



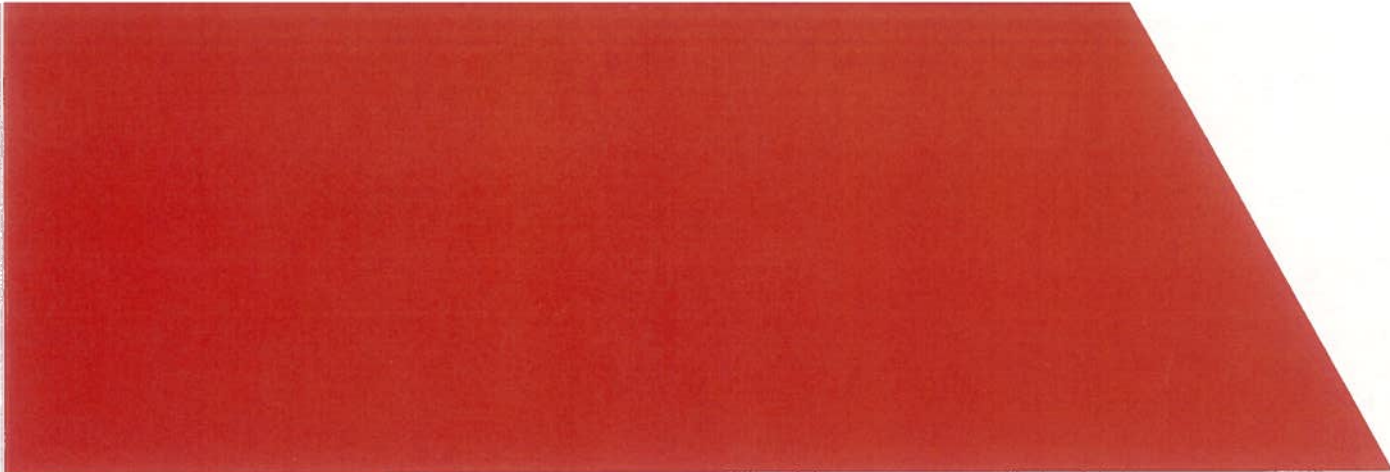
Oil and Gas in Denmark

Exploration and Production

Annual Report 1987

MINISTRY OF ENERGY

Danish Energy Agency



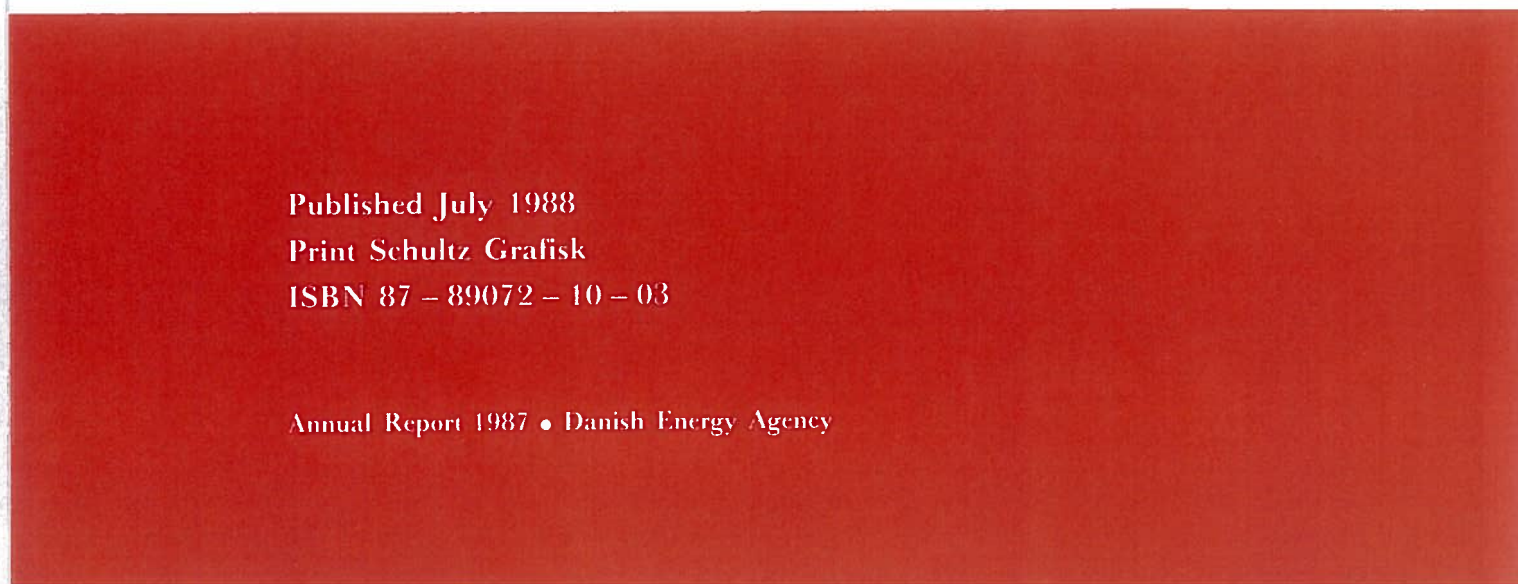
The Danish Energy Agency was established by law in 1976.

The Agency functions as a governmental authority directly under the Ministry of Energy. Its primary responsibility is to assist the Minister for Energy and other governmental authorities in energy matters.

As the executive arm of the Ministry the Agency assumes responsibility for planning, coordination and development of energy sources and supply systems on a national scale, and participates in international energy co-operation.

Published July 1988
Print Schultz Grafisk
ISBN 87 - 89072 - 10 - 03

Annual Report 1987 • Danish Energy Agency



Oil and Gas Department



Deputy Director



Oil and Gas Secretariat



Economist, Lawyer, M. Sc.

Engineer

Geologist

Technician

Office Staff, EDP



Division 2

Division 3

Division 4

Division 5

Division 6

Established by law in May 1976 the Danish Energy Agency (Energistyrelsen) is the executive arm of the Ministry of Energy.

The Danish Energy Agency is active in all aspects of governmental action in the field of energy.

This report, however, only deals with activities relating to exploration, production and transportation of hydrocarbon resources: oil and natural gas.

On behalf of the Minister for Energy the Danish Energy Agency supervises all licences for exploration and exploitation of Danish oil and gas and advises the Government in all matters related hereto. Furthermore the Agency is the main governmental authority responsible for all matters relating to health and safety in offshore operations.

This English version of the 1987 activity report of the Oil and Gas Department of the Danish Energy Agency is the first of its kind. It includes a five year production forecast and the latest assessment of the Danish hydrocarbon reserves.

The Agency hopes that the information contained in this report will meet the requirements of the interested foreign observer.

Copenhagen, July 1988.



Hans von Bülow
Managing Director

Organization	4	Appendices	
Exploration	7	A Licences on Danish Territory	46
Exploration in 1987	7	B Exploration and Appraisal Wells	47
Seismic Surveys	8	C Seismic Surveys	53
Reprocessing of Seismic Data	9	D Danish Oil and Gas Production	54
Drilling Activities	10	E Field Data	56
Exploration Wells	11	F Licence Maps	
Appraisal Activities	12		
Relinquishments 1987	14		
Release of Well Data	15		
Production	17		
Producing Fields	19		
Planned Field Developments	21		
Reserves	23		
General Terms and Definitions	23		
The 1987 Reserves Assessment	23		
Five Year Prognosis	27		
Oil and Gas Production	27		
Oil and Gas Exploration	29		
Self-sufficiency and Foreign Exchange Expenditure	29		
Economics	31		
Supervision	35		
Government Regulations	35		
Establishment of Permanent Installations	35		
Mobile Marine Equipment	35		
Operations on Marine Installations	36		
Accidents and Injury	36		
Flaring of Gas	37		
Onshore Installations	37		
The Coordination Committee	38		
The Action Committee	39		
Training and Research	41		
Training	41		
Research and Development	41		
Danish Involvement	43		
The Hydrocarbon Committee	43		

Organization

The Danish Energy Agency was established in 1976 under the Act on Energy Policy Measures. The Agency functions as a governmental authority within the Ministry of Energy. It is an administrative and technical institution. Its primary responsibility is to assist the Minister for Energy and other governmental authorities in energy matters.

The Agency has two departments. The Oil and Gas Department deals solely with matters relating to the exploration for and exploitation of Denmark's hydrocarbon resources. The Energy Consumption and Supply Department handles all other matters that the Agency is responsible for. The Administration office of the Agency serves the two departments, both of which report to the managing director, whose deputy carries special responsibility for the Oil and Gas Department.

The activities of this department are the subject of this annual report.

The Oil and Gas Department retains expertise within the fields of engineering, geology, law and economics. The department has the responsibility for supervising exploration, production and transportation of oil and gas. A second task includes preparation and planning with regard to future exploration for and exploitation of hydrocarbons in Denmark.

The Department has a staff of 71 distributed among five divisions, numbered from 2 to 6. The distribution of their tasks is summarized below.

The 2nd Division is responsible for aspects in relation to training, research and Danish involvement in the oil and gas sector, including the administration of agreements on training and research as agreed upon with licensees.

In collaboration with the Ministry the division also handles research and development issues within the hydrocarbon field at national, Nordic and EEC levels. In this context technical assistance is rendered to EEC committees set up by the Commission, including assistance in evaluating project applications for research grants. This division also serves as secretariat to the Advisory Hydrocarbon Committee set up by the Minister for Energy.

The 3rd Division is responsible for the supervision of exploitation of underground resources. The division evaluates licensees' plans on exploitation of resources in fields declared commercial. It further monitors resource exploitation in producing fields and prepares technical guidelines. The 3rd Division prepares reserves assessments as well as short and long term production forecasts.

The 4th Division handles geological and technical tasks in relation to the preparation, negotiation and monitoring of exploration licences. The division assists the Ministry in the preparation and allocation of new exploration licences in the Danish area.

The supervision of drilling activities carried out by the licence groups is also undertaken by the 4th division to ensure compliance with safety requirements and provisions under the Danish Subsoil Act.

In addition to the above-mentioned the 4th Division prepares the Agency's estimates of reserves relative to new discoveries, and discoveries under evaluation with regard to commercial viability.

The 5th Division conducts supervision under the Acts on Certain Marine Installations and Natural Gas Supply. The supervision includes evaluation of safety and technical aspects in construction and operation of offshore installations. The Division cooperates with The Maritime Authority (Søfartsstyrelsen), which is responsible for the maritime aspects of the Marine Installations Act.

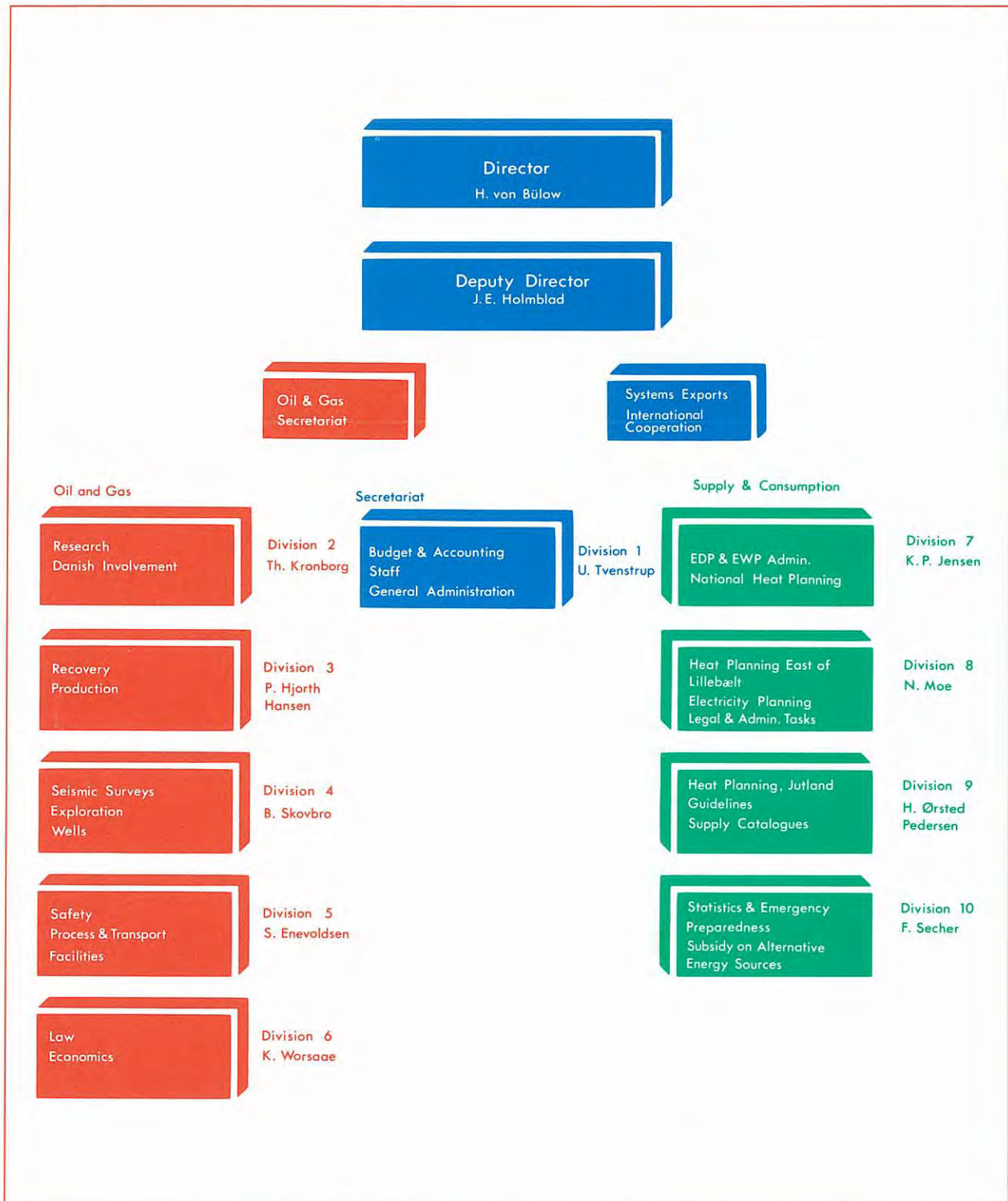
The 6th Division deals with economic and legal matters related to oil and gas activities.

The duties of the 6th Division include supervision of the licensees' royalty accounts and preparation of economic forecasts for future hydrocarbon recovery.

Legal and economic tasks related to evaluation of development plans, operating programmes, licensing rounds, etc., are also performed by this division.

The division serves as secretariat to the Action Committee (Aktionskomitéen) and to the Emergency Committee (Havarikommissionen).

Fig. 1.1 Organization of the Danish Energy Agency



The Energy Agency ensures the Government's interests in connection with hydrocarbon exploration. The Agency also monitors the activities of licence groups engaged in exploration, to ensure compliance with safety regulations and licence terms.

The Agency approves seismic and well programmes before initiation, registers all information retrieved from seismic surveys and drilling of exploratory, appraisal and development wells.

Exploration in 1987

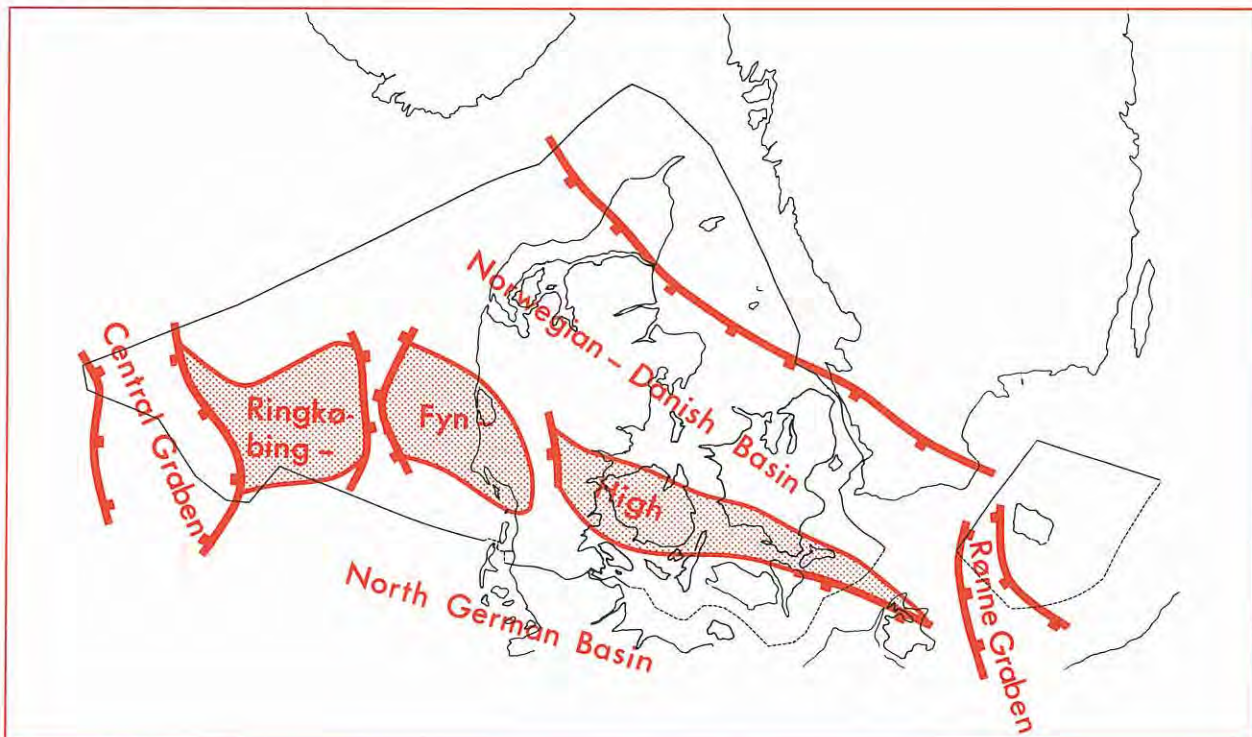
The exploratory activities in 1987 were concentrated in the Norwegian-Danish Basin. Three out of five exploratory wells were drilled in this area (Fig. 2.1). Previous exploratory activities predo-

The Norwegian-Danish Basin includes the northern part of Jutland, the area west and north-west of Skagerrak and part of the North Sea. The geological and structural history of this basin is notably different from that of the Central Graben. Hence finding significant hydrocarbon accumulations in Late Cretaceous-Early Tertiary chalk is less probable in the Norwegian-Danish Basin.

However, hydrocarbon potentials may exist in deeper formations, i.e. sandstones and limestone of the Permian through the Jurassic.

The three exploratory wells drilled in the Norwegian-Danish Basin during 1987 did not result in new discoveries, but nevertheless provided valuable new information, especially with regard to the offshore part of the basin.

Fig. 2.1 Geological Provinces



minantly took place in other geologic provinces, especially in the Central Graben area.

In terms of exploration strategy the policy adopted in the 1st and 2nd Danish Rounds aimed at exploring a wider area also outside the Central Graben.

At the end of 1987 ten licence groups were engaged in exploratory activities in Denmark. The participating companies and their constitutions are listed in Appendix A. The distribution of the licences per 31. December 1987 is shown in the enclosed licence map.

