 1965	March 1967
Leman Bank	49/26	Shell UK Ltd (Shell)	50	49/27	Amoco UK Petroleum Ltd (Amoco)	30.77	April 1966	August 1968
		Esso Petroleum Co Ltd (Esso)	50		British Gas Corporation	30.77		
					Amerada Exploration Ltd (Amerada)	23.08		
					Texas Eastern (UK) Ltd (Texas Eastern)	15.38		
				49/28	Arpet Petroleum Ltd (Arpet)	33⅓		
					British Sun Oil Co Ltd	23⅓		
					North Sea Exploitation and Research Co Ltd	10		
					Superior Oil (UK) Ltd	20		
					Canadian Superior Oil (UK) Ltd	3⅓		
					Sinclair (UK) Oil Co Ltd	10		
				53/2	Mobil Producing North Sea Ltd	100		

Proven Gas Fields	Main Block			Extension into other UK Blocks				
Field name	Block number	Licensees	Company interest in block (%)	Block number	Licensees	Company interest in block (%)	Date discovered	Date of production start-up
Indefatigable	49/18	Amoco	30.77	49/23	Amoco	30.77	June 1966	October 1971
		British Gas Corporation	30.77		British Gas Corporation	30.77		
		Amerada	23.08		Amerada	23.08		
		Texas Eastern	15.38		Texas Eastern	15.38		
				49/19	Shell	50		
					Esso	50		
				49/24	Shell	50		
					Esso	50		
Hewett	48/29	Arpet	33⅓	48/30	Phillips Petroleum Exploration UK Ltd	35	October 1966	July 1969
		British Sun Oil Ltd	23⅓		Fina Exploration Ltd	30		
		North Sea Exploitation and Research Co Ltd	10		AGIP (UK) Ltd	15		
					Century Power and Light Ltd	7.22		
		Superior Oil (UK) Ltd	20		Plascom (1909) Ltd	4.26		
		Canadian Superior Oil (UK) Ltd	3⅓		Halkyn District United Mines Ltd	4.26		
		Sinclair (UK) Oil Co Ltd	10		Oil Exploration Ltd	4.26		
				52/5a	Phillips group as above			
Viking	49/17	Conoco Ltd (Conoco)	50	49/12a	Conoco	50	May 1968	July 1972
		BNOC (Exploration) Ltd	50		BNOC (Exploration) Ltd	50		
Rough	47/8*	Amoco	13.68	47/3a	Amoco	30.77	May 1968	October 1975
		British Gas Corporation	69.23		British Gas Corporation	30.77		
		Amerada	10.26		Amerada	23.08		
		Texas Eastern	6.83		Texas Eastern	15.38		
Frigg (UK)	10/1	Total Oil Marine Ltd.	33⅓	–	–	–	May 1972	1977 (planned)
		Aquitaine Oil (UK) Ltd	22⅔					
		Elf Oil Exploration and Production (UK) Ltd	44⅔					

* Discovered by Gulf Oil (Great Britain) Ltd but licence now assigned to Amoco group

Appendix 7
Other significant * gas and gas condensate discoveries announced by the end of 1976

Field name	Block number	Discovered by	Date discovered
Dotty†	48/30	Phillips Group	May 1967
—	53/4a	BODL/Conoco Group	July 1967
—	48/21a	Placid Oil (GB) Ltd	August 1967
Deborah†	48/30	Phillips Group	August 1968
—	49/28	Arpet Group	March 1969
Sean	49/25a	Allied Chemical Group	April 1969
—	49/28	Arpet Group	May 1969
—	41/24a	Total Group	June 1969
—	43/20a	Hamilton Group	June 1969
—	43/8a	Whitehall/Hamilton Group	January 1970
—	47/13a	Tricentrol/Conoco/BNOC Group	April 1970
Viking Area	49/21	BODL/Conoco Group	July 1970
Viking Area	49/16	Conoco/BNOC Group	January 1971
—	30/2 (Condensate)	BODL/Hamilton Group	June 1971
—	48/18b	Ranger/Berry Wiggins Group	April 1972
Lomond	23/21 (Condensate)	Amoco Group	May 1972
—	49/22	Mobil/Conoco/BNOC Group	May 1972
Amethyst	47/14a	BODL Group	October 1972
—	3/19	Total Group	July 1973
Bruce	9/8 (Condensate)	Hamilton Group	July 1974
—	211/13 (Condensate)	Shell/Esso	July 1974
—	3/25	Total Group	July 1974
—	110/2	Hydrocarbons (GB) Ltd	September 1974
—	15/30 (Condensate)	Conoco/BNOC/Gulf Group	September 1975
—	21/2 (Condensate)	Zapata Group	December 1975
—	48/12	Transocean Group	December 1975
—	49/11a	Phillips Group	March 1976
—	49/29b	Mobil	June 1976

* The description "significant" relates to the flow rates achieved in well tests, and this is not necessarily an indicator of the potential commerciality of the find.