Exploration

Seismic Surveys

Approximately 10,900 km of seismic data were acquired during 1987 in connection with exploration and production of oil and gas. Appendix C lists the companies who carried out these surveys.

In accordance with the Danish Subsoil Act data retrieved through activities aiming at exploration and production of hydrocarbons are protected from public use under a confidentiality clause stating a five years confidentiality period of said data. With regard to non-exclusive seismic data from 1981 and 1982, the confidentiality period was however extended. An earliest date for release of the 1981/1982 non-exclusive seismic data has been set to 31st December 1988.

In 1985 the Energy Agency issued regulations with regard to the plugging and abandonment of shot holes drilled in connection with seismic data acquisition onshore, i.e. holes penetrating the ground water level. Extended regulations aiming at stan-

standardizing the requirements with regard to all bore holes penetrating the ground water level are currently being prepared by the Agency of Environmental Protection in cooperation with the Energy Agency.

Inconvenience and damage to the fishing trade caused by seismic surveying have been significantly reduced during the past two years. This has been accomplished through close cooperation between operators and the fishing trade, including observers from the fishing trade onboard seismic vessels, i.e. in accordance with guidelines provided by the Energy Agency.

Non-exclusive Seismic Surveys

In 1987, approx. 700 km of non-exclusive seismic data were acquired (Fig. 2.2). For comparison, 13,000 km were acquired in 1985 and 1,700 km in 1986. The declining seismic survey activity reflects the current economic constraints of the oil industry.

Fig. 2.2 Seismic Coverage, 1987

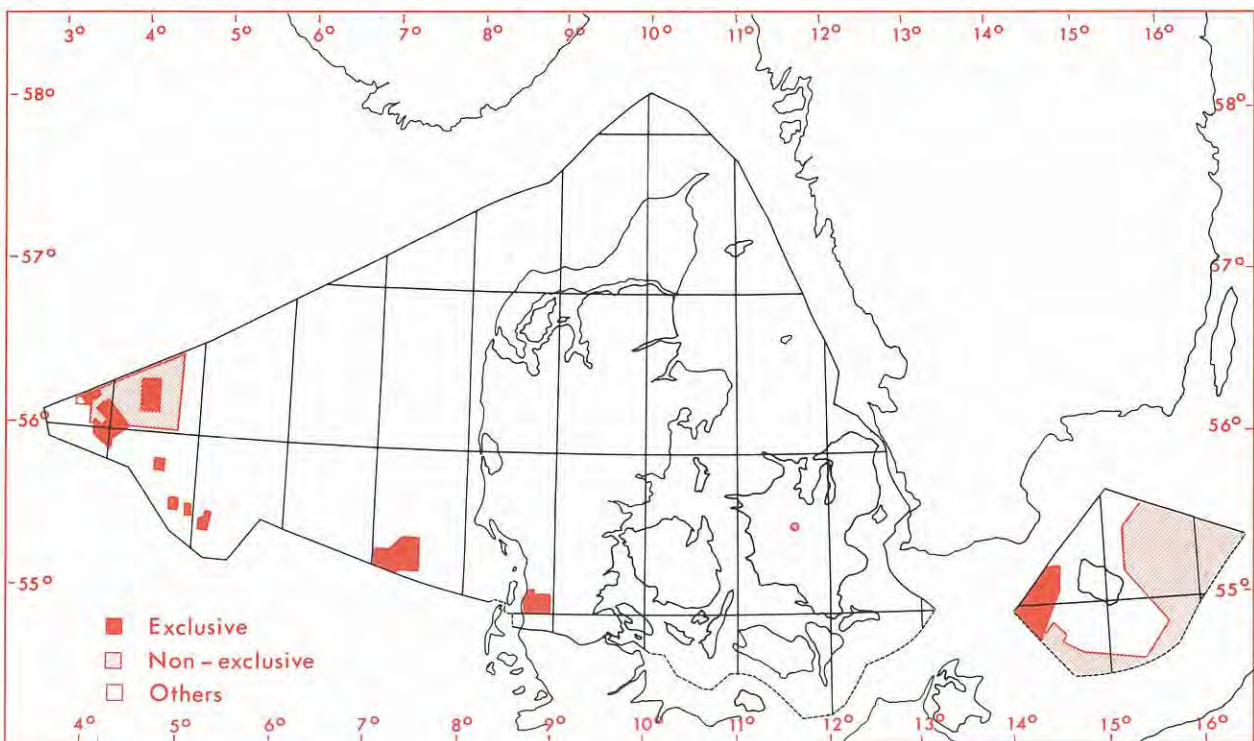
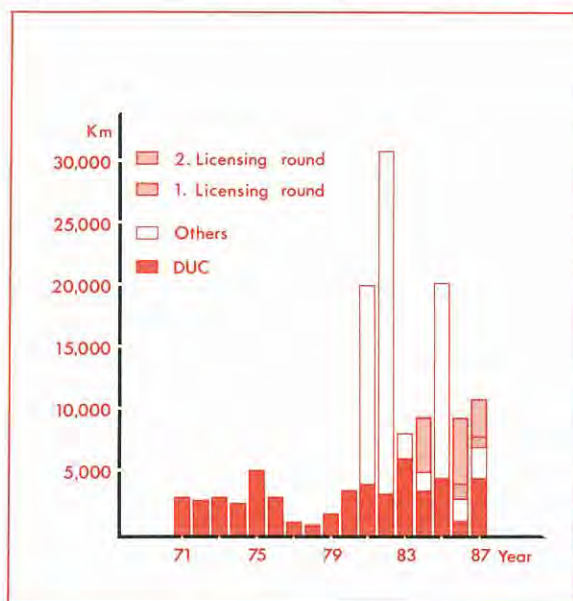


Fig. 2.3 Annual Seismic Survey Activities 1971-1987



Exclusive Seismic Surveys

Approx. 8,200 km of seismic data were acquired in 1987 in licenced acreage.

The Danish Underground Consortium (DUC) carried out approx. 4,800 km in the Central Graben area, i.e. in the areas of the Dan, Gorm and Skjold fields and over the Gert area where a three dimensional (3D) seismic survey was acquired (1,552 km).

Further exclusive marine seismic surveying was carried out by Statoil, Phillips and Agip in the Central Graben and Southern North Sea areas. Norsk Hydro acquired 1,188 km in the Bornholm area.

Dansk Operatørselskab I/S (DANOP) acquired 53 km of seismic land data, on account of the Statoil Group, located in South Jutland. DANOP further acquired 90 km of land data on Zealand as part of a gas storage project.

Reprocessing of Seismic Data

The Energy Agency conducts reprocessing of seismic data with the objective to modernize the Danish seismic data base.

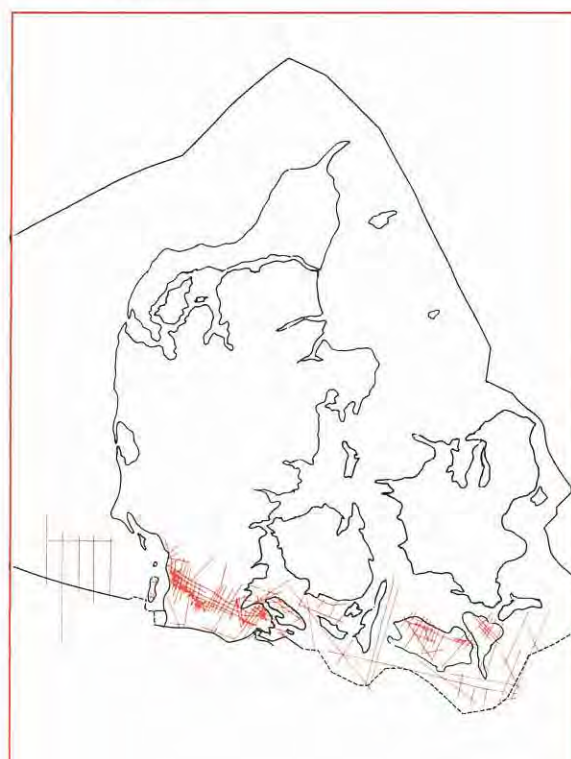
Large quantities of old data are reprocessed with modern computer techniques. Reprocessing is con-

sidered economically advantageous especially with regard to land data.

Seismic data reprocessing was conducted by the Energy Agency during 1985 and 1986, comprising 2,200 km of data previously acquired in North Jutland by Prakla-Seismos during 1973-1974. This project also included the preparation of synthetic seismograms of selected wells in the area. Purchases of data pertaining to this project were made by BP, Phillips and DOPAS.

A further seismic reprocessing project comprised 3,500 km of 1976-1980 data from Southern Denmark. The project was carried out in cooperation between the Energy Agency, DOPAS and the consultant company DANPEC. Prakla-Seismos and Horizon carried out the reprocessing. The project was completed by the end of 1987.

Fig. 2.4 Reprocessed Seismic Lines in Southern Denmark



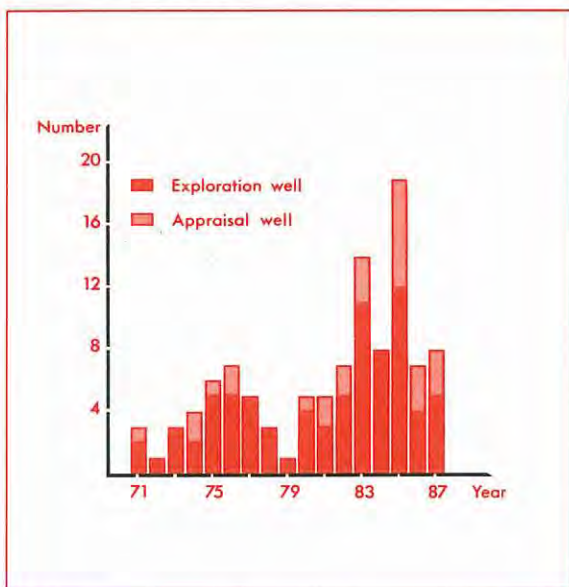
Exploration

Drilling Activities

Eight exploratory and appraisal wells for oil and gas were drilled in 1987 (Figs. 2.8 and 2.9). These wells will be discussed in detail in the two sections below, ref. *Exploratory Wells* and *Appraisal Activities*.

The drilling of three wells was initiated in producing field areas, i.e. two wells located in the Dan field and one well in the Skjold field area. The drilling activities conducted at the Dan field include horizontal completions in the main pay zone, i.e. the Maastrichtian chalk.

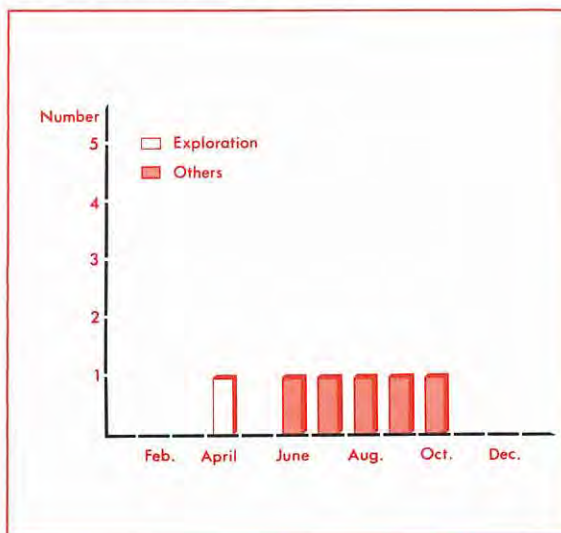
Fig. 2.5 Exploration and Appraisal Wells 1971-1987



Remaining drilling activities comprise the well Hvornum-6 located in an area from which the company Dansk Salt produces salt; DANGAS terminated the drilling of well Tostrup-11 located at the natural gas storage Lille Torup, and two further wells, i.e. Stenlille-2 and -3 were drilled in conjunction with investigations for a possible underground gas storage located in Zealand.

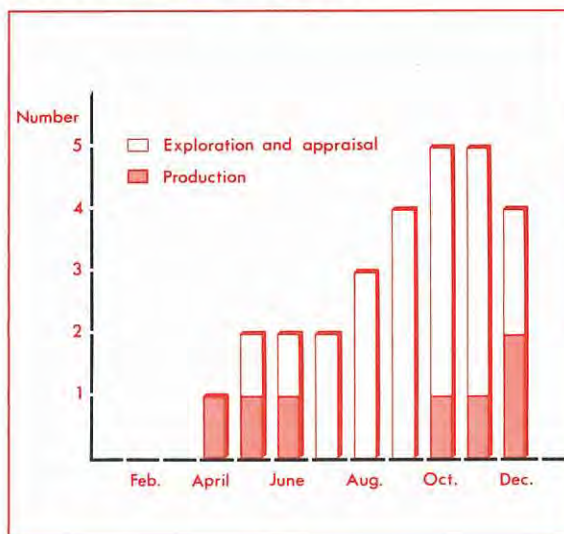
The exploratory and appraisal drilling activity is shown in Fig. 2.5 for the period 1971 – 1987. The well year corresponds to the spud date.

Fig. 2.6 Onshore Wells in 1987



The drilling activity on a monthly basis is shown in Figs. 2.6. and 2.7. The accounts are made on the 15th day of each month. The category *Others* in Fig. 2.6 includes the four above mentioned onshore wells (Hvornum-6, Tostrup-11, Stenlille-2 and -3). The category *Production* in Fig. 2.7 comprises wells drilled in producing field areas. During 1987, offshore drilling activities were unevenly distributed; however predominantly conducted during the last 5 months of the year.

Fig. 2.7 Offshore Wells in 1987



A chronologic listing of exploratory and appraisal wells including wells drilled for the purpose of salt prospecting and gas storage feasibility is included in Appendix B together with the well location maps.

Exploration Wells

Five exploratory wells were drilled during 1987. One well was drilled onshore, i.e. the well Mejrurp-1 by the Phillips Group. The remaining four wells were drilled offshore, i.e. the wells Deep Gorm-1 DUC, and Jeppe-1 Norsk Hydro, in the Central Graben area. Two wells were drilled in the North Sea outside the Central Graben, i.e. the wells Felicia-1 Statoil, and Ibenholt-1 Phillips.

The wells Mejrurp-1 and Ibenholt-1 were drilled in accordance with the work commitments of the Danish 1st Round Award (1984); the wells Felicia-1 and Jeppe-1 were drilled under the requirements of the 2nd Licensing Round Awards in 1986.

Fig. 2.8 Exploration Wells 1987 Located in the Norwegian-Danish Basin

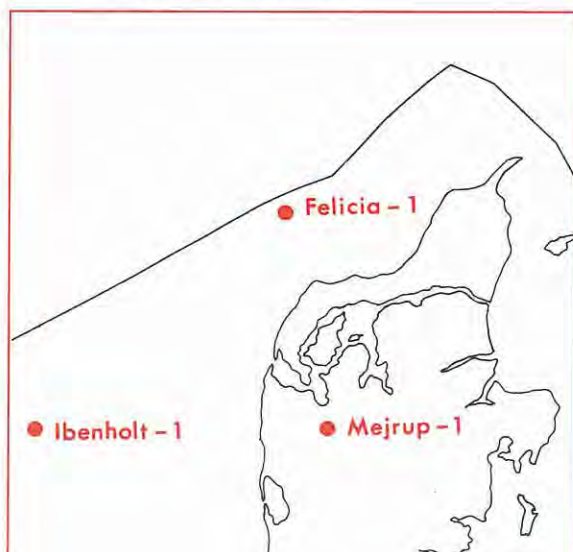
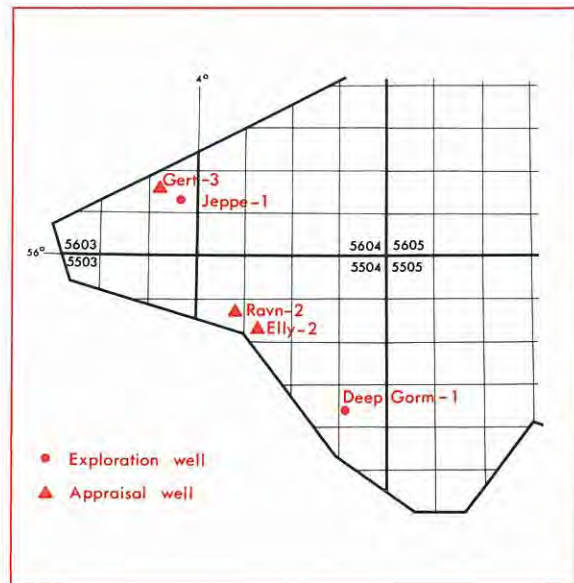


Fig. 2.9 Exploration and Appraisal Wells 1987 Located in the Central Graben Area



The well Deep Gorm-1 was drilled by DUC, fulfilling the requirement of the Arbitration Board Award resulting from the arbitration between A.P. Møller and Ministry of Energy in 1983.

The Amoco Group drilled the well Ravn-2 in order to appraise the discovery made in Ravn-1; a secondary objective comprised exploratory purposes. Further details of the results of well Ravn-2 are given below in *Prospects Under Evaluation 1987*.

Well Details

Block 5608/19, Mejrurp-1

The Phillips Group acquired their licence in 1984 as a result of the 1st Licensing Round. Phillips (operator) conducted the drilling of the well Mejrurp-1 (5608/19-1), located north-east of Holstebro during March-April 1987. The well reached its total depth at 2,532 m in the Triassic. Hydrocarbon presence was indicated during drilling and was inferred in the wire line log data.

No further testing was conducted due to insignificant thicknesses of the hydrocarbon bearing zones.

Exploration

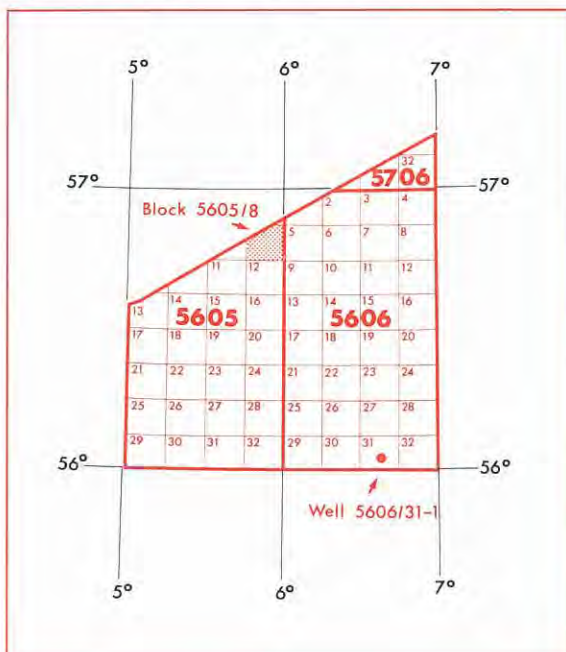
Block 5605/20, Ibenholt-1

The licence was awarded the Phillips Group in the 1st Licensing Round in 1984. The well Ibenholt-1 (5605/20-1) was drilled during August-September 1987 with Phillips as operator. Total depth was reached at 2,599 m in the Precambrian. The well provided valuable information for future hydrocarbon exploration in the Norwegian-Danish Basin.