† Gas supplies from these discoveries are included in the contract for the sale of gas from the Hewett Field.

Appendix 8
Natural gas production

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	Cumulative total to end 1976
West Sole Field											
$M^3 \times 10^7$	0.5	130	159	119	188	231	192	185	185	204	1596
Oil equivalent m. tonnes	—	1.11	1.35	1.02	1.60	1.96	1.63	1.57	1.57	1.74	13.55
Leman Bank Field											
$M^3 \times 10^7$	—	75	300	808	1317	1361	1360	1619	1562	1592	9995
Oil equivalent m. tonnes	—	0.64	2.54	6.85	11.17	11.51	11.53	13.73	13.24	13.61	84.82
Hewett Field											
$M^3 \times 10^7$	—	—	55	199	344	527	581	713	773	819	4012
Oil equivalent m. tonnes	—	—	0.47	1.69	2.91	4.46	4.93	6.05	6.55	7.00	34.06
Indefatigable Field											
$M^3 \times 10^7$	—	—	—	—	18	460	466	569	640	656	2810
Oil equivalent m. tonnes	—	—	—	—	0.15	3.90	3.95	4.83	5.43	5.61	23.87
Viking Field											
$M^3 \times 10^7$	—	—	—	—	—	139	359	485	561	618	2162
Oil equivalent m. tonnes	—	—	—	—	—	1.18	3.04	4.11	4.76	5.28	18.37
Rough Field											
$M^3 \times 10^7$	—	—	—	—	—	—	—	—	1	52	53
Oil equivalent m. tonnes	—	—	—	—	—	—	—	—	—	0.44	0.44
Totals											
$M^3 \times 10^7$	0.5	205	514	1127	1867	2718	2959	3573	3723	3941	20629
Oil equivalent m. tonnes	—	1.75	4.36	9.55	15.83	23.04	25.08	30.29	31.55	33.68	175.13

1 M^3 = 35.31 cubic feet
1 tonne = 1170 M^3
1 therm = 2.75 M^3

Appendix 9
Oil production platforms

Field	Operator		Platform contractor	Site	Platform type	Installation date
Platforms installed						
Argyll	Hamilton		Converted by Wilson Walton	Teesside	Converted Drilling Rig	March 1975
Auk	Shell		Redpath Dorman Long	Methil	Steel	July 1974
Beryl	Mobil		Norwegian Contractors	Stavanger Norway	Concrete	July 1975
Brent	Shell	A	Redpath Dorman Long	Methil	Steel	May 1976
		B	Norwegian Contractors	Stavanger Norway	Concrete	August 1975
		D	Norwegian Contractors	Stavanger Norway	Concrete	July 1976
Claymore	Occidental		Union Industrielle et d'Entreprise	Le Havre France	Steel	July 1976
Forties	BP	FA	Laing Offshore	Teesside	Steel	June 1974
		FB	Laing Offshore	Teesside	Steel	June 1975
		FC	Highlands Fabricators	Nigg Bay	Steel	August 1974
		FD	Highlands Fabricators	Nigg Bay	Steel	June 1975
Montrose	Amoco		Union Industrielle et d'Entreprise	Le Havre France	Steel	August 1975
Piper	Occidental		McDermott Scotland Union Industrielle et d'Entreprise	Ardersier Le Havre France	Steel	June 1975
Thistle	BODL		Laing Offshore	Teesside	Steel	August 1976
Platforms under construction						Platform delivery date
Brent	Shell	C	McAlpine SeaTank	Ardyne Point	Concrete	1978
Cormorant	Shell		McAlpine SeaTank	Ardyne Point	Concrete	1978
Dunlin	Shell		Andoc	Rotterdam Holland	Concrete	1977
Heather	Unocal		McDermott Scotland	Ardersier	Steel	1977
Ninian	Chevron	Central	Howard Doris	Loch Kishorn	Concrete	1977
		South	Highlands Fabricators	Nigg Bay	Steel	1977