Block 5708/18, Felicia-1

The Statoil Group was awarded this block as a result of the 2nd Licensing Round in 1986. The well Felicia-1 (5708/18-1) was drilled by Statoil between July and September, 1987. The well, located in Skagerrak, reached a total depth at 5,321 m in the Permian and is so far the deepest well drilled offshore Denmark. No shows of hydrocarbons were observed in the well, however, extensive sampling, coring and logging programmes conducted in the well provided valuable information with regard to this basically unexplored part of the Danish continental shelf.

Fig. 2.10 Designation of Blocks and Wells



Block 5504/16, Deep Gorm-1

The well Deep Gorm-1 (5504/16-5) was drilled between August and December, 1987, by Mærsk Oil & Gas A/S on behalf of DUC. The primary objective was to evaluate the section located below the oil bearing chalk reservoir of the Gorm field. However the Pre-chalk section was found barren of hydrocarbons. The well provided useful information with regard to the flanks of the oilbearing structure. A successful production test of the chalk was carried out in the well.

Block 5603/28, Jeppe-1

The Norsk Hydro Group acquired the licence as a result of the 2nd Licensing Round in 1986. Norsk Hydro (operator) spudded the well Jeppe-1 (5603/28-3) in December 1987. The drilling was terminated in March 1988.

Appraisal Activities

Three appraisal wells were drilled during 1987 in the Central Graben area, i.e. two wells by DUC (Gert-3 and Elly-2) and one by Amoco (Ravn-2). In addition DUC re-entered the well Gert-1 for the purpose of production testing. Gert-1 was originally drilled in 1984. Drilling activities at the well Elly-2 were not terminated at the time of writing. A declaration of commerciality with regard to the Elly prospect is pending the results of well Elly-2. Subsequent to the drilling of the well Gert-3, DUC declared the Gert prospect commercially exploitable in December, 1987.

The appraisal well Ravn-2 (5504/5-1) was drilled by Amoco (operator) according to the approved appraisal programme pertaining to the Ravn prospect.

Prospects Under Appraisal in 1987

Elly

The Elly prospect occupies part of blocks 5504/5 and 6 located within the Central Graben area. The well Elly-1 drilled by DUC in 1984 established the presence of hydrocarbons in the area. Appraisal work including the drilling of the well Elly-2 is ongoing.

Elna

The Elna prospect occupying part of blocks 5604/19 and 23 was drilled by DUC in 1985 (Elna-1) and encountered hydrocarbons. An appraisal programme previously submitted by DUC expired on the 23rd of March 1988, at which time the Elna acreage was relinquished.

Gert

The Gert prospect is located in the northern Central Graben area occupying part of blocks 5603/27 and 28 respectively. The prospect covers approximately 12 km² and extends into blocks 2/11 and 2/12 of the southern Norwegian North Sea sector.

The hydrocarbon discovery at Gert was made by DUC in 1984 when the well Gert-1 encountered hydrocarbons. Due to pressure equipment constraints the well Gert-1 could not be tested at the time of drilling. However the well was re-entered in 1987, when a production test revealed flow rates of approximately 635 m³ opd.

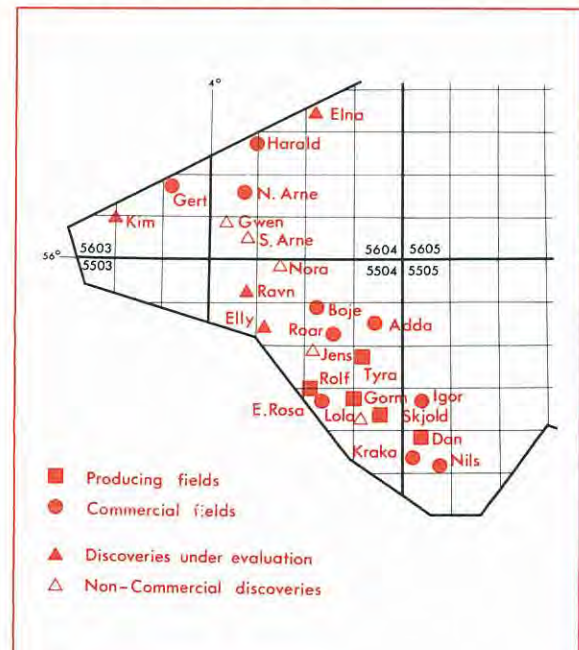
The well Gert-2 drilled in 1985 confirmed the presence of hydrocarbons in the area; a third well, Gert-3 drilled in 1987 had only marginal indications of hydrocarbon presence and the well Gert-3 was plugged and abandoned without testing.

The northern extension of the Gert prospect was drilled by Norsk Hydro as operator for the licence group currently holding the prospect acreage in Norway. Hence two wells were drilled in 1986 and 1987 respectively, wells 2/11-7 and 2/12-1.

The well 2/11-7 had to be abandoned without having reached the objective reservoir section; well 2/12-1 did however penetrate hydrocarbon bearing strata. A test conducted across the hydrocarbon bearing section had flow rates of 1,600 m³ opd.

An agreement was entered by the two licence groups (DUC and Norsk Hydro Groups) allowing the exchange of salient data with a view to further appraisal and development. The Danish part of the Gert prospect was declared commercial in December 1987. Further work in order to evaluate the hydrocarbon potential at Gert is still ongoing.

Fig. 2.11 Discoveries and Fields



Gwen

The Gwen prospect occupies parts of blocks 5604/25 and 29. Two wells have been drilled on the structure, i.e. the well Q-1 (Gwen-1) in 1973, and the well Gwen-2, drilled in 1986. Well Gwen-1 encountered good oil shows in the Jurassic at around 4,100 m; the well Gwen-2 failed to encounter hydrocarbons. In October 1987 the Gwen area was relinquished by DUC, hence currently providing prospective open acreage (Fig. 2.12).

Kim

The Kim prospect occupies part of blocks 5603/26, 27, 30, and 31. The well Kim-1 drilled in 1985, indicated the presence of hydrocarbons. The appraisal period expires on 29. September 1988, at which time the approved appraisal work programme must be completed.

Nora

The Nora prospect extends northwest-southeast, occupying part of blocks 5504/2, and 5604/29 and 30. The well Nora-1 drilled in 1984 had shows

Exploration

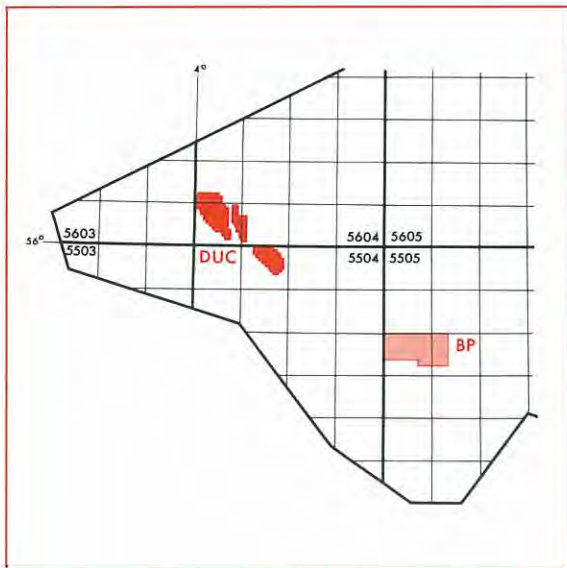
of hydrocarbons. However, DUC relinquished the Nora prospect in 1987 (Fig. 2.12). The chalk was previously established to be hydrocarbon bearing within the northwestern part of the Nora prospect area.

The well I-1 drilled by DUC in 1969 had flow rates up to 635 m³ opd from Maastrichtian chalk located at around 2,800 m.

Ravn

The Ravn prospect occupies part of blocks 5504/1, 2, 5 and 6, located in the northern part of the Central Graben area. The well Ravn-1 (5504/1-2) drilled by Amoco in 1985 penetrated oil bearing Jurassic sands, a test conducted in these sands established presence of producible oil. Subsequent to Government approval of the appraisal work programme, submitted in 1987, Amoco conducted the drilling of Ravn-2 (5504/5-1). The well Ravn-2 reached total depth at 4,507 m in the Triassic. Although hydrocarbon shows were detected in the Jurassic no testing was conducted in the well.

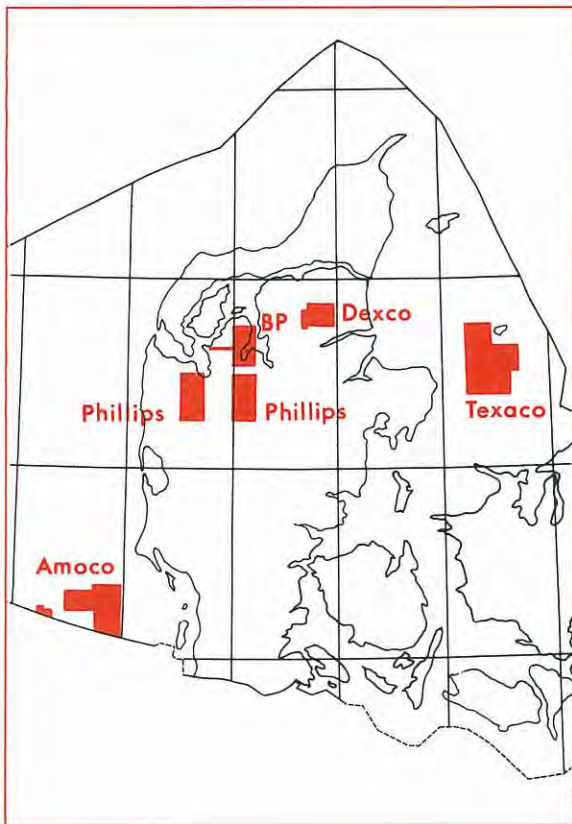
Fig. 2.12 Relinquished Acreage, Central Graben 1987



Relinquishments 1987

A number of areas awarded under the 1st Licensing Round (1984) were relinquished during 1987. The BP Group hence relinquished their entire licence acreage in Denmark, comprising blocks

Fig. 2.13 Relinquished Acreage Outside the Central Graben 1987



5608/16, 5609/9, and 13, located in Jutland, and blocks 5505/9 and 10 in the Central Graben. The Phillips Group gave back land acreage in Jutland, blocks 5608/19, 23, 5608/17 and 21. The Amoco Group dropped their acreage in the southern North Sea, comprising blocks 5507/20, 22, 23, 24, 26, and 28. The Texaco Group relinquished blocks 5611/10,14,15,18, and 19 located in Kattegat. Finally, the Dexco Group dropped the licence located in northern Jutland, i.e. blocks 5609/7,8, and 11.

Release of Well Data

Data collected in accordance with the Subsoil Act are usually protected by a five-year confidentiality clause.

Hence data and information retrieved during 1982 were released in 1987. The distribution of these data and information is handled by the Danish Geological Survey. Inspection of data, samples etc., may take place at the Danish Geological Survey prior to purchase.

With regard to licences under the Danish 1st and 2nd Rounds the period for release of data and information has been set to two years subsequent to relinquishment of the pertaining licence acreage.

In 1987 data on the following wells were released.

Wells released, 1987

Offshore:

5604/25-2 Otto-1 (DUC)
5504/11-2 Jens-1 (DUC)
5504/7-4 Boje-1 (DUC)
5505/9-2 Ugle-1 (BP)
5505/18-1 Emma-1 (DUC)

Onshore:

5609/6-2 Farsø-1 (D.O.N.G.)
5608/3-1 Thisted-2 (D.O.N.G.)
5609/13-1 Skive-2 (BP)
5411/6-1 Søllested (DUC)

The hydrocarbon production in Denmark takes place in five fields, i.e. the Dan field, the Gorm field, the Skjold field, the Tyra field and the Rolf field. Oil and associated gas is produced at Dan, Gorm, Skjold and Rolf. Gas and condensate comprises the main production at Tyra, however small amounts of oil are also produced from the oil rim underlying the main gas zone.

The production is confined within the DUC Contiguous Area, comprising nine blocks located in the Southern Central Graben area.

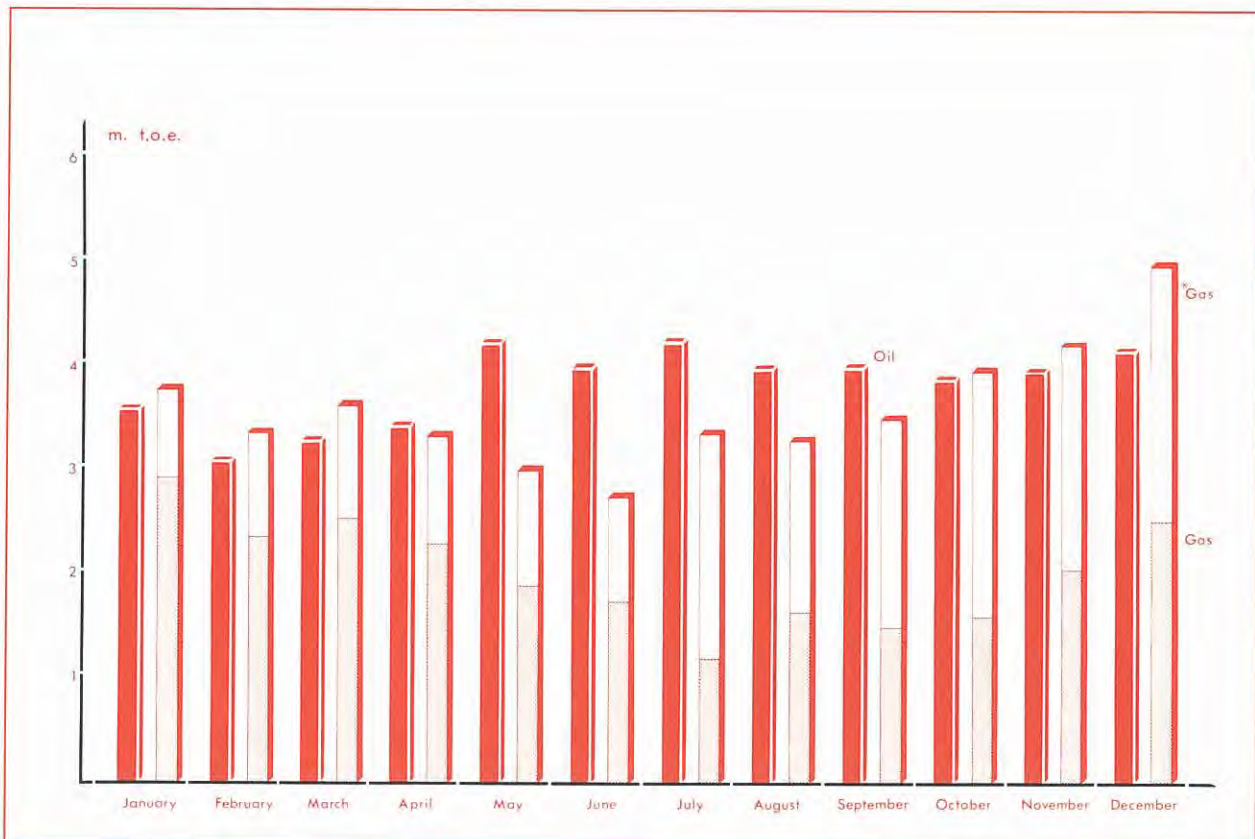
Oil And Gas Production in 1987

The production of liquid hydrocarbons (oil and condensate) during 1987 corresponds to 5.4 million m³ (4.6 million t.o.e.).

The gas production totalled approx. 4.1 billion normal cubic metres (Nm³), predominantly comprising Tyra gas and subordinate amounts of associated gas produced in conjunction with the oil. Approximately 56 per cent comprised sales gas, 37 per cent of the produced gas was used for reinjection at the Gorm field and re-cycling at the Tyra field. The gas recycling project at Tyra was initiated in June 1987. 7 per cent was comprised by gas shrinkage including flare gas (3 per cent).

In terms of tons oil equivalent (t.o.e.) the total oil and gas production for 1987 corresponds to approximately 8.9 million t.o.e. whereof 7.0 million t.o.e. were transported ashore via the existing gas and crude oil pipelines in the Danish North Sea.

Fig. 3.1 Production of Oil and Gas in 1987

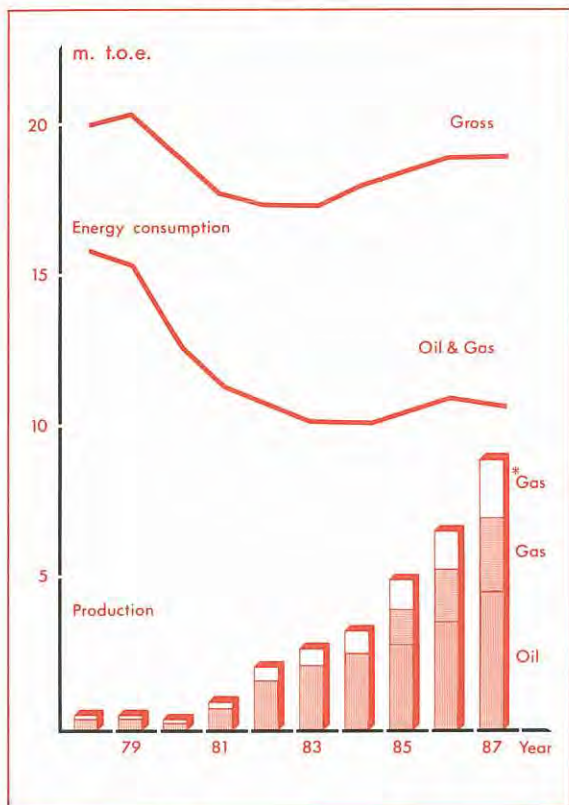


*) Gas not brought ashore

Production

The annual Danish energy consumption in 1987 corresponds to 19.3 million t.o.e. whereof hydrocarbon products and gas comprise 10.7 million t.o.e., hence the current rate of self sufficiency regarding oil and gas reached 66 per cent in 1987. The corresponding rate of self sufficiency during 1980 was only 2 per cent.

Fig. 3.2 Consumption and Production of Oil and Natural Gas 1978-1987



The average growth rate of Danish oil production corresponds to 50 per cent p.a. since 1980. During 1987 the oil production exceeded the 1980 production by a factor 16.

The gross gas production in 1987 corresponds to approximately 95 per cent of the oil production in terms of t.o.e.

The oil and gas production between 1971 and 1987 is shown in Appendix D together with the production for 1987 on a monthly basis.

Secondary Recovery

Secondary recovery methods are increasingly being applied in Denmark for pressure maintenance and hence increased oil recovery. Furthermore a gas re-cycling project to improved condensate recovery was initiated in the Tyra field during 1987.