Appendix 10
Accident and employment statistics

Year	Mobile drilling activity (rig years)	Fixed platform drilling activity (rig years)	Production platforms	Estimated numbers employed on installations	Number of fatal accidents (approximate rate per 1000 in brackets)		Number of serious accidents (approximate rate per 1000 in brackets)	
					Installations	Vessels	Installations	Vessels
1967	8.8	2.4	–	1120	1 (1.0)	–	18 (16.0)	–
1968	6.0	5.3	1	1210	3 (2.5)	5	21 (17.5)	–
1969	7.7	4.5	4	1450	2 (1.5)	1	19 (13.0)	–
1970	5.3	3.3	9	1150	1 (1.0)	–	12 (10.5)	–
1971	5.2	3.7	11	1260	4 (3.0)	–	15 (12.0)	2
1972	8.8	3.8	16	1850	3 (1.5)	–	17 (9.0)	–
1973	13.3	3.2	19	2430	2 (1.0)	1	22 (9.0)	–
1974	24.5	2.8	23	4030	9 (2.0)	3	19 (4.5)	6
1975	27.7	2.6	29	6300	9 (1.5)	1	46 (7.5)	4
1976	21.2	9.4	39	9200	16 (1.5)	1	50 (5.5)	7

NOTES:

1 The above accident statistics are based on data reportable under S.I. No 1842 1973, the Offshore Installations (Inspectors and Casualties) Regulations 1973. This does not include pipe laying barges. Accident rates are therefore only calculable for installations.

2 The estimated numbers employed on installations are based on the average number of persons on each of the different type of operational installations and assume that an average 42 hours week is worked.

Fatal and serious accidents by activity

	Fatal accidents											Serious accidents											Dangerous occurrences		
	Pre 67	67	68	69	70	71	72	73	74	75	76	Pre 67	67	68	69	70	71	72	73	74	75	76	74	75	76
Construction										2	4			1			1				5	12		5	6
Drilling	14*		2			2	2		5	2	2	17*	11	10	10	4	5	7	10	13	26	21	8	5	13
Production																	2			1	2	4		4	9
Maintenance				1		1					1		1	1		1		2	1	3	6	4	4		5
Diving	1					1	1	1	3	3†	6	1		2	2		1	1	1			2	2	3	3
Helicopters											1											4		2	1
Boats			5	1				1	3	1	1						2			2	4	7	10	7	12
Cranes		1	1	1	1			1	1	2	2	4			6	3	2	5	5	6	7	3	10	25	21
Domestic																							2	2	1
Unallocated‡												2	6	7	1	4	4	2	5						
Total	15	1	8	3	1	4	3	3	12	10	17§	24	18	21	19	12	17	17	22	25	50	57	36	53	71

* Sea Gem accounts for 13 of the Pre-1967 fatal accidents and 6 serious accidents.
† One further diver died from natural causes while diving from an offshore installation.
‡ 1965–1973 had an allocated group to slips, falls etc, unassociated with working operations. Only the fatal accidents have been re-classified.
§ The 1976 total does not include one diver and two construction workers who were killed while working on vessels not covered by the accident reporting requirement of the Mineral Workings Act (see "Offshore accidents and dangerous occurrences" page 15).