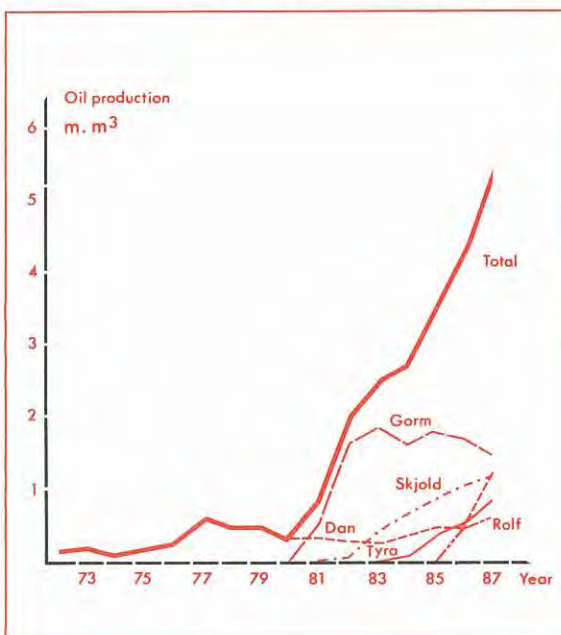
Gas injection has been taking place in the Gorm field since the initiation of oil production in 1981; a water injection project was initiated in the Skjold field in 1986; in November 1987 the DUC concessionaires requested government approval for the implementation of water injection in the Gorm field.

Horizontal Drilling

Horizontal drilling techniques were implemented in the Dan field during 1987. The purpose of the introduction of this drilling technique is to provide enhanced exposure of the tight reservoir rock to the well bore, hence improving the oil recovery of the well.

The results of the horizontal well completions carried out so far are encouraging; one well started production during 1987 and a second horizontal well was still being drilled at the end of the year.

Fig. 3.3 Annual Oil Production 1972-1987



Horizontal well completions are advantageous in reservoir rocks of restricted permeability. In addition to improved well production potential the improvement with regard to drainage area may result in enhanced ultimate field recovery.

Producing Fields

Information with regard to the producing fields are summarized in Appendix E.

The Dan Field

Oil production commenced in July 1972, the average take-off rate corresponding to 1,540 m³ per producing day. The field installations at the time comprised a six slot wellhead platform (Dan A) with an attendant processing and accommodation platform (Dan B) and a gas flare jacket (Dan C).

A second six slot wellhead platform was installed in 1975 (Dan D) and placed on stream in July 1976. The third six slot wellhead platform was installed in 1976 (Dan E) and put on stream in May 1977. In 1987 the installations of the Dan F complex were implemented. It comprises two twelve slot wellhead platforms (Dan FA and FB) and a processing and accommodation platform (Dan FC). In conjunction with the installation of Dan F, the production from the previously existing A, D and E platforms was tied in to the FC platform. The old processing facilities at Dan B were shut down, but still used for well test operations. Oil production from the Dan F was initiated in April 1987. The oil is processed at Dan FC and transported to the Gorm field (Gorm C and E) and carried ashore via the crude oil pipeline. The gas is pre-processed at Dan FC and carried to Tyra (Tyra East) for final processing and brought ashore via the gas pipeline.

The cumulative production from the Dan field corresponds to 1.23 million m³ oil and 435 million Nm³ gas in 1987.

Temporary shut down of individual production wells takes place due to the individual well GOR limit imposed for the Dan field, corresponding to 1,062 Nm³/m³. The GOR limit was introduced by the Danish authorities in 1979 as a conservation measure.

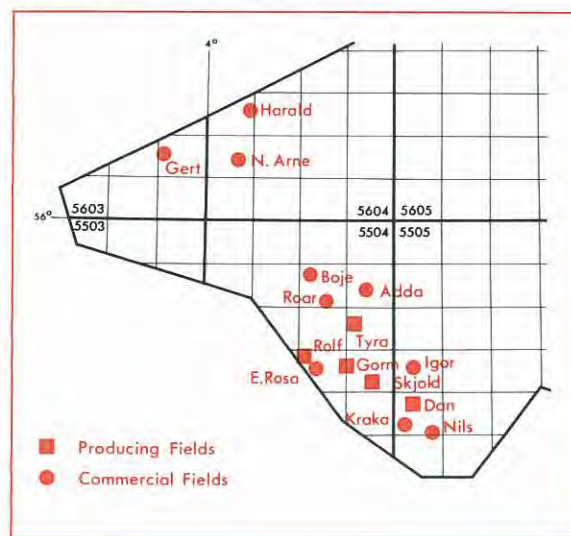
The Gorm Field

Partial oil production from the Gorm field was initiated in May 1981, and full production was achieved in June 1982. Gas injection was initiated in July 1981. Installations include two twelve slot well head platforms (Gorm A and B), a processing and accommodation platform (Gorm C), a gas flare jacket (Gorm D) and a riser and booster platform (Gorm E). The booster capacity was increased from 13,000 m³ opd to 20,700 m³ opd in 1987. The 1987 oil production from the Gorm field totalled 1.5 million m³, a decline of 0.22 million m³ as compared to the 1986 production.

At present production takes place in 16 producing wells, two wells are used for gas injection; 98 per cent of the produced gas (GOR is 590 Nm³/m³) is injected into the reservoir.

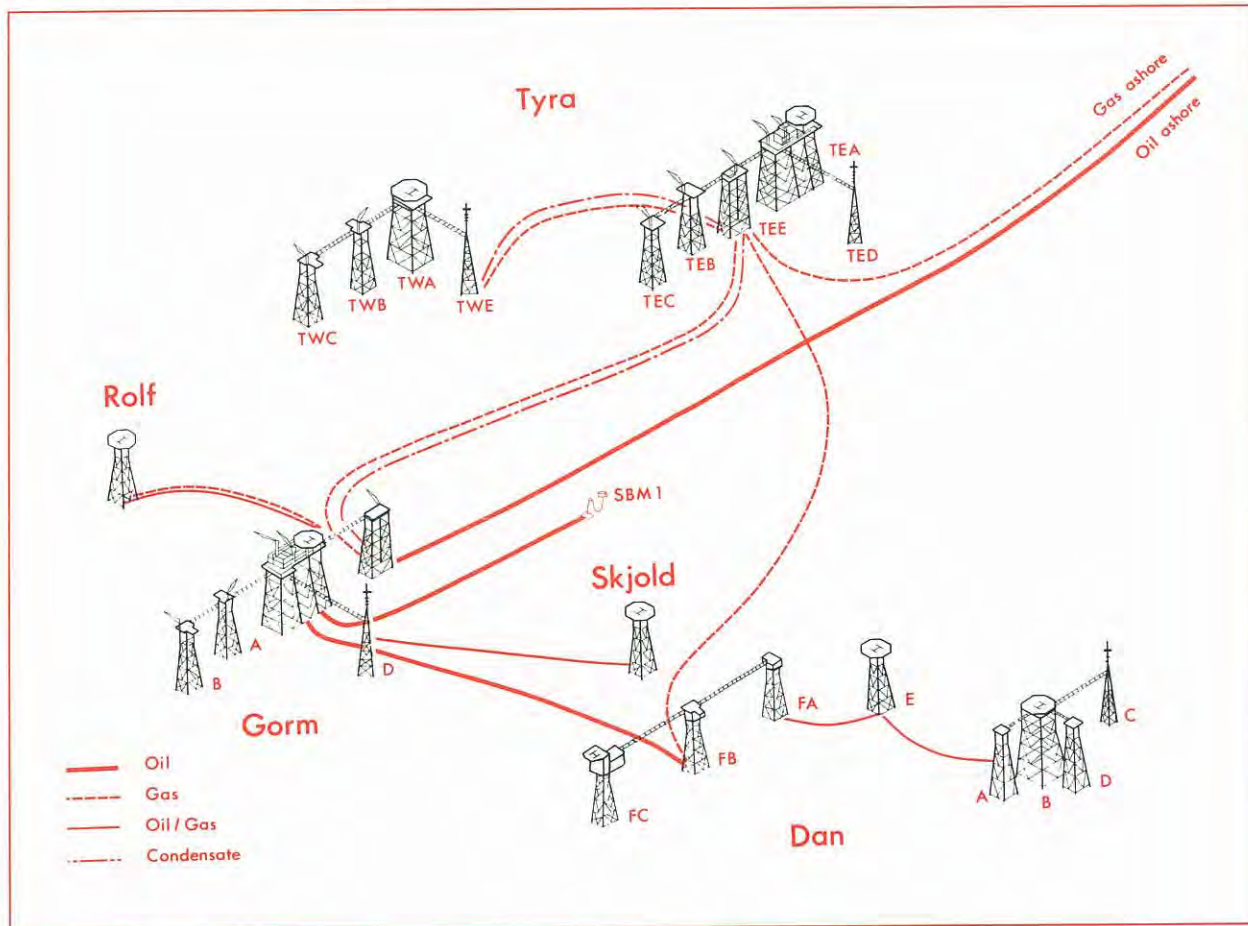
In November 1987 the DUC concessionaires requested government approval for the initiation of water injection at Gorm. The project includes drilling of four injectors and two new producers and installation of a pipeline between Gorm and the water treatment facility located in the Skjold field.

Fig. 3.4 Danish Oil/Gas Fields



Production

Fig. 3.5 Developments in the North Sea



The Skjold Field

Oil production from the Skjold field commenced in December 1982. The installations comprise one nine slot wellhead platform and a two phase flow pipe line tying Skjold to Gorm, located 11 km to the northeast.

The oil production from Skjold is maintained from one producing well, in addition one well is used for water injection and another was drilled in order to observe fluctuations in the oil/water interphase. A further development well (Skjold-5) in the northern part of the field was being drilled at the time of writing.

The 1987 oil production from Skjold corresponds to 1.21 million m³, the GOR averaged 83 Nm³/m³.

The Tyra Field

The Tyra field was put on stream in October 1984. The installations comprise two major platform complexes, i.e. Tyra East and Tyra West, located approximately 2 km apart. Each complex comprises two twelve slot wellhead platforms (TEB, TEC, TWB and TWC) with attendant processing and accommodation platforms (TEA and TWA) and gas flare jackets (TED and TWD). In addition Tyra East comprises a riser platform with facilities for compression and transportation of sales gas. Gas re-cycling facilities were furthermore installed at Tyra West during 1987 for improved condensate recovery. At present the maximum injection capacity corresponds to approximately 140 million Nm³ gas per month.

The total production from Tyra during 1987 was 2.65 billion Nm³ gas and 0.84 million m³ hydrocarbon liquids (condensate and oil); 0.63 billion Nm³ gas was reinjected in conjunction with the gas re-cycling project; the oil production for 1987 was estimated at 0.15 million m³.

The Rolf Field

Oil production from the Rolf field commenced in January 1986. Production takes place from one well located in the crestal area of the chalk structure. One observatory well serves the purpose of observing fluctuations in the oil/water interphase. The field installations comprise an unmanned six slot wellhead platform tied in to the Gorm field via a two phase flow pipe line. Gas lift has been installed in order to sustain the oil production.

The 1987 oil production from the Rolf field was 0.63 million m³ with an average GOR of 43 Nm³/m³.

Planned Field Developments

Three development plans were submitted by the DUC concessionaires during 1987, concerning the hydrocarbon discoveries previously made at East Rosa, Boje, Lulu and West Lulu. A joint development was proposed at Lulu/West Lulu under the field designation Harald. The Boje development plan includes the hydrocarbon discoveries previously announced in the wells Bo-1, Boje-1 and North Jens-1 and -2.

Nine development plans have now been filed with the Ministry of Energy, comprising six oil discoveries and three gas discoveries. The prospects dealt with in the development plans are briefly described below.

Roar

Roar is a gas discovery located approximately 10 km north-west of the Tyra field in block 5504/07. The discovery was made in 1968 by the well H-1 that penetrated top chalk at 1,998 m. An approximately 25 m thick gas bearing section is underlain by 18 m of oil and oil/water. The appraisal well

Roar-2/2A topped the chalk at 1,989 m and penetrated 44 m of gas overlying 21 m of oil/water transition.

The Roar development plan was approved by the Ministry of Energy in 1980. The time schedule for the development is pending the sales gas requirements under the Gas Contract of 1979 between DUC and D.O.N.G. A/S.

Kraka

The Kraka hydrocarbon discovery was made in 1967 by the well A-2 located in block 5505/17. The hydrocarbon bearing zone confined in the Danian and Maastrichtian chalk comprises 6 m of free gas overlying approximately 61 m of oil in well A-2. Top Danian chalk was penetrated at 1,800 m.

Kraka is the first hydrocarbon discovery made in Denmark and the first oil discovery made in the North Sea. The development plan was approved in principle by the Ministry of Energy in 1987. Development of Kraka is planned as a satellite to the Dan field, located 7 km to the north-northeast. The Government approval requires Kraka on stream not later than 1992.

Igor

Igor is a gas discovery located in block 5505/13 approx. 13 km north of the Dan field.

The Igor discovery was made in 1968. The development plan was approved in principle by the Ministry of Energy in 1987. The plan includes field development at Igor as a satellite to the Dan field. The timing of the development is pending available processing capacity at Dan FC and gas market demand.

Adda

Adda comprises an oil and gas accumulation located in block 5504/08 approximately 10 km north of the Tyra field.

The Adda discovery was made in 1977; a development plan was submitted to the Ministry of Energy in 1986.

Production

The plan comprises development at Adda as a satellite to the Tyra field. The timing of development has not yet been settled.

Nils

Nils is an oil discovery located in block 5505/17 approximately 10 km south-east of the Dan field.

The Nils discovery was made in 1979; a development plan was submitted to the Ministry of Energy in 1986.

The plan includes development of Nils as a satellite to the Dan field. The timing for development has not yet been settled.

North Arne

North Arne is an oil discovery located in block 5604/25 approximately 15 km south of the Harald.

The North Arne discovery was made in 1975; a development plan was submitted to the Ministry of Energy in 1986.

The timing for development of North Arne is pending the development at Harald (see below).

Boje

Boje is an oil and gas discovery located in block 5504 approximately 20 km north-west of the Tyra field. The development plan filed under Boje comprises the gas discovery in the well Bo-1 (1977), the oil and gas discovery in the well Boje-1 (1982) and the oil and gas discovery in the wells North Jens-1 and -2 (1985). The development plan for Boje was submitted to the Ministry of Energy in 1987. The implementation of Boje is scheduled in 1991. The field has in early 1988 been renamed Valdemar.

East Rosa

East Rosa is an oil discovery located in block 5504/15 approximately 10 km west of the Gorm field.

The East Rosa discovery was made in 1983; a development plan was submitted to the Ministry of Energy in 1987. Development in stages is proposed for East Rosa. The implementation of the first stage is planned during 1988. The field has in early 1988 been renamed Dagmar.

Harald

The Harald development plan incorporates the gas discoveries previously made at Lulu (1980) and West Lulu (1984); the development plan was submitted to the Ministry of Energy in 1987.

Harald occupies part of blocks 5604/21 and 22, located just south of the Danish-Norwegian boundary. The current plan includes processing and separation facilities at Harald tied to Tyra and Gorm via a gas and an oil pipeline respectively for final processing and stabilization.

The timing for the implementation of development at Harald is pending gas market demand.

Prospect and Field Designations.

When a hydrocarbon discovery is transferred from prospect to field status, a name change is commonly executed. Name changes in accordance with this practice are listed below:

Prospect Name	Field Name
Abby	Dan
Vern	Gorm
Cora	Tyra
Bent	Roar
Ruth	Skjold
Middle Rosa	Rolf
Anne	Kraka
Lulu/West Lulu	Harald

Every year the Energy Agency carries out an assessment of the hydrocarbon reserves on the Danish Continental Shelf. The assessment constitutes the background for planning of further activities and the management of the hydrocarbon resources.

The reserves assessment does not include speculative reserves.

General Terms and Definitions

The calculations underlying the reserves assessment carried out by the Energy Agency are based on a probabilistic method. Variable parameters applied in the calculations *porosity, hydrocarbon saturation ect.* are represented in terms of frequency distributions. The probabilistic combination of each distribution yields the hydrocarbon recovery in terms of *low, medium and high* values of reserves (recoverable hydrocarbons). The average of the low, medium and high values thus assessed corresponds to the expected value of the reserves calculated. The expected reserves expressed in m^3 of oil and gas respectively correspond to the *ultimate recovery* that may be commercially obtained from an individual reservoir (field or prospect) in accordance with recognized technology and economic conditions. The difference between the ultimate recovery and produced quantities of oil and gas corresponds to the remaining reserves contained in a reservoir at any given time.

For further illustration of the actual expectations whether the reserves are likely to be produced or not they are allocated into the categories: *developed and decided, planned* and *possible* recovery corresponding to decreasing technical/economical confidence level.

Developed and decided recovery corresponds to reserves that can be recovered through existing wells and facilities, and reserves that can be recovered through developments for which government approval has been obtained.

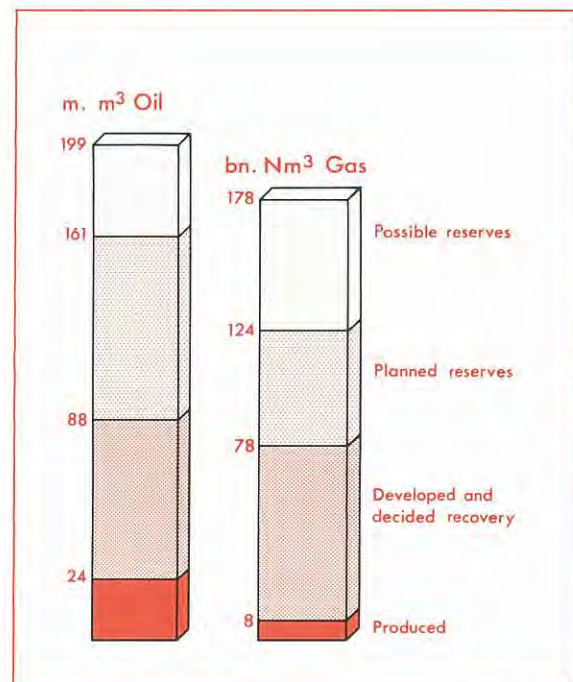
Planned recovery are the reserves to be recovered from future planned activities on producing fields, or reserves present in fields with a positive declaration of commerciality.

Possible recovery for producing or commercial fields could typically be producible reserves in connection with improved recovery projects. Reserves in discoveries under evaluation are also categorized as possible recovery.

The 1987 Reserves Assessment

The results of the reserves assessment for 1987 as prepared by the Energy Agency are summarized in the Tables 4.1 and 4.2 and further illustrated in Fig. 4.1.

Fig. 4.1 Oil- and Gas Reserves



The following comments apply to the 1987 reserves assessment.

Developed and Decided Reserves

This category has been extended in 1987 to include the reserves calculated for Igor and Kraka, due to the grant of a government approval of the development plans (satellite development in both cases).

Reserves

*Table 4.1 Oil and Condensate Reserves
(million m³), January 1988*

	Ultim. Rec.			Prod.	Reserves		
	Low	Exp.	High		Low	Exp.	High
<i>Developed and Decided Reserves:</i>							
Dan	19	24	29	6	13	18	23
Gorm	14	19	25	11	3	8	14
Skjold	18	24	30	4	14	20	26
Rolf	1	2	2	1	<1	1	1
Tyra	8	12	15	2	6	10	13
Roar	3	4	5	-	3	4	5
Kraka	1	3	4	-	1	3	4
Igor	<1	<1	<1	-	<1	<1	<1
<i>Sub Total</i>	88			24	64		
<i>Planned Reserves:</i>							
Dan	16	20	24	-	16	20	24
Skjold	4	5	6	-	4	5	6
Gorm	4	8	12	-	4	8	12
Boje	1	4	9	-	1	4	9
Kraka	1	2	2	-	1	2	2
Nils	<1	<1	<1	-	<1	<1	<1
North Arne	4	7	10	-	4	7	10
East Rosa	2	4	6	-	2	4	6
Adda	<1	1	2	-	<1	1	2
Harald	9	11	15	-	9	11	15
Gert	6	11	17	-	6	11	17
<i>Sub Total</i>	73				73		
<i>Possible Reserves:</i>							
Prod.fields	15	20	24	-	15	20	24
Comm.fields	3	13	28	-	3	13	28
Pot.fields	1	5	11	-	1	5	11
<i>Sub Total</i>	38				38		
Total	199			24	175		

Planned Reserves

The planned reserves category reflects improved oil recovery at the Gorm field due to the request submitted by the concessionaires for government approval for implementation of a water injection project at Gorm.

With regard to the Dan field the planned reserves were calculated assuming further application of horizontal well completions in the field.

*Table 4.2 Gas Reserves (billion Nm³),
January 1988*

	Ultim. Rec.			Net prod.	Reserves		
	Low	Exp.	High		Low	Exp.	High
<i>Developed and Decided Reserves:</i>							
Dan	7	8	10	2	5	6	8
Gorm	5	6	9	<1	5	6	9
Skjold	2	2	3	<1	1	1	2
Rolf	<1	<1	<1	<1	<1	<1	<1
Tyra	35	45	54	5	30	40	49
Roar	9	13	17	-	9	13	17
Kraka	1	2	2	-	1	2	2
Igor	1	2	3	-	1	2	3
<i>Sub Total</i>	78			8	70		
<i>Planned Reserves:</i>							
Dan	4	5	6	-	4	5	6
Skjold	<1	<1	1	-	<1	<1	1
Gorm	<1	<1	<1	-	<1	<1	<1
Boje	2	6	12	-	2	6	12
Kraka	1	1	1	-	1	1	1
Nils	<1	<1	<1	-	<1	<1	<1
North Arne	1	1	2	-	1	1	2
East Rosa	<1	<1	1	-	<1	<1	1
Adda	<1	1	1	-	<1	1	1
Harald	26	31	38	-	26	31	38
Gert	1	1	2	-	1	1	2
<i>Sub Total</i>	46			-	46		
<i>Possible Reserves:</i>							
Prod.fields	2	2	2	-	2	2	2
Comm.fields	7	23	43	-	7	23	43
Pot.fields	8	29	56	-	8	29	56
<i>Sub Total</i>	54			-	54		
Total	178			8	170		

The Harald field has been included under planned reserves due to the submittal of a development plan in 1987.

The reserves assessed for East Rosa reflect the stagewise development, currently proposed by the concessionaires.

The reserves assessed for Gert were furthermore included in the planned reserves category, due to the submittal of a declaration of commerciality by the DUC concessionaires in 1987.

The combined effect of the above-mentioned resulted in a marked improvement of the planned reserves compared to the 1986 assessment, corresponding to 17 million m³ of oil and 11 billion Nm³ of gas.

Possible Reserves

Possible reserves were calculated, assuming the implementation of further enhanced recovery measures, in particular with regard to the Dan Field. A further improvement under possible reserves comprises improved recovery at Boje.

Unit System

The metric unit system (SI) is applied in this report.

Oil reserves are reported in cubic metres at standard conditions, i.e. m³ (15°C).

The gas reserves are reported in cubic metres at normal conditions, i.e. Nm³ at 0°C and 101.325 kPa (1 atmosphere).

Five Year Prognosis

Prognosis with regard to exploration, hydrocarbon production, self-sufficiency and net expenditure of foreign exchange incurred through energy imports during the period 1988-1992.

The production forecasts are prepared semi-annually by the Energy Agency and supplemented with estimates of costs with regard to production and exploration. Based on the production forecast, an estimate is provided with regard to self-sufficiency, and the net expenditure of foreign exchange incurred through energy imports. The presented five year prognosis was prepared as of 1st of January, 1988 reflecting the Agency's expectations with regard to the next five year period. The previous five year period 1983-1987 is covered under the section entitled *Economics*

Oil and Gas Production

In estimating the oil and gas production activities the production under the *developed* and *decided* category is distinguished from the activities under *planned* production. Hence the procedure is in line with the reserves classification discussed under the section *Reserves*.

Table 5.1 Oil and Condensate Production 1988-1992, million m³

	1988	1989	1990	1991	1992	Reserves 1.1.1993
Developed and Decided Production ¹⁾						
Dan	1.8	1.7	1.4	1.3	1.1	11
Gorm	1.3	1.1	1.0	0.8	0.7	2
Skjold	1.8	2.3	2.1	1.9	1.8	10
Rolf	0.3	0.2	0.1	0.1	0.0	0
Tyra	1.0	1.0	1.0	1.0	1.0	5
Total	6.2	6.3	5.6	5.1	4.6	28
Planned Production		1.0	2.9	3.1	3.3	70
Expected Production	6.2	7.3	8.5	8.2	7.9	98

¹⁾ In this category, only production with a date of commencement approved by the Minister for Energy is included.

The planned activity in conjunction with *developed* and *decided* production is pending approval by the Minister for Energy, whereas the activity under *planned* production does not yet require approval by the Minister. Activities under *planned* production are therefore assumed in the following.

It is further assumed that the combined annual oil and gas production is separated and processed using the existing facilities including future expansion of such facilities.

The oil and condensate production forecast (Table 5.1) assumes full utilization of the existing processing facilities. The gas production forecast (Table 5.2) was prepared in line with the requirements under the Gas Sales Contract of 1979 between DUC and D.O.N.G. A/S.

It is expected that the *developed/decided* annual oil and condensate production will increase to 8.5 million m³ in 1990 and subsequently decline to around 8 million m³ in 1991 and 1992.

With regard to *planned* production an upward trend is expected from 1989 onwards.

Table 5.2 Gas Production 1988-1992, billion Nm³

	1988	1989	1990	1991	1992	Reserves 1.1.1993
Developed and Decided Production ¹⁾						
Dan	0.4	0.4	0.3	0.3	0.3	4
Gorm	0.1	0.1	0.1	0.1	0.1	9
Skjold	-	-	-	-	-	
Rolf	-	-	-	-	-	
Tyra	2.0	2.5	2.5	2.2	2.1	29
Total	2.5	3.0	2.9	2.6	2.5	42
Planned Production			0.1	0.5	0.7	60
Expected Production	2.5	3.0	3.0	3.1	3.2	102

¹⁾ In this category, only production with a date of commencement approved by the Minister for Energy has been included.

Five Year Prognosis

Table 5.3 Investments, Development Projects, 1988-1993, DKK billion (1988)

	1988	1989	1990	1991	1992
Developed and Decided Production ¹⁾					
Dan	0.2				
Skjold	0.4				
Kraka				0.2	0.7
Total	0.6			0.2	0.7
Planned Production	0.4	2.7	2.2	1.1	0.2
Expected Investments	1.0	2.7	2.2	1.3	0.9

¹⁾ Only projects with approved implementation date approved by the Minister for Energy are included in this category.

Table 5.4 Operation and Maintenance Costs, 1988-1992, DKK billion (1988)

	1988	1989	1990	1991	1992
Developed and Decided Production					
Dan	0.2	0.2	0.2	0.2	0.2
Gorm	0.2	0.2	0.2	0.2	0.2
Skjold	0.1	0.1	0.1	0.1	0.1
Rolf	0.0	0.0	0.0	0.0	0.0
Tyra	0.3	0.3	0.3	0.3	0.3
Total	0.8	0.8	0.8	0.8	0.8
Planned Production	0.1	0.1	0.2		
Expected Costs	0.8	0.8	0.9	0.9	1.0

This growth in the *planned* production is due to planned expansions in existing fields and the implementation of production from new fields. This will result in the acceleration of pertaining expenditure. Expenditure forecasts, i.e. comprising investments, operations and transportation costs are summarized in Tables 5.3, 5.4 and 5.5.

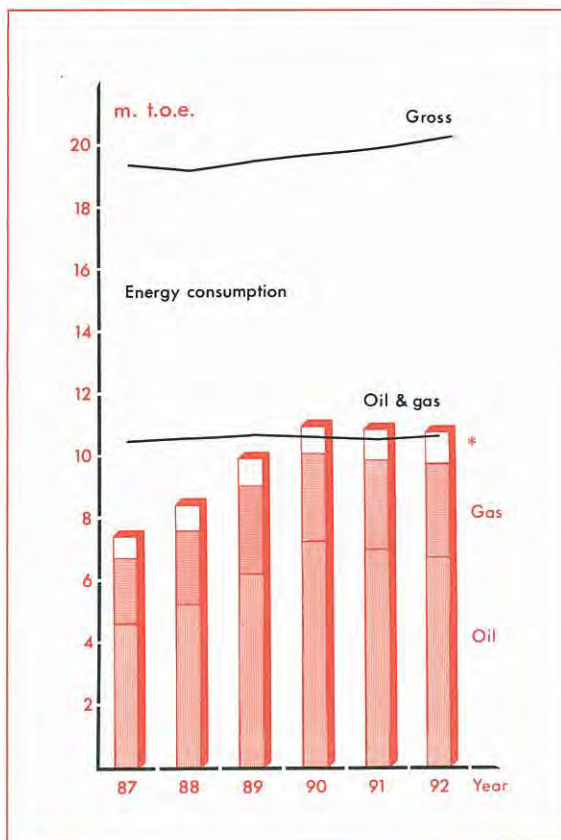
Table 5.5 Transportation Costs, the Oil pipeline, 1988-1992, DKK billion (1988)

	1988	1989	1990	1991	1992
Total	0.8	0.8	0.8	0.8	0.8

Table 5.6 Exploration and Appraisal Costs, 1988-1992, DKK billion (1988)

	1988	1989	1990	1991	1992
Total	0.3	0.5	0.3	0.2	0.2

Fig. 5.1 Energy Demand and Oil and Gas Production.



* Alternative Energy.

Oil and Gas Exploration

The expected activities with regard to exploration and appraisal (Table 5.6) include currently approved activities under appraisal programmes as well as expected exploratory activities towards the end of the forecast period.

Table 5.7 Rate of Self-Sufficiency and Foreign Exchange Expenditure for Energy Imports 1988-1992

	1988	1989	1990	1991	1992
Production:					
Crude Oil million m ³	6.2	7.3	8.5	8.2	7.9
Natural Gas billion Nm ³	2.5	3.0	3.0	3.1	3.2
Total Energy Consumption (PJ)					
	803	814	822	831	840
Rate of Self- Sufficiency, %					
A)	72	85	95	94	92
B)	40	47	51	50	49
C)	44	51	56	55	54
Net Foreign Exchange Ex- penditure for Energy Imports (DKK bill.)					
	7.1	6.3	5.5	6.2	6.8
Crude Oil Prices \$/bbl					
	18	19	20	21	22
DKK/\$					
	7.00	7.00	7.00	7.00	7.00
A) Production of oil and natural gas versus consumption of oil and natural gas.					
B) Production of oil and natural gas versus total energy demand.					
C) Production of oil, natural gas and alternative energy versus total energy demand.					

Self-Sufficiency and Foreign Exchange Expenditure

The forecast of oil and gas production is compared to the expected domestic consumption of oil and natural gas and furthermore with the total energy demand; subsequently the rate of self-sufficiency is calculated (Table 5.7).

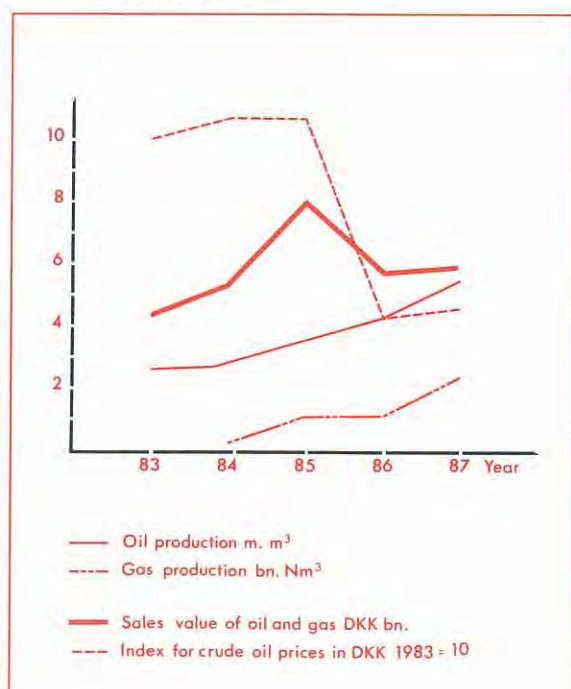
Based on the assessed rate of self-sufficiency, the immediate effect of the energy supply on the balance of trade is calculated. The energy supply comprises all sources of energy. The calculation does not account for imports attributed to construction of production installations or transfers of dividends etc., out of the country. However, the calculations account for anticipated trends in the oil price and the US dollar exchange rate. A diagram depicting the domestic total energy demand and oil and gas production in terms of t.o.e. is shown in Figure 5.1.

The Danish oil and gas production brought ashore in 1987 amounted to 7 mill. t.o.e. The 1987 production was 78 per cent higher than that of 1985, however the corresponding sales value was 26 per cent lower.

The reason is the plummeting crude oil prices on the international market since winter 1985-1986. The OPEC countries discontinued their quota and fixed price system which continuously had been undermined. OPEC sought to regain the market share by reducing prices, i.e. the crude oil prices were reduced by 50 per cent. The result was that oil prices dived below US\$ 10 per barrel. Later on OPEC re-established its quota and fixed price system with some success. Crude oil prices settled late in 1986. During 1987 the oil price was approx. US\$ 18 per barrel.

The value of domestic crude oil and natural gas depends on international prices, expressed in US\$. The decline in oil prices, in terms of US\$ and the

Fig. 6.1. Sales Value of Oil and Gas Production 1983-1987.



steep decline of the dollar exchange rate resulted in a considerable decline in the sales value of Danish oil and gas in terms of Danish kroner.

The decline in sales value of the domestic oil and gas production for the period 1983-1987 is illustrated in Fig. 6.1.

The total domestic energy consumption in 1987 corresponded to 19.29 million t.o.e., whereof the oil and gas brought ashore via pipeline contributed 7.04 mill. t.o.e. Hence despite the reduced oil price, the production of oil and gas during 1987 contributed substantially to the improvement of the balance of payments, even after deducting the value of imports (operation and investments), and of interest payments and dividend transfers.

Table 6.1 Sales Value and Production of Oil And Gas

	1983	1984	1985	1986	1987*)
Sales Value					
DKK million					
Oil	4,300	4,900	6,280	3,270	4,200
Gas	0	400	1,680	2,440	1,700
Total	4,300	5,300	7,960	5,710	5,900
Production					
Oil, million m ³	2.52	2.71	3.46	4.29	5.42
Gas, billion Nm ³	0	0.22	1.04	1.08	2.30
International Crude Oil Price (Brent)					
US\$/bb.l	30.33	28.31	27.61	14.45	18.38
DKK/US\$	9.14	10.36	10.60	8.09	6.84
DKK per m ³	1,744	1,845	1,841	735	791
Nominal prices, *) Energy Agency estimate					

Expences of Exploration, Development and Operations

The total expenses with regard to exploration, development and operations carried by the licence groups in addition to the licence fees/expences

Economics

corresponded to DKK 3.1 billion in 1986. The corresponding expense for 1985 was DKK 4.2 billion. The total expense for 1987 is estimated to DKK 2.3 billion.

Information on the balance of accounts for 1987 has not yet been received by the Energy Agency, but it is estimated that exploration and appraisal activities amounted to DKK 500 million.

Compared to previous years the rate of investment declined during 1987. No new developments were implemented and the capital costs relating to the further development at Tyra (gas re-cycling project) and the new development at Dan (Dan F) had basically been consummated prior to 1987. It is expected that the investments will increase after 1988 due to the implementations of secondary recovery projects at Dan, Gorm and Skjold and the new developments at Kraka (*Ref. Five Year Prognosis*).

Table 6.2 Costs of Exploration, Development and Operations (DKK million)

	1983	1984	1985	1986	1987*)
Exploration and Appraisal:					
DUC	1,264	893	873	309	200
Licence Groups					
1st and					
2nd Rounds.	0	211	500	304	300
Total	1,264	1,104	1,373	613	500
Development					
(DUC)	3,699	1,985	2,023	1,764	950
Operations					
(DUC)	477	483	779	760	850
Nominal prices, *) Energy Agency estimate.					

Costs incurred in connection with the development of the individual fields are shown in the table 6.3.

Transportation Costs

The crude oil and natural gas produced in the Danish North Sea fields are transported ashore via the oil and the gas pipelines owned and operated

Table 6.3 Development Investments by DUC (DKK million)

	1983	1984	1985	1986	1987*)
Dan	65	71	17	53	—
Dan F		240	1,249	1,250	600
Gorm	15	70	21	23	—
SKjold	26	10	92	44	—
Rolf		8	366	163	—
Tyra	3,448	1,197	137	134	200
Not allocated	145	388	143	99	150**)
Total	3,699	1,985	2,025	1,766	950
Nominal prices, *) Energy Agency estimate. **) Comprises some of the above-mentioned fields.					

by D.O.N.G. (DANGAS/DORAS). DUC is still the sole user of the oilpipeline. The transportation costs with regard to crude oil are in accordance with the Transportation Agreement between Dansk Olierør A/S (DORAS) and DUC of 1984. Transportation costs are summarized in table 6.4. The profit component reverts to the State. Approximately DKK 200 million were invested in the transportation system during 1987, i.e. primarily allocated to the expansion of the oil storage facilities located in Fredericia.

Working Results

DUC's working results for the period 1983-1986 are summarized in Table 6.5. The decline in the oil price accounts for the comparatively lower income

Table 6.4 Transportation Costs (DKK million)

	1983	1984	1985	1986	1987*)
Tanker	110	38			
Operation	0	86	68	99	140
Financing	0	405	526	357	310
Other Expenditures		5	24	30	?
Profit Component (5%)		146	266	131	189
Total	110	680	884	617	639
Nominal prices, *) Energy Agency Estimate.					

in 1986. The 1987 results have not yet been submitted. The figures allocated to *Exchange Rate Adjustment* are related to project financing in foreign currency.

The total government take corresponded to approx. DKK 4.9 billion for the period 1977-1986 (1987 prices), i.e. DKK 2.8 billion are allocated to royalty payments; DKK 0.6 billion comprised profit component; approx. DKK 0.9 billion comprised corporate tax and approx. DKK 0.6 billion comprised hydrocarbon tax. It is estimated that royalty payment and profit from oil transportation will amount to approx. DKK 0.64 billion for 1987.