Appendix 11
Major North Sea pipelines

Major North Sea Pipelines from – to	Length (miles)	Diameter (inches)	Material conveyed	Operator	Year commissioned	Remarks
(a) *Operating*						
West Sole – Easington	42	16	Natural Gas	BP	1967	
Leman Bank – Bacton	35	30	Natural Gas	Shell/Esso	1968	
Hewett–Bacton	20½	30	Natural Gas	Phillips/Arpet	1969	
Leman Bank – Bacton	38	30	Natural Gas	Amoco	1969	
Leman Bank – Bacton	40	30	Natural Gas	Amoco-Shell/Esso	1970	Joint line
Leman Bank – Leman Bank	5	30	Natural Gas	Amoco-Shell/Esso	1970	Joint link line
Indefatigable – Leman Bank	25	30	Natural Gas	Amoco-Shell/Esso	1971	Joint line
Viking–Mablethorpe	86	28	Natural Gas	Conoco	1972	
Hewett–Bacton	20½	30	Natural Gas	Phillips/Arpet	1973	
Leman Bank–Bacton	36	30	Natural Gas	Amoco-Shell/Esso	1973	
Rough–Easington	18	16	Natural Gas	Amoco	1975	
Ekofisk–Teesside	220	34	Crude Oil	Phillips	1975	Originates in Norwegian waters
Forties–Cruden Bay	111	32	Crude Oil	BP	1975	
Piper–Flotta	124	30	Crude Oil	Occidental	1976	
(b) *Under construction*						
Frigg–St Fergus No. 1 } Frigg–St Fergus No. 2 }	225	32	Natural Gas	Total Oil Marine		
Cormorant–Sullom Voe (Brent System)	93	36	Crude Oil	Shell/Esso		Will serve Brent and other fields
Ninian–Sullom Voe	105	36	Crude Oil	BP		
Claymore–Pipeline (tie in)	8	30	Crude Oil	Occidental		
Piper–Claymore	22	16	Associated Gas	Occidental		
Brent–St Fergus	281	36	Natural Gas	Shell		
Dunlin–Cormorant	17	24	Crude Oil	Shell		
Thistle–Dunlin	7	16	Crude Oil	BODL Ltd		
(c) *Completed but not commissioned*						
Heather–Ninian	22	16	Crude Oil	Union Oil		

Appendix 12
Licensing rounds

Offshore production and exploration licences are issued under the Petroleum (Production) Act 1934, as extended offshore by the Continental Shelf Act 1964. To date there have been five rounds of production licensing in 1964, 1965, 1970, 1971/1972 and 1976/1977. Details of each round are given below. Formal awards of Fifth Round licences will not take place until the summer of 1977.

Petroleum production licensing – round by round

Round	Area under offer	No. of blocks on offer	No. of applications	No. of companies in consortia	No. of blocks applied for	Licences		
						No. of blocks	No. awarded	No. of companies
First (1964)	North Sea	960	31	61	394	348	53	51
Second (1965)	North Sea Irish Sea English Channel	1102	21	54	127	127	37	44
Third (1970)	North Sea Irish Sea Orkney/ Shetland Basin	157	34	54	117	106	37	61
Fourth (1971/ 1972)	North Sea Irish Sea Celtic Sea Orkney/ Shetland Basin	421 for Discretionary award: 15 for tender bid	92 31	228 73	271 15	282	118	213
Fifth (1976/ 1977)	North Sea Irish Sea Celtic Sea Orkney/ Shetland Basin English Channel West of Scotland	71	53	133	51	Licences yet to be formally awarded		

Appendix 13
Fifth Round: extracts from notice inviting applications

Fifth Licensing Round: extracts from notice inviting applications, published in London, Edinburgh and Belfast Gazettes 20 August 1976.

1. Majority State Interest

"Licences will be granted on the basis that the British National Oil Corporation (BNOC), or one of its subsidiaries, is from the grant of the licence a co-licensee entitled to a 51 per cent share in all the benefits of the licence, except
(a) that where another state corporation or subsidiary of such a Corporation is also to be a co-licensee, the combined share to be held in the licence by that other corporation or its subsidiary, and the BNOC or its subsidiary, shall total 51 per cent; and
(b) where the Secretary of State decides to grant a licence solely to a state corporation or its subsidiary."

2. Criteria for consideration of applications.

"Applicants will be judged against the background of the continuing need for expeditious, thorough and efficient exploration to identify oil and gas resources of the UK Continental Shelf, and the following factors will be particularly borne in mind when examining applications:
(a) technical competence to undertake a programme of exploration and production;
(b) capability to produce funds commensurate with work programme obligations in respect of initial exploration and the extent of access to adequate funds in the event of a commercial discovery being made;
(c) where the applicant already holds or has held a licence, his overall performance to date in meeting licence obligations;
(d) exploration already done by or on behalf of the applicant which is relevant to the areas applied for;
(e) the extent of the contribution which the applicant has made or is planning to make to the economy of the UK, including the strengthening of the UK balance of payments and the growth of industry and employment;
(f) where a body incorporated in a country outside the United Kingdom applies for a licence or holds a controlling interest in the applicant, how far equitable treatment is afforded in such other country;
(g) the degree to which the applicant, or any existing licensee in whom he has a controlling interest, or any existing licensee who has a controlling interest in the applicant, has demonstrated his agreement to the conceding to the state a majority share in any discovery made under existing licences;
(h) whether the applicant subscribes to the Memorandum of Understanding agreed by the Secretary of State and United Kingdom Offshore Operators Association to ensure that full and fair opportunity is provided to UK industry to compete for orders of goods and services. Where the applicant is an existing licensee, his past performance in providing full and fair opportunity to UK industry will be taken fully into account:
(i) whether the applicant is willing to grant reasonable access to representatives of independent trade unions to his offshore installations, having in mind the Government's objective to negotiate a memorandum of understanding on this matter.