A revenue from hydrocarbon tax (the rate is 70 per cent) is not expected for 1987 because depreciation on the investments corresponding to 25 per cent p.a. in 10 years are allowed. Furthermore hydrocarbon taxation is only implemented after deduction of corporate tax. In view of the foregoing combined with the current oilprice level the basis for hydrocarbon taxation decreases.

Table 6.5 DUC Working Results before Tax, (DKK million)

	1983	1984	1985	1986
Income	4,460	5,480	8,020	5,630
Costs	-2,000	-3,410	-4,730	-3,320
Depreciations	-920	-890	-1,770	-1,540
Exchange Rate Adjustments	-1,260	-1,490	+1,860	+1,390
Balance before Tax	280	-310	3,380	2,160
Nominal prices.				

Royalty

Royalties for new licencees are stipulated in conjunction with the Licence Awards. With regard to DUC the royalty corresponds to 8.5 per cent of the production value after deduction of transportation costs. The royalty payments for the period 1983-1987 are summarized in Table 6.6. Royalties may be paid either in cash or in kind.

Table 6.6 Royalties (DKK million)

	1983	1984	1985	1986	1987*)
Oil	369	362	458	212	300
Gas	0	26	143	211	145
Total	369	388	601	423	445
Nominal prices, *) Energy Agency Estimate					

The balance on royalty payments for oil in 1983-1987 is summarized in Table 6.7. An outstanding royalty payment comprising DKK 86 million was made by DUC at the end of 1986.

Table 6.7 Balance on Royalties, Crude Oil

	Total Royalty Crude Oil (DKK million)	Cash Settlement (DKK million)	Settlement in Kind (m ³)
1983	369	369	0
1984	362	0	208,200
1985	458	0	563,200
1986	212	212	0
1987*)	300	300	0
Nominal prices, *) Energy Agency Estimate.			

In connection with offshore exploration and production of oil and gas the Energy Agency performs supervision in the field of safety and work environment with regard to utilization of ships and vessels and installation of permanent facilities. The supervision is carried out according to inter alia the Act on Certain Marine Installations. Initiation of production and the operation of marine installations require special approval by the Agency. With regard to land based operations supervision is provided with regard to drilling equipment and operation.

Government Regulations

Principal governmental regulations with regard to safety etc., on marine installations were issued in November, 1987, i.e. Order No. 711 by the Ministry of Energy. The regulations were prepared in pursuance of the Act on Certain Marine Installations. The regulations lay down the general principles and objectives pertaining to Government Supervision and approval and further provide guidelines on inter alia health services, reporting of accidents and injuries etc. Further specific guidelines are planned.

A major requirement of the Order calls for Operators' establishment of their own internal control system for persuance of the regulations. A further requirement comprises the establishment of a system for the certifications and procedure with regard to mobile marine equipment, aiming at an equal degree of safety as that obtained onshore. Approved certifying institutions or companies may form part of Operator's internal control system.

Establishment of Permanent Installations

In 1987 the Energy Agency approved the implementation and initiation of production at the Dan F complex, and the installation and implementation of the gas re-cycling project at Tyra West. Furthermore, the gas pipelines under the Limfjorden at Aalborg and Sallingsund were installed for gas transmission into the Vendsyssel and Mors areas. An additional pipeline is being installed under Vilsund for gas transmission to Thy.

Mobile Marine Equipment

Mobile marine equipment comprises drilling rigs, crane barges, and pipelaying barges and accommodation vessels.

As a rule a mobile marine installation will only be approved for operation in Danish territory pending Operator's specific request. However, it is also possible to obtain approval in advance for such equipment for later utilization.

During 1987 the following mobile marine equipment was in operation on the Danish Continental Shelf:

- The jack-up rig *Mærsk Guardian* from Mærsk Drilling in connection with the development at the Dan F complex for Mærsk Oil and Gas. The rig was also used by Statoil and Norsk Hydro for exploratory drilling.
- The jack-up rig *Mærsk Endeavour*, from Mærsk Drilling for exploratory and development drilling for Mærsk Oil and Gas furthermore. The rig was employed for accommodation during the last phase of the implementation of the gas recycling project at Tyra West.
- The drilling rig *Zapata Scotian* from the Zapata Offshore Company, Holland for exploratory drilling for Mærsk Oil and Gas.
- The drilling rig *Dyvi Sigma* from Dyvi Offshore, Norway for exploratory and appraisal drilling for Phillips and Mærsk Oil and Gas.
- The drilling rig *Dan Earl* from Lauritzen Offshore for exploratory drilling for Amoco.
- The drilling rig *Neddrill Trigon* from Neddrill (Holland) B.V. for appraisal drilling for Mærsk Oil and Gas.
- The accommodation platform *Safe Holmia* was used from 1986 to the autumn 1987 in connection with the hook-up and commissioning of Dan F.

Operations on Marine Installations

The Energy Agency supervises safety and work environment pertaining to mobile and permanent marine installations. It comprises the supervision of working conditions under the Act on Marine Installations, including inspection activity similar to that of the Labour Inspection Service's on land and the approval of manning and organizational plans.

As a rule the Energy Agency performs as a minimum one inspection per year on permanent marine installations. In connection with the increased exploratory activities in the North Sea during 1987, Agency inspections comprised the pertaining drilling rigs. During 1987 the following inspections were performed on the permanent installations:

- Dan F in connection with the hook-up and commissioning.
- Dan B/E in connection with modifications and extension of accommodation facilities on Dan B.
- Tyra East in connection with the the inspection of working conditions.
- Tyra West in connection with the hook ups and commissioning of the gas re-cycling project.

When monitoring operation and maintenance of the installations the Energy Agency requires inspection and maintenance programmes with regard to supporting constructions, safety equipment, processing equipment, accommodation and working areas, etc. Regular inspections by the Agency made on spot check basis ensure that the inspection maintenance programmes are adhered to.

Accidents and Injury

A total of 82 accidents were reported in offshore activities during 1987, i.e. 18 on mobile marine installations and 64 on permanent marine installations. There was no fatal accident or serious personal injury reported during 1987.

Table 7.1 Accident Frequency on Permanent Installations

	1984	1985	1986	1987
Accident Frequency per Million Man Hours	36	34	40	40

In terms of accidents per number of man hours the reported rate of accidents corresponds to 40 accidents per one million man hours with regard to permanent installations (Ref. Table 7.1)

Table 7.2 Reported Accidents and Technical Causes

Technical Cause	Perm. Inst.	Perm. Inst.	Perm. and Mob. Inst.
	1986	1987	1987
1. Power Engines, Compressors, Driving Devices	1	0	0
2. Work Machines	0	7	9
3. Cranes	5	0	1
4. Hoisting Devices and Motor Winches	4	0	0
5. Working Transport Equipment	0	0	0
6. Manual Transport Equipment and Handwinches	0	1	1
7. Lifting and Working Positions of Working Persons	6	5	7
8. Process Plants	1	0	0
9. Devices and Electrical Instruments	1	0	0
10. Tools	6	7	7
11. Mechanically Driven Tools	3	8	9
12. Drilling Equipment	0	0	7
13. Chemical Substances and Materials	1	2	2
14. Goods (Store Supply, Elements and Materials)	10	12	13
15. Work Space	22	16	19
16. Other	11	6	7
Total	71	64	82

The frequency of accidents in the iron and steel industry was 99 per million man hours in 1984.

Tables 7.2 and 7.3 summarize the reported work accidents during 1986 and 1987, as allocated to type of work (i.e. the type of work the injured person was engaged in when the accident occurred), and a technical factor and technical cause.

Flaring of Gas

Gas flaring is prohibited in Denmark due to energy conservation policy. However limited flaring of gas has been approved, when called for in connection with emergency or caused by operational or hydrocarbon transport requirements.

Table 7.3 Reported Accidents and Type of Work

Type of Work	Perm.	Perm.	Perm.
	Inst.	Inst.	and Mob. Inst.
	1986	1987	1987
1. Administration/Supervision	2	0	0
2. Catering, Cleaning	11	11	11
3. Instrument Set-Up, Electrical Jobs	2	6	6
4. Scaffolding	8	11	11
5. Pipeline Installation, Welding, Forging	14	15	15
6. Painting and Sand Blasting	0	1	1
7. Insulation	1	3	3
8. Unloading, Moving of Materials	8	1	2
9. Building's Installation, Smith Work	1	1	1
10. Crane Driving	0	0	0
11. Drilling Floor Work	0	0	7
12. Processing Control and Other Maintenance	6	0	4
13. Drills, Training	0	0	0
14. Work Area	10	8	12
15. Diving	0	0	0
16. Other	3	7	9
17. Unreported	5	0	0
Total	71	64	82

During 1987 total of 122 million Nm³ was flared, corresponding to 3 per cent of the total gas production. According to new regulations the permitted flaring for 1987 was 146 million Nm³.

Onshore Installations

During 1987 the crude oil terminal at Fredericia was expanded. With this expansion together with the modifications on the Gorm field, the oil transportation and terminal systems have a current maximum capacity of approx. 7.5 million m³ per year by utilizing drag reducing additives. Oil production ultimo 1987 utilized approx. 75 per cent of the maximum capacity.

In May 1987 the natural gas storage at Lille Torup was brought into operation. The purpose of the gas storage is to maintain gas supply in case of offshore delivery problems and during periods of peak demand. The storage at present comprises three caverns located in salt domes at a depth between 1,200-1,500 m. When completed the storage project will include six gas storage caverns, each with a capacity of 350,000 to 500,000 m³. Under the planned operational pressure the total storage capacity corresponds to 460 million Nm³ at 175 bar. Further underground gas storage potential is currently being investigated in Zealand (Stenlille).

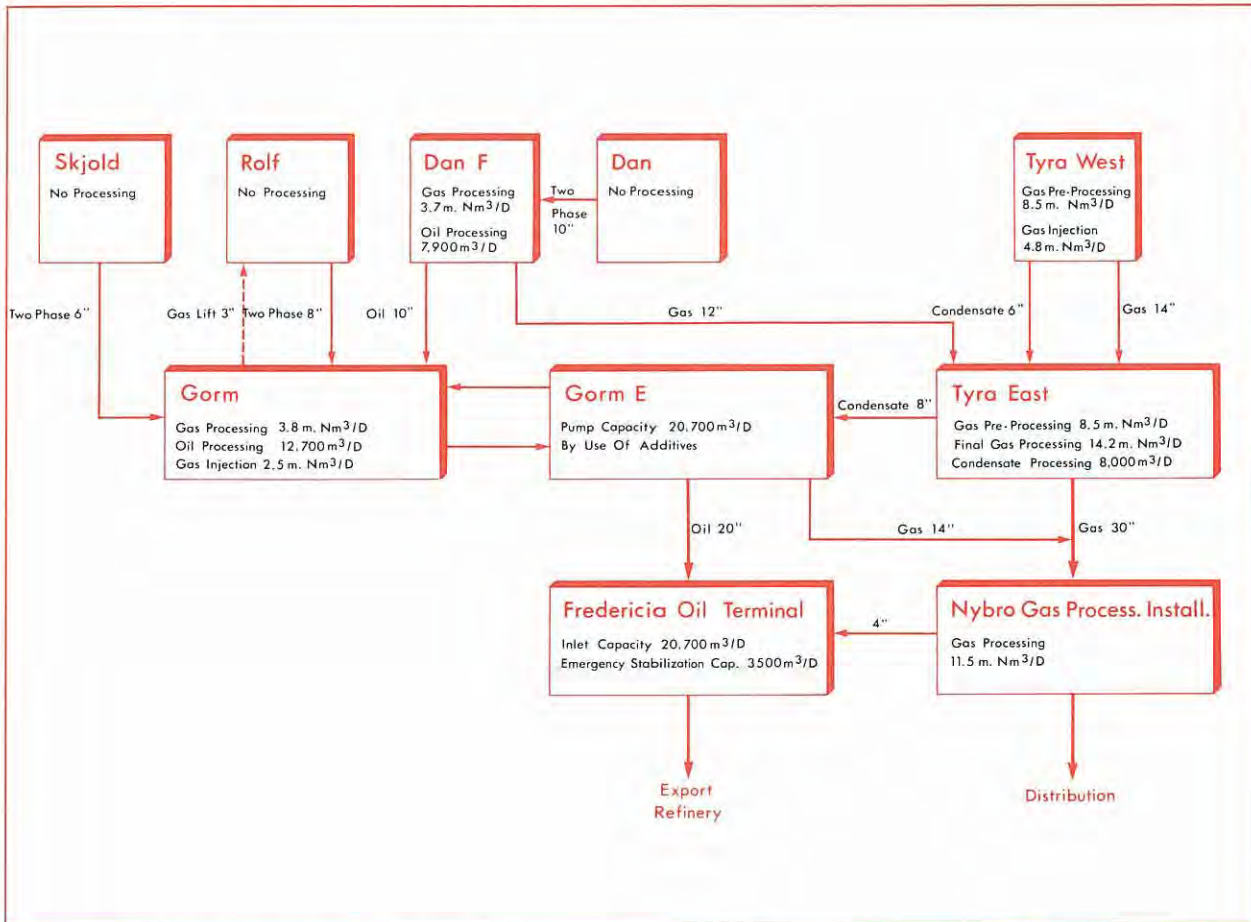
Metering Systems for Oil and Gas

The Energy Agency performs supervision with regard to the maintenance and control of the metering systems with regard to production and transportation. During 1987, the Agency supervised the calibration of the system in conjunction with the capacity increase of DORAS's oil storage at Fredericia. Furthermore, the Agency monitored the calibration of the system on the Dan F complex.

Analysis and Evaluation

A number of evaluations and analyses were conducted during 1987 by the Energy Agency, comprising evaluations aiming at minimizing the current gas flaring and with regard to future requirements for the processing and transportation capacities in Denmark.

Fig. 7.1 Processing and Transportation Capacity



The evaluations revealed that ample spare capacity exists in the processing and transportation system for a number of new discoveries, currently under planning. The capacities of the currently existing processing and transportation facilities are shown in Fig. 7.1.

The Coordination Committee

The Coordination Committee was established under the Act on Certain Marine Installations in order to support the Energy Agency in the coordination of supervisory activities carried out by Danish authorities, including assistance in the preparation of guidelines and regulations in accordance with the Act. The Committee is composed of representatives from relevant authorities and from the

employee's and employer's organizations. The Agency chairs and serves as secretariat for the Committee.

During 1987 the Committee submitted a proposal with regard to regulations on drilling equipment, prepared by the Energy Agency in cooperation with the Maritime Authority. The Committee participated in the preparation of the regulations on safety under the Ministerial Order No. 711 by the Ministry of Energy, issued in November 1987.

Further activity by the Committee included regulatory work with regard to marine installations, diving and diving equipment, accommodation, training and work conditions.

The Action Committee

The objective of the Action Committee is to coordinate the activities of the Danish authorities in the case of emergency on marine installations.

Furthermore, the Committee provides supervision and monitors adherence to the operators' contingency plans.

The Energy Agency chairs and also serves as a secretariat to the Committee. The Action Committee includes:

- Flag Officer Denmark.
- The Esbjerg Police Authorities.
- The Agency of Environmental Protection.
- The Danish Maritime Authority.
- The Danish Energy Agency.

The Committee participated in contingency drills held by Norsk Hydro and Statoil with the purpose of testing that communication routes and alarm systems functioned properly.

The Committee was partly involved in an incident of emergency on the 16th October 1987, when an abandoned tanker was on collision course towards the Dan field. Furthermore, the Action Committee has been summoned twice during 1987 when sinking vessels were threatening the oil and gas transmission systems in the North Sea.

In connection with the Licence Awards under the 1st and 2nd Licensing Rounds agreements were made between the Licence Groups and the Ministry of Energy with regard to research, development and education provided by the oil companies.

Training courses may be subdivided into three main categories:

1. Courses in Denmark
2. Participation in the Companies Internal Courses
3. On the Job Training at the Oil Companies

The Licencees commitments with regard to research and education are primarily comprising the following disciplines:

- Geology
- Exploration Technology
- Reservoir Technology
- Drilling Technology
- Production and Pipeline Technology
- Field Development
- Operation and Maintenance
- Oil/Gas Refining Technology

In addition, economic, administrative and legal aspects of exploration, development and production are included in several of the agreements on educational activity.

Training

Participation in internal training courses held by various oil companies included 29 employees from 9 Danish institutions during 38 weeks in 1987. The training took place in the United States, the United Kingdom, Italy and Norway. On The Job Training was provided by Amoco, Phillips, Norsk Hydro and Statoil. 9 staff members from the Energy Agency, the Ministry of Energy and the Danish Geological Survey spent a total of 55 months in On The Job Training projects in USA and Norway during 1987. Four courses in Denmark were provided by the Licencees during 1987. A total of

80 students participated. The courses comprised the following disciplines:

- Seismic Facies Analysis
- Seismic Stratigraphy
- Well Log Interpretation
- Rock Mechanics for Petroleum Geologists and Engineers

Scholarships

Four individuals obtained scholarships for hydrocarbon studies not available in Denmark. The studies were undertaken at universities, organizations and companies in USA, England and Norway.

Guest Lecturer

A Polish guest lecturer was attached to the Geological Institute at Århus during six months in 1987, financed by the Licence Groups.

Research and Development

A total of DKK 65 million was allocated to research and development according to the Licence Awards of the 1st and 2nd Rounds.

The status of utilization of these funds is as follows:

- Completed Projects DKK 7.5 million
- Ongoing Projects DKK 20.0 million
- Approved Projects DKK 8.8 million
- Planned Projects DKK 5.5 million
- Total DKK 41.8 million

To date the funds primarily have been allocated to research and development in the fields:

- Geology and Geophysics
- Automation, Sound and Signals
- Installations and Platforms
- Pipelines
- Computer Software.

Danish Involvement

Supervisory services are provided by the Energy Agency in order to ensure that Danish Companies are given a realistic and equal opportunity to participate in the activities related to exploration and production.

Guidelines with regard to invitation and evaluation of tenders have been prepared by the Agency and submitted to the various Licence Groups. These guidelines furthermore require reporting from the Licence Groups concerning entering of new contracts.

It is estimated that Danish Involvement in exploration and production corresponded to 55 per cent during 1987.

The Danish Involvement with regard to development activities conducted at Dan, Tyra and Rolf during 1986-1987 corresponded to 61 per cent.

The Hydrocarbon Committee

The Energy Agency serves as secretariat to the Hydrocarbon Committee established by the Minister for Energy in 1986. In 1987, the Committee published its first report on research and industrial development within the hydrocarbon field in Denmark.

The report highlights six priority areas that will become the subject of future research and development activities.

– Improved Exploration Methods

- Basin Analysis
- Seismic Data Processing

– Enhanced Recovery Methods

- High Technology Drilling Procedures
- Enhanced Oil Recovery (EOR)
- Reservoir Simulation
- 3-D Seismic

– Production Plants and Transport Systems

- Platform Concepts
- Process Plants
- Two Phase Flow

– Operation and Maintenance

- Automation and Measuring Equipment

- Determination Factors in Fatigue Studies, Reliability and Maintenance
- Improved Lifetime of Plants and Materials

– Safety and Environment

- Risk Analysis
- Nature Determined Construction Loads
- Standardization and Quality Control
- Environmental Protection

– Operations under Severe Conditions

The Committee recommends that the technological problems relating to north Atlantic and Arctic exploration, production and transportation of hydrocarbons should be upgraded in cooperation with the authorities and private industry of the Faroe Islands and Greenland.