The Secretary of State will in due course notify those applicants who are being favourably considered for the grant of a licence that they will be offered a licence if
(a) they settle a form of operating agreement with the BNOC to the satisfaction of the Secretary of State and
(b) in association with the BNOC, they agree with the Secretary of State an acceptable work programme for the prospective licence."

Appendix 14
Memorandum of understanding on trade union access to offshore installations

"The Government is extending employment legislation to offshore areas in order to contribute to secure industrial relations between employers and workers. This legislation includes the recognition provisions of the Employment Protection Act 1975".

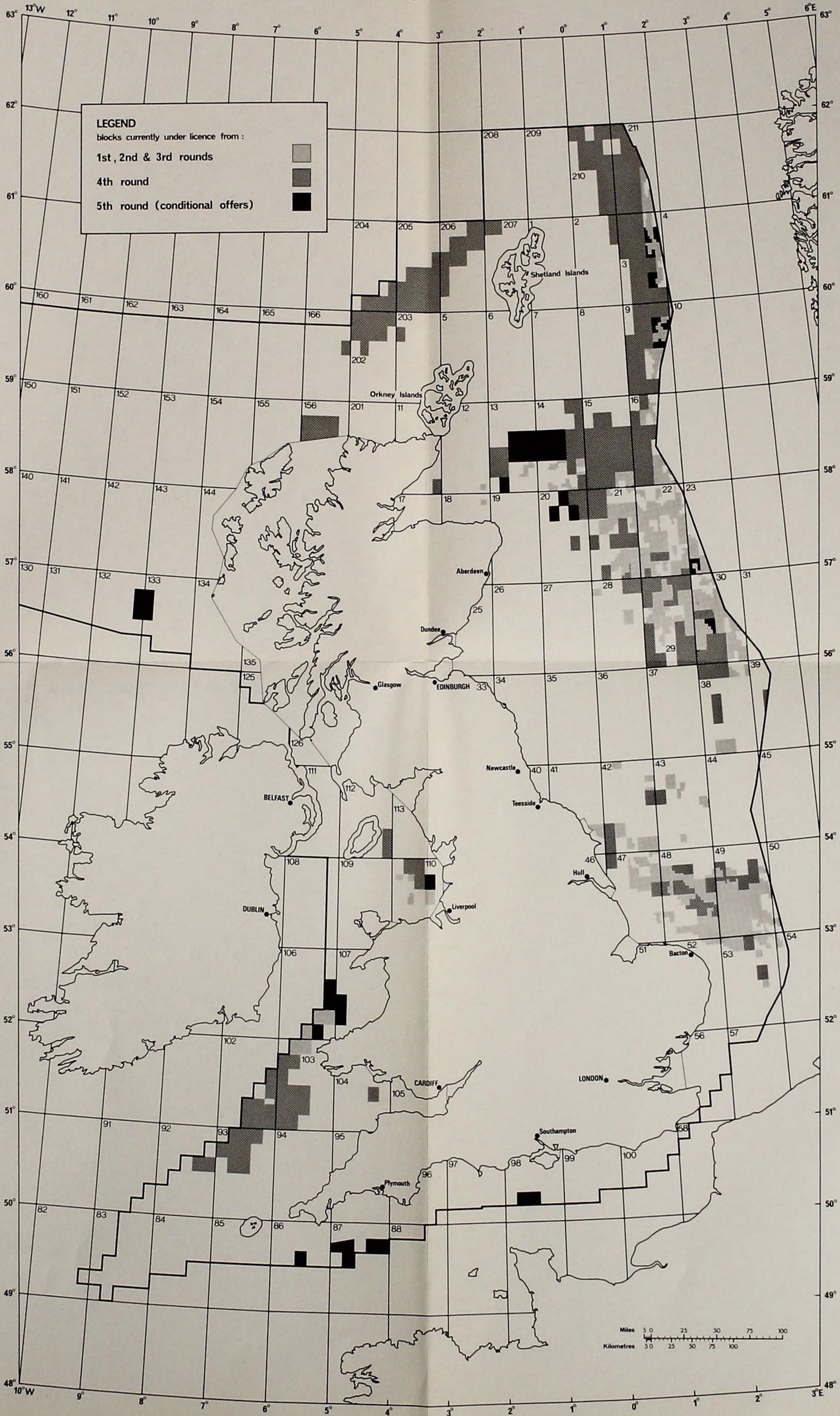
"Access of union officials to workers offshore does however present particular difficulties. It is the agreed intention of the Government, the operators and the unions designated by the Inter Union Committee (IUC) that all reasonable action should be taken to facilitate access by the companies' normal transport facilities. The operators have therefore individually agreed that they and, as far as they are able to influence them, the contractors working for them will take appropriate action under agreed arrangements to be entered into to ensure that trade union officials designated by the IUC are, on request, granted reasonable access to all their offshore installations".