Appendix A

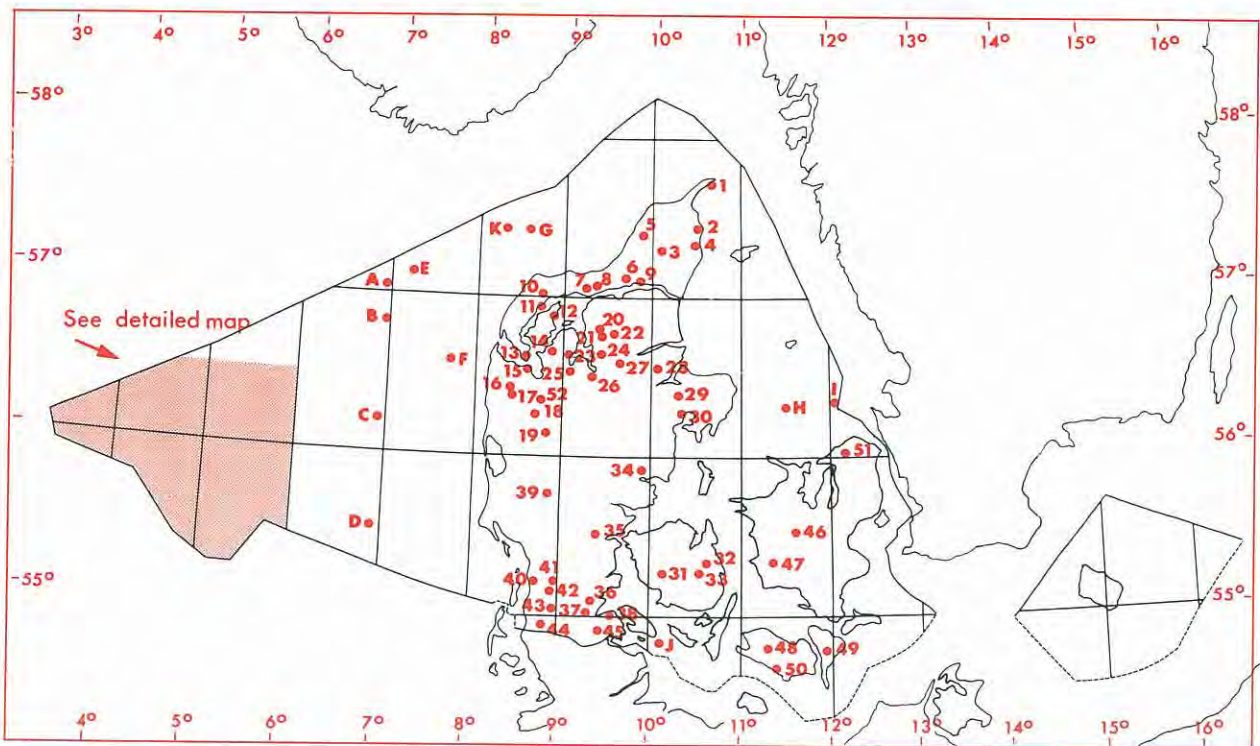
Licensees On Danish Territory

(31. December 1987)

Company	Share	Company	Share
A.P. Møller (The DUC Group):		Dansk Oliesøgning K/S	
A.P. Møller	39.00%	Korn- og Foderstof Kompagniet A/S	7.50%
Shell Olie- og Gasudvinding Danmark	46.00%	DENERCO K/S	2.50%
Texaco Denmark Inc.	15.00%	DOPAS	7.50%
Mærsk Oil and Gas is operator		(DANOP is operator on licence nr. 4/86, called Dogger West)	20.00%
The Agip Group:		The Phillips Group:	
Agip Danmark Olie- og Gas- efterforskning Aps (operator)	40.00%	Zealand	
Fina Exploration Denmark S.A.	28.80%	Phillips Petroleum Int. Corp. Denmark (operator)	48.00%
ÖMV Erdöl-Aufsuchungsges.m.b.H.	11.20%	Petroleum Exploration Denmark A/S	32.00%
DOPAS	20.00%	DOPAS	20.00%
The Amoco Group:		Offshore	
The Bornholm Area. (2nd Licensing Round)		Phillips Petroleum Int. Corp. Denmark (operator)	26.66%
Amoco Denmark Exploration Co. (operator)	75.00%	Fina Exploration Denmark S.A.	26.66%
FLS-Energy A/S	5.00%	Agip Danmark Olie- og Gasefterforsk- ning Aps	26.66%
DOPAS	20.00%	DOPAS	20.00%
Other Areas (1st Licensing Round)		The Statoil Group:	
Amoco Denmark Exploration Co. (operator)	50.00%	Statoil Efterforskning og Produktion A/S (operator offshore)	26.50%
Enterprise Petroleum Ltd.	25.00%	BHP Petroleum Inc.	21.00%
FLS-Energy A/S	10.00%	Skeie Energy Denmark A/S	12.00%
DOPAS	15.00%	The Employees Capital Pension Fund	7.50%
The Britoil Group:		EAC Energy A/S	4.00%
Britoil Danmark (operator offshore)	38.75%	DENERCO K/S	9.00%
Amerada Hess A/S	38.75%	DOPAS	20.00%
Danish Co-Operative Farm Supply	1.25%	(DANOP is operator onshore)	
Danoil Exploration A/S	1.19%	The Texaco Group:	
Danoil	0.06%	Getty Oil (Denmark) Inc (operator)	20.00%
DOPAS (operator onshore)	20.00%	Murphy Denmark Oil Co.	10.00%
The Norsk Hydro Group:		Canam Offshore Ltd.	10.00%
Norsk Hydro Udforskning (operator)	19.50%	Clyde Petroleum plc.	12.00%
Texas Eastern Denmark A/S	19.50%	Petrex S.p.A.	12.00%
Gas Council Ltd.	13.70%	Enterprise Oil Exploration Ltd.	16.00%
Amerada Hess A/S	9.80%	DOPAS	20.00%

Exploration and Appraisal Wells

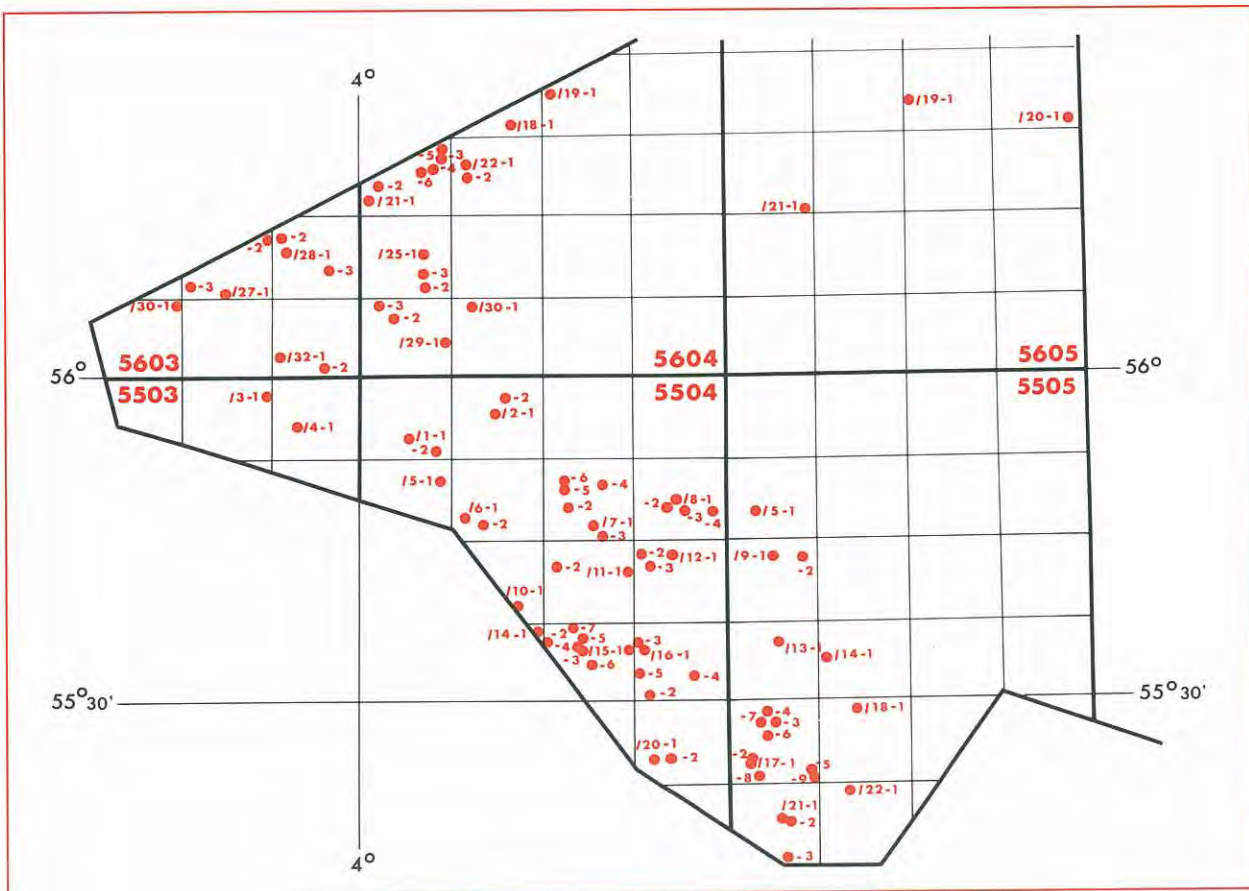
1: 5710/11-1	5608/3-2	5609/10-3	31: 5510/21-1	5408/4-2	A: 5706/32-1
Skagen-1	Thisted-3	Tostrup-3	Glamsbjerg-1	Tønder-2	Nina F-1
5710/11-2	12: 5608/4-1	5609/10-4	32: 5510/23-1	5408/4-3	B: 5606/8-1
Skagen-2	Mors-1	Tostrup-4	Ringe-1	Tønder-3	Inez-1
2: 5710/19-1	13: 5608/11-1	5609/10-5	33: 5510/23-2	5408/4-4	C: 5606/28-1
Frederikshavn-1	Uglev-1	Tostrup-5	Ullerslev-1	Tønder-5	Kaye R-1
5710/19-2	14: 5608/12-1	5609/10-6	34: 5509/4-1	5408/4-5	D: 5506/16-1
Frederikshavn-2	Rødning-1	Tostrup-6	Horsens-1	Tønder-4	Pele S-1
5710/19-3	15: 5608/15-1	5609/10-7	35: 5509/14-1	45: 5409/2-1	E: 5707/25-1
Frederikshavn-3	Oddeund-1	Tostrup-7	Harte-1	Kværs-1	Lena K-1
3: 5710/21-1	16: 5608/18-1	5609/10-8	5509/14-2	46: 5511/15-1	F: 5607/15-1
Flyvbjerg-1	Vemb-1	Tostrup-8	Harte-2	Stenlille-1	Dora C-1
4: 5710/22-1	17: 5608/18-2	5609/10-9	36: 5509/30-1	5511/15-2	G: 5708/19-1
Sæby-1	Linde-1	Tostrup-9	Åbenrå-1	Stenlille-2	Lisa J-1
5: 5709/20-1	18: 5608/23-1	5609/10-10	37: 5509/30-2	5511/15-3	H: 5611/23-1
Børglum-1	Vinding-1	Tostrup-10	Rødekro-1	Stenlille-3	Terne-1
6: 5709/27-1	19: 5608/28-1	5609/10-11	38: 5509/31-1	47: 5511/22-1	I: 5612/21-1
Vedsted-1	Nøvling-1	Tostrup-11	Varnæs-1	Slagelse-1	Hans-1
7: 5709/29-1	20: 5609/6-1	25: 5609/13-1	39: 5508/8-1	48: 5411/6-1	J: 5410/5-1
Fjerritslev-1	Hyllebjerg-1	Skive-2	Grindsted-1	Søllested-1	Kegnæs-1
8: 5709/30-1	21: 5609/6-2	26: 5609/14-1	40: 5508/27-1	49: 5411/8-1	K: 5708/18-1
Fjerritslev-2	Farsø-1	Kvols-1	Brøns-1	Ørslev-1	Felicia-1
9: 5709/32-1	22: 5609/7-1	27: 5609/15-1	41: 5508/28-1	50: 5411/10-1	
Haldager-1	Års-1	Hobro-1	Arnum-1	Rødby-1	
10: 5708/31-1	23: 5609/9-1	28: 5610/13-1	42: 5508/28-2	5411/10-2	
Thisted-1	Skive-1	Gassum-1	Hønning-1	Rødby-2	
5708/31-2	24: 5609/10-1	29: 5610/18-1	43: 5508/32-1	51: 5612/29-1	
Thisted-4	Tostrup-1	Voldum-1	Løgumkloster-1	Lavø-1	
11: 5608/3-1	5609/10-2	30: 5610/22-1	44: 5408/4-1	52: 5608/19-1	
Thisted-2	Tostrup-2	Rønde-1	Tønder-1	Mejrup-1	



Appendix B

Exploration and Appraisal Wells

5603/27-1 Sten-1	5604/18-1 Cleo-1	5604/25-2 Otto-1, T-2	5504/6-1 Elly-1	5504/8-4 D. Adda-1	5504/15-4 Ø. Rosa-2	5605/19-1 Jane D-1	5505/17-4 Dan M-8
5603/27-2 Gert-1	5604/19-1 Elna-1	5604/25-3 N. Arne T-3	5504/6-2 Elly-2	5504/10-1 Edna-1	5504/15-5 Ø. Rosa-3	5605/20-1 Ibenholt-1	5505/17-5 Nils-1
5603/27-3 Lone-1	5604/21-1 Mona-1	5604/29-1 S. Arne I-1	5504/7-1 Roar H-1	5504/11-1 Tyra E-2	5504/15-6 Ø. Rosa F-1	5605/21-1 Else L-1	5505/17-6 Dan M-9
5603/28-1 Gert-2	5604/21-2 Karl-1	5604/29-2 Gwen Q-1	5504/7-2 Bo-1	5504/11-2 Jens-1	5504/15-7 M. Rosa F-1	5505/5-1 Per-1	5505/17-7 Dan M-10
5603/28-2 Gert-3	5604/21-3 V. Lulu-1	5604/29-3 Gwen-2	5504/7-3 Roar-2	5504/12-1 Tyra E-1	5504/16-1 Gorm N-2	5505/9-1 Poul V-1	5505/17-8 Anne-3
5603/28-1 Jeppe-1	5604/21-4 V. Lulu-2	5604/30-1 Iris-1	5504/7-4 Boje-1	5504/12-2 Tyra E-3	5504/16-2 Lola U-1	5505/9-2 Ugle-1	5505/17-9 Nils-2
5603/30-1 Kim-1	5604/21-5 V. Lulu-3	5504/1-1 Heno W-1	5504/7-5 N. Jens-1	5504/12-3 Tyra E-4	5504/16-3 Gorm N-3	5505/13-1 Igor G-1	5505/18-1 Emma-1
5603/32-1 Inge P-1	5604/21-6 V. Lulu-4	5504/1-2 Ravn-1	5504/7-6 N. Jens-2	5504/14-1 M. Rosa-2	5504/16-4 Skjold Ruth-1	5505/14-1 S.Ø. Igor-1	5505/21-1 Vagn-1
5603/32-2 Diamant-1	5604/22-1 Lulu-1	5504/2-1 Elin-1	5504/8-1 Adda-1	5504/15-1 Gorm N-1	5504/16-5 Dyb Gorm-1	5505/17-1 Anne A-1	5505/21-2 Vagn-2
5503/3-1 Olaf-1	5604/22-2 Lulu-2	5504/2-2 Nora-1	5504/8-2 Adda-2	5504/15-2 M. Rosa-1	5504/20-1 John-1	5505/17-2 Anne A-2	5505/21-3 Tove-1
5503/4-1 Liva-1	5604/25-1 N. Arne T-1	5504/5-1 Ravn-2	5504/8-3 Adda-3	5504/15-3 Ø. Rosa-1	5504/20-2 John F-1	5505/17-3 Dan M-1	5505/22-1 Ryan O-1