"It is not possible to lay down exact details of conditions of access. These must depend on operational circumstances and the number of requests made by unions. However, the Advisory, Conciliation and Arbitration Service will be available to assist employers and unions faced with any particular difficulties."

Appendix 15
Map of UK Continental Shelf licensing rounds

UK CONTINENTAL SHELF

Licensing Rounds



Appendix 16
Map of sedimentary basins, UK Continental Shelf

LOCATION OF SEDIMENTARY BASINS
UK Continental Shelf

Faeroes Platform
Faeroe Islands
Atlantic Ocean
FAEROES TROUGH
UNST BASIN
Wyville-Thompson Ridge
Shetland Islands
West Shetland Platform
East Shetland Platform
WEST SHETLAND BASIN
EAST SHETLAND BASIN
Horda Platform
Scandinavian Highlands
Bergen
OSLO GRABEN
Stavanger
Hatton Bank
George Bligh Bank
Rosemary Bank
ROCKALL TROUGH
FAIR ISLE BASIN
Vestland Ridge
NORTH MINCH BASIN
WEST ORKNEY BASIN
Orkney Islands
Halibut Horst
MORAY FIRTH BASIN
ROCKALL-HATTON BASIN
Rockall Plateau
Rockall
Hebrides Platform
Anton Dohrn Seamount
Rockall Bank
Hebrides Terrace Seamount
SEA OF THE HEBRIDES TROUGH
INNER HEBRIDES TROUGH
Aberdeen
Scottish Highlands
FORTH APPROACHES BASIN
NORTHERN NORTH SEA BASIN
NORWEGIAN-DANISH BASIN
Norwegian-Danish Dividing Line
Dundee
Glasgow
EDINBURGH
Southern Uplands
Mid North Sea High
Ringkobing-Fyn High
Esbjerg
Danish-German Dividing Line
German-Dutch Dividing Line
MALIN SEA BASIN
LOCH INDAAL BASIN
CLYDE BASIN
RATHLIN TROUGH
NORTH CHANNEL BASIN
BELFAST
SOLWAY BASIN
Teesside
SOUTHERN NORTH SEA BASIN
NORTH WEST GERMAN BASIN
ROCKALL TROUGH
IRISH SEA BASIN
Pennine High
SLYNE TROUGH
Irish Massif
KISH BANK BASIN
DUBLIN
Liverpool
Texel-Ijsselmeer High
Amsterdam
CHESHIRE BASIN
Porcupine Bank
PORCUPINE SEA BIGHT
CARDIGAN BAY BASIN
WORCESTER BASIN
CENTRAL NETHERLANDS BASIN
Rotterdam
London Brabant Platform
Antwerp
Rhenish Massif
Cork
NORTHERN SUB-BASIN
CARDIFF
BRISTOL CHANNEL BASIN
Mendip High
LONDON
WESSEX BASIN
Calais
Southampton
CELTIC SEA BASIN
SOUTHERN SUB-BASIN
Cornubian High
Plymouth
EASTERN ENGLISH CHANNEL BASIN
Haig Fras High
Start-Cherbourg Ridge
Cherbourg
Le Havre
PARIS BASIN
PARIS
WESTERN ENGLISH CHANNEL BASIN
SOUTH WESTERN APPROACHES BASIN
Brest
Armorican Massif

PARIS BASIN	Major basin with thick sedimentary sequences in some of which hydrocarbons have been discovered
CLYDE BASIN	Minor basins within basement areas usually with thin sedimentary sequences. The presence of hydrocarbon is possible but as yet unproven.
Irish Massif	Basement areas which formed the boundaries of basins. They may contain rocks of Precambrian or Palaeozoic age with sedimentary cover thin or absent. The possibility of hydrocarbons being present cannot be ruled out.
	Basin boundaries
	Well defined basement edge
	Poorly defined basement edge
	Limit of UK Designated area

100 Nautical Miles
100 Statute Miles
100 Kilometres

Department of Energy Headquarters Drawing Office No 7201

Appendix 17
Map of the UK Continental Shelf

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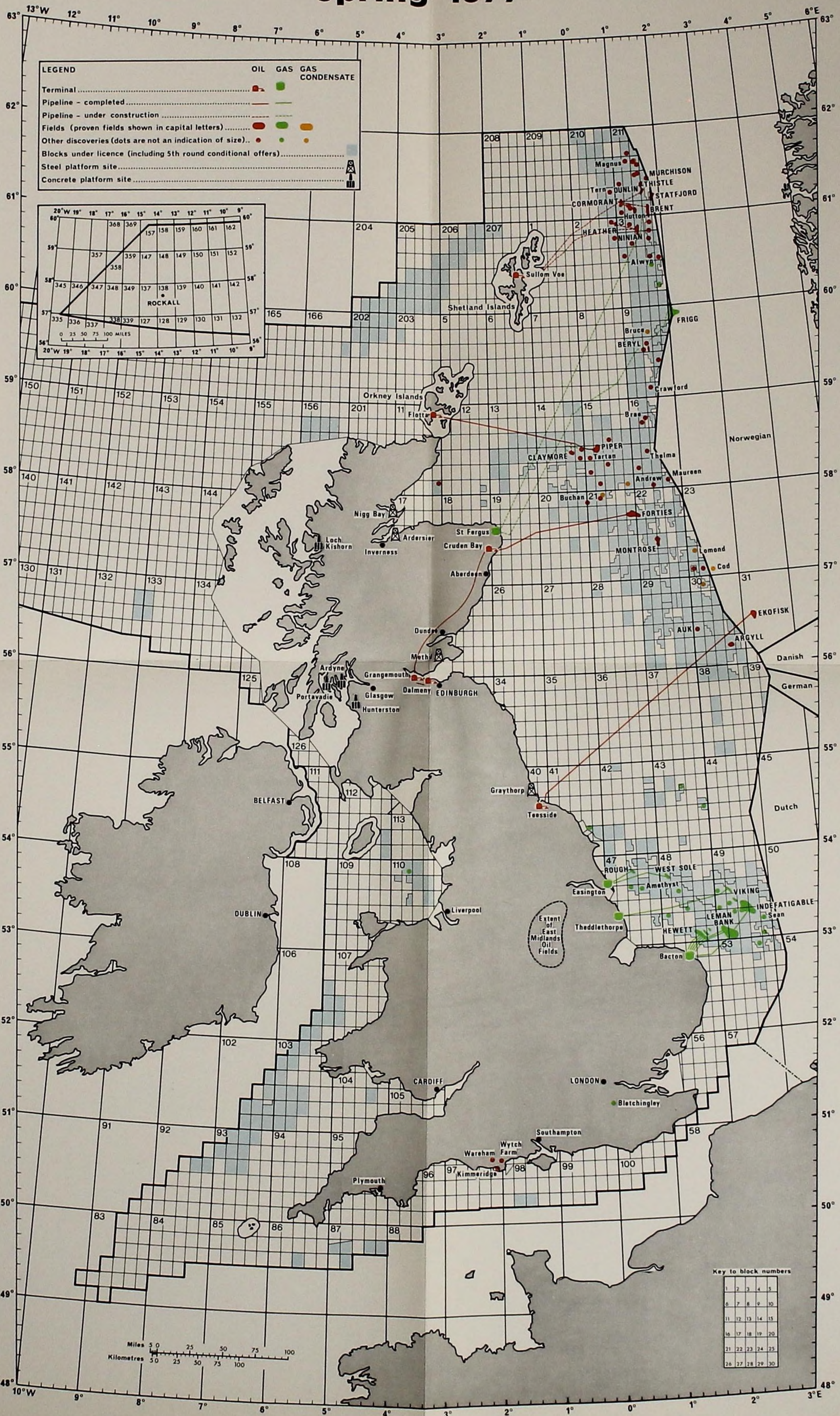
Mr Ray,

UK CONTINENTAL SHELF

Spring 1977



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