Exploration and Appraisal Wells

Well name Number	Operator Rig	N. latt. E. long	Total Depth Formation	Spud Completed	Well name Number	Operator Rig	N. latt. E. long	Total Depth Formation	Spud Completed
Harte-1 5509/14-1	Dapco Cardwell	55° 30' 37" 09° 25' 04"	791 m Pre U.Creta.	1935-07-27 1936-07-29	Fjerritslev-1 5709/29-1	(Standard) Dapco Emsco	57° 04' 52" 09° 12' 56"	910 m L.Jurassic	1958-02-14 1958-02-28
Harte-2 5509/14-2	Dapco Cardwell	55° 30' 37" 09° 25' 03"	1096 m U.Triassic	1936-09-02 1937-08-16	Fjerritslev-2 5709/30-1	(Standard) Dapco Emsco	57° 05' 46" 09° 15' 05"	2337 m U.Triassic	1958-03-13 1958-05-05
Vinding-1 5608/23-1	(Gulf) Dapco Emsco	56° 17' 26" 08° 41' 56"	2434 m Triassic	1947-07-17 1947-12-24	Vedsted-1 5709/27-1	(Standard) Dapco Emsco	57° 08' 26" 09° 40' 12"	2068 m U.Triassic	1958-05-09 1958-06-08
Gassum-1 5610/13-1	(Gulf) Dapco Emsco	56° 33' 46" 10° 00' 19"	3404 m U.Permian	1948-03-18 1951-03-19	Flyvbjerg-1 5710/21-1	(Standard) Dapco Emsco	57° 18' 16" 10° 03' 18"	1651 m Triassic	1958-06-14 1958-07-05
Skagen-1 5710/11-1	(Gulf) Dapco Cardwell	57° 44' 12" 10° 36' 02"	458 m Jurassic	1949-08-24 1949-09-02	Horsens-1 5509/04-1	(Standard) Dapco Emsco	55° 56' 11" 09° 54' 29"	1672 m U.Triassic	1958-07-13 1958-07-31
Frederikshavn-1 5710/19-1	(Gulf) Dapco Cardwell	57° 26' 01" 10° 31' 16"	1304 m Precambrium?	1950-07-03 1950-08-22	Hønning-1 5508/28-2	(Standard) Dapco Emsco	55° 10' 52" 08° 54' 29"	2457 m Pre U.Permian	1958-08-09 1958-10-19
Haldager-1 5709/32-1	(Gulf) Dapco Cardwell	57° 07' 08" 09° 46' 46"	1520 m L.Jurassic	1950-10-10 1950-12-30	Grindsted-1 5508/08-1	(Standard) Dapco Emsco	55° 45' 26" 08° 49' 25"	1615 m Precambrium	1958-10-29 1958-11-27
Ringe-1 5510/23-1	(Gulf) Dapco Cardwell	55° 16' 53" 10° 30' 22"	1364 m Precambrium	1951-02-04 1951-04-19	Rødekro-1 5509/30-2	(Standard) Dapco Emsco	55° 05' 08" 09° 20' 25"	1596 m L.Permian	1958-12-05 1958-12-30
Ullerslev-1 5510/23-2	(Gulf) Dapco Cardwell	55° 22' 13" 10° 38' 42"	1037 m U.Triassic	1951-05-02 1951-06-11	Lavø-1 5612/29-1	(Standard) Dapco Emsco	56° 01' 59" 12° 10' 31"	2414 m U.Triassic	1959-01-19 1959-03-01
Tønder-1 5408/04-1	(Gulf) Dapco Cardwell	54° 57' 37" 08° 51' 17"	3123 m U.Permian	1951-05-05 1952-06-19	Slagelse-1 5511/22-1	(Standard) Dapco Emsco	55° 22' 21" 11° 22' 42"	2934 m Precambrium	1959-03-09 1959-05-21
Tostrup-1 5609/10-1	56° 38' 23" 09° 25' 57"	763 m		1951-05-29 1951-06-17	Rønde-1 5610/22-1	Gulf Oilwell 940E	56° 18' 15" 10° 26' 07"	5259 m Silurian	1965-10-23 1966-08-25
Glamsbjerg-1 5510/21-1	(Gulf) Dapco Cardwell	55° 17' 33" 10° 07' 47"	840 m Precambrium	1951-07-05 1951-08-02	Kraka A-1 5505/17-1	Gulf Glomar IV	55° 24' 20" 05° 03' 45"	1811 m Paleocene	1966-08-27 1966-09-28
Tostrup-2 5609/10-2	(Gulf) Dapco Cardwell	56° 37' 35" 09° 24' 32"	761 m	1951-07-26 1951-08-24	Nøvling-1 5608/28-1	Gulf Oilwell 940E	56° 10' 09" 08° 48' 36"	3692 m Silurian	1966-09-13 1966-11-25
Børglum-1 5709/20-1	(Gulf) Dapco Cardwell	57° 22' 32" 09° 50' 23"	1527 m U.Triassic	1951-08-14 1951-09-26	Mors-1 5608/04-1	Gulf Oilwell 940E	56° 54' 00" 08° 53' 05"	5303 m L.Triassic	1966-12-13 1967-09-21
Skagen-2 5710/11-2	(Gulf) Dapco Sullivan	57° 44' 22" 10° 36' 00"	618 m U.Triassic	1951-09-24 1951-10-25	Kraka A-2 5505/17-2	Gulf Mærsk Explorer	55° 24' 21" 05° 03' 34"	3396 m M.Triassic	1967-07-30 1967-10-22
Uglev-1 5608/11-1	(Gulf) Dapco Emsco	56° 37' 58" 08° 32' 09"	1208 m U.Permian	1951-10-11 1951-12-17	Thisted-1 5708/31-1	Gulf Oilwell 940E	57° 01' 26" 08° 39' 10"	909 m U.Triassic	1967-10-01 1967-10-16
Rødby-1 5411/10-1	(Gulf) Dapco Cardwell	54° 41' 37" 11° 24' 18"	1529 m L.Triassic	1952-01-11 1952-03-24	Ørlev-1 5411/08-1	Gulf Oilwell 940E	54° 46' 55" 11° 59' 02"	2551 m L.Carbonife.	1967-10-31 1968-01-09
Frederikshavn-2 5710/19-2	(Gulf) Dapco Cardwell	57° 25' 45" 10° 30' 45"	1046 m Triassic	1952-04-21 1952-05-28	Dora C-1 5607/15-1	Gulf Mærsk Explorer	56° 36' 42" 07° 40' 00"	3206 m L.Permian	1968-01-19 1968-03-04
Frederikshavn-3 5710/19-3	(Gulf) Dapco Cardwell	57° 27' 31" 10° 32' 05"	998 m Triassic	1952-06-06 1952-07-26	Jane D-1 5605/19-1	Gulf Mærsk Explorer	56° 25' 30" 05° 31' 52"	3563 m L.Permian	1968-03-27 1968-05-27
Tønder-2 5408/04-2	(Gulf) Dapco Emsco	54° 59' 07" 08° 51' 38"	3183 m L.Permian	1952-07-10 1953-03-07	Tyra E-1 5504/12-1	Gulf Mærsk Explorer	55° 43' 52" 04° 51' 04"	4084 m U.Jurassic	1968-05-29 1968-08-17
Arnum-1 5508/28-1	(Gulf) Dapco Cardwell	55° 13' 13" 08° 57' 48"	1805 m Precambrium	1952-09-06 1952-11-27	Tyra E-2 5504/11-1	Gulf Mærsk Explorer	55° 42' 32" 04° 44' 39"	2201 m U.Cretaceous	1968-08-20 1968-10-02
Åbenrå-1 5509/30-1	(Gulf) Dapco Cardwell	55° 01' 32" 09° 21' 17"	2291 m Ordovician	1952-12-11 1953-06-04	Nina F-1 5706/32-1	Gulf Mærsk Explorer	57° 01' 53" 06° 54' 28"	2420 m Triassic	1968-10-06 1968-10-20
Rødby-2 5411/10-2	(Gulf) Dapco Emsco	54° 41' 29" 11° 22' 22"	2938 m L.Permian	1953-04-20 1953-11-24	Igor G-1 5505/13-1	Gulf Mærsk Explorer	55° 35' 05" 05° 09' 47"	3812 m U.Jurassic	1968-10-26 1968-12-11
Vemb-1 5608/18-1	(Standard) Dapco Emsco	56° 22' 53" 08° 21' 47"	1944 m U.Triassic	1957-12-14 1958-01-27	Roar H-1 5504/07-1	Gulf Mærsk Explorer	55° 46' 28" 04° 38' 48"	2164 m U.Cretaceous	1968-12-13 1969-01-30

Appendix B

Well name Number	Operator Rig	N. latt. E. long	Total Depth Formation	Spud Completed	Well name Number	Operator Rig	N. latt. E. long	Total Depth Formation	Spud Completed
Syd Arne I-1 5604/29-1	Gulf Mærsk Explorer	56°03'10" 04°14'59"	3908 m U.Jurassic	1969-02-12 1969-04-09	Gorm N-3 5504/16-3	Gulf Mærsk Explorer	55°35'16" 04°45'19"	2294 m U.Cretaceous	1976-06-27 1976-09-05
Lisa J-1 5708/19-1	Gulf Mærsk Explorer	57°25'57" 08°33'06"	1987 m U.Triassic	1969-12-24 1970-01-16	Tyra E-4 5504/12-3	Gulf Mærsk Explorer	55°43'02" 04°48'05"	2289 m U.Cretaceous	1976-09-08 1976-11-24
Lena K-1 5707/25-1	Chevron Mærsk Explorer	57°07'38" 07°09'43"	2291 m Triassic	1970-01-21 1970-02-09	Skjold Ruth-1 5504/16-4	Chevron Mærsk Explorer	55°32'20" 04°54'53"	1710 m U.Cretaceous	1977-01-08 1977-03-19
Else L-1 5605/21-1	Chevron Mærsk Explorer	56°15'10" 05°14'55"	2708 m L.Permian	1970-08-21 1970-10-17	Adda-1 5504/08-1	Chevron Mærsk Explorer	55°48'38" 04°52'19"	3050 m U.Jurassic	1977-03-22 1977-07-16
Dan M-1 5505/17-3	Gulf Britannia	55°28'10" 05°08'02"	2309 m L.Cret./U.Jur.	1971-03-08 1971-05-08	Bo-1 5504/07-2	Chevron Mærsk Explorer	55°48'09" 04°34'19"	2743 m U.Jurassic	1977-08-19 1977-09-04
Gorm N-1 5504/15-1	Gulf Britannia	55°34'44" 04°44'47"	2485 m U.Cretaceous	1971-05-11 1971-06-19	Inez-1 5606/08-1	Chevron Mærsk Explorer	56°50'28" 06°57'42"	1983 m U.Triassic	1977-09-11 1977-10-04
Ryan O-1 5505/22-1	Gulf Transocean II	55°22'02" 05°19'19"	3578 m Triassic	1972-10-09 1973-01-13	Vagn-1 5505/21-1	Chevron Dyvi Beta	55°19'06" 05°09'46"	1223 m Cretaceous	1977-10-09 1977-12-14
Inge P-1 5603/32-1	Gulf Zapata Nordic	56°02'04" 03°46'10"	3494 m L.Paleozoic	1973-01-21 1973-03-18	Tostrup-3 5609/10-3	Dong DST SMG FB-291	56°38'06" 09°24'06"	1593 m U.Permian	1978-04-21 1978-05-26
Gwen Q-1 5604/29-2	Gulf Zapata Nordic	56°05'30" 04°06'15"	4494 m L.Permian	1973-03-28 1973-10-04	Tove-1 5505/21-3	Chevron Mærsk Explorer	55°15'17" 05°09'45"	1878 m U.Permian	1978-08-09 1978-10-15
Kaye R-1 5606/28-1	Chevron Transworld 61	56°12'57" 06°53'46"	2702 m L.Permian	1973-09-21 1973-12-08	Vagn-2 5505/21-2	Chevron Mærsk Explorer	55°19'21" 05°09'44"	1930 m U.Permian	1978-08-09 1978-09-04
Voldum-1 5610/18-1	Gulf Deutag-14	56°23'02" 10°16'01"	2277 m U.Triassic	1974-03-04 1974-04-15	Per-1 5505/05-1	Chevron Mærsk Explorer	55°47'30" 05°05'01"	2781 m Precambrium	1978-10-18 1978-11-23
Hobro-1 5609/15-1	Gulf Deutag-14	56°36'30" 09°38'04"	2561 m U.Triassic	1974-06-07 1974-07-10	Års-1/1A 5606/07-1	Dong CH 1400E	56°47'44" 09°30'32"	3401 m U.Triassic	1978-11-06 1979-09-03
Dan M-8 5505/17-4	Gulf Orion	55°28'44" 05°06'42"	3660 m Triassic	1974-07-03 1974-09-02	Nils-1 5505/17-5	Chevron Mærsk Explorer	55°23'15" 05°13'37"	2033 m U.Permian	1978-12-03 1979-02-19
Tyra E-3 5504/12-2	Gulf Orion	55°44'01" 04°46'30"	2661 m L.Cretaceous	1974-09-14 1974-11-02	Tostrup-4 5609/10-4	Dong DST 1400/23	56°39'06" 09°20'39"	1610 m U.Permian	1979-03-10 1979-10-22
Pele S-1 5506/16-1	Chevron Orion	55°30'57" 06°55'18"	3812 m U.Triassic	1975-02-06 1975-04-17	Dan M-9 5505/17-6	Chevron Mærsk Explorer	55°26'48" 05°06'33"	2093 m U.Cretaceous	1979-09-10 1979-12-04
Gorm N-2 5504/16-1	Chevron Orion	55°34'50" 04°46'31"	2289 m U.Cretaceous	1975-04-24 1975-06-12	Linde-1 5608/18-2	Elsam Cabot Franks 900	56°26'04" 08°26'35"	2237 m U.Triassic	1979-11-22 1980-01-24
Nord Arne T-1 5604/25-1	Chevron Ocean Voyager	56°11'38" 04°10'16"	2652 m U.Permian	1975-05-05 1975-07-27	Lulu-1 5604/22-1	Chevron Sedco J.	56°20'03" 04°17'37"	3720 m U.Permian	1980-01-03 1980-09-17
Lola U-1 5504/16-2	Chevron Ocean Voyager	55°30'04" 04°48'08"	4877 m L.Triassic	1975-07-29 1975-11-15	Tostrup-5 5609/10-5	Dong Ideco BIR-800	56°38'32" 09°24'59"	1609 m U.Permian	1980-04-21 1980-10-19
Poul V-1 5505/09-1	Chevron Mærsk Explorer	55°43'50" 05°07'59"	3856 m Triassic	1975-11-21 1975-02-02	Stenlille-1 5511/15-1	Dong Ideco BIR-800	55°32'38" 11°37'06"	1664 m U.Triassic	1980-06-07 1980-07-10
Hyllebjerget-1 5609/06-1	Dansk Borelskab National 80B	56°48'53" 09°20'54"	2855 m U.Triassic	1975-12-07 1976-01-19	Tostrup-6 5609/10-6	Dong Ideco BIR-800	56°38'24" 09°25'17"	1614 m U.Permian	1980-07-14 1980-08-27
Rødding-1 5608/12-1	Dansk Borelskab National 80B	56°38'49" 08°48'18"	2163 m U.Triassic	1976-01-27 1976-02-20	Løgumkloster-1 5508/32-1	Dansk Borelskab Deutag T-14	55°02'33" 08°57'04"	2724 m Ordovician	1980-07-31 1980-10-31
Kvois-1 5609/14-1	Dansk Borelskab National 80B	56°31'41" 09°17'56"	2624 m U.Triassic	1976-02-27 1976-03-29	Tostrup-7 5609/10-7	Dong Ideco BIR-800	56°38'40" 09°25'22"	1746 m U.Permian	1980-08-30 1980-10-13
Heno W-1 5504/01-1	Chevron Mærsk Explorer	55°54'27" 04°08'43"	4381 m L.Permian	1976-03-20 1976-06-16	Tønder-3 5408/04-3	Dansk Borelskab Deutag T-14	54°57'30" 08°51'28"	1840 m L.Triassic	1980-10-10 1980-11-10
Skive-1 5609/09-1	Dansk Borelskab National 80B	56°37'38" 09°00'11"	2290 m U.Triassic	1976-04-04 1976-04-28	Varnæs-1 5509/31-1	Dansk Borelskab Deutag T-14	55°02'13" 09°35'32"	2236 m Pre U.Permian	1980-11-20 1980-12-23
Oddeund-1 5608/15-1	Dansk Borelskab National 80B	56°33'37" 08°34'10"	3535 m U.Triassic	1976-05-04 1976-08-10	Adda-2 5504/08-2	Chevron Dyvi Beta	55°48'20" 04°50'41"	2743 m U.Jurassic	1981-01-03 1981-03-03

Appendix B

Well name Number	Operator Rig	N. latt. E. long	Total Depth Formation	Spud Completed	Well name Number	Operator Rig	N. latt. E. long	Total Depth Formation	Spud Completed
Brøns-1/1A 5508/27-1	Dansk Boreelskab Deutag T-14	55° 12'04" 08° 44'08"	2539 m Pre U.Permian	1981-01-11 1981-04-11	Karl-1 5604/21-2	Chevron Dyvi Beta	56° 17'43" 04° 03'12"		1983-07-12 1983-10-04
Midt Rosa-1 5504/15-2	Chevron Dyvi Beta	55° 35'39" 04° 30'05"	2143 m U.Permian	1981-03-16 1981-06-06	Hans-1 5612/21-1	Dansk Boreelskab Mærsk Explorer	56° 21'55" 12° 00'51"		1983-08-04 1983-10-09
Tostrup-8 35609/10-8	Dong Ideco BIR-8085	56° 38'20" 19° 24'56"	1435 m	1981-05-31 1981-07-14	Thisted-3 5608/03-2	Dong Kenting 21E	56° 57'59" 08° 44'26"		1983-08-10 1983-08-26
Tostrup-9 5609/10-9	Dong Ideco BIR-8085	56° 38'10" 09° 25'15"	1456 m	1981-07-19 1981-08-30	Vest Lulu-1 5604/21-3	Chevron Dyvi Epsilon	56° 20'26" 04° 13'28"		1983-09-11 1984-01-18
Roar-2/2A 5504/07-3	Chevron Dyvi Beta	55° 45'10" 04° 39'56"	2683 m L.Cretaceous	1981-08-08 1981-11-07	Nora-1 5504/02-2	Chevron Dyvi Beta	55° 58'09" 04° 24'04"		1983-10-10 1984-02-28
Tostrup-10 5609/10-10	Dong Ideco BIR-8085	56° 38'14" 09° 24'34"	1594 m	1981-09-03 1981-10-21	John-1 5504/20-1	Chevron Mærsk Endeavour	55° 24'48" 04° 48'45"		1983-10-24 1983-11-10
Farsø-1 5609/06-2	Dong Ideco BIR-8055	56° 46'53" 09° 21'50"	2952 m U.Triassic	1981-10-22 1982-01-24	Øst Rosa-2 5504/15-4	Chevron Mærsk Endeavour	55° 35'14" 04° 35'08"		1983-11-14 1984-01-25
Otto-1 5604/25-2	Chevron Dyvi Beta	56° 09'07" 04° 11'23"	2682 m U.Permian	1981-12-21 1982-03-20	Kraka Anne-3 5505/17-8	Chevron Mærsk Endeavour	55° 23'38" 05° 04'47"		1984-01-31 1984-06-04
Thisted-2 5608/03-1	Dong Ideco BIR-8085	56° 57'56" 08° 42'57"	3287 m Triassic	1982-02-04 1982-03-28	Cleo-1 5604/18-1	Chevron Dyvi Epsilon	56° 23'23" 04° 25'23"		1984-02-06 1984-04-29
Jens-1 5504/11-2	Chevron Dyvi Beta	55° 42'49" 04° 32'12"	4420 m Triassic	1982-03-24 1982-09-23	Gert-1 5603/27-2	Chevron Dyvi Epsilon	56° 13'09" 03° 43'57"		1984-05-01 1984-07-29
Boje-1 5504/07-4	Chevron Dan Earl	55° 50'02" 04° 40'40"	2779 m U.Jurassic	1982-04-01 1982-06-08	Elly-1 5504/06-1	Chevron Mærsk Endeavour	55° 47'15" 04° 17'40"		1984-06-08 1984-08-15
Mona-1 5604/21-1	Chevron Dyvi Beta	56° 16'36" 04° 00'16"		1982-10-03 1983-02-09	Liva-1 5503/04-1	Chevron Dyvi Epsilon	55° 55'32" 03° 49'31"		1984-08-02 1984-09-30
Emma-1 5505/18-1	Chevron Mærsk Explorer	55° 29'31" 05° 21'28"	2736 m Triassic	1982-10-26 1982-11-28	Adda-3 5504/08-3	Chevron Dan Earl	55° 47'50" 04° 53'26"		1984-08-31 1984-10-25
Søllested-1 5411/06-1	Dansk Boreelskab Deutag T-14	54° 48'05" 11° 17'55"	2694 m L.Permian	1982-10-27 1982-12-11	Nils-2 5505/17-9	Chevron Dan Earl	55° 23'10" 05° 13'41"		1984-10-31 1984-12-29
Dan M-10 5505/17-7	Dansk Boreelskab Mærsk Explorer	55° 28'30" 55° 05'07"		1982-12-16 1983-02-16	Iris-1 5604/30-1	Britoil Dan King	56° 06'45" 04° 18'21"	Jurassic	1984-11-05 1985-02-24
Elin-1 5504/02-1	Chevron Dyvi Epsilon	55° 56'51" 04° 22'21"		1983-01-27 1983-04-27	Dyb Adda-1 5504/08-4	Chevron Dan Earl	55° 48'13" 04° 58'24"		1985-01-01 1985-02-17
Tønder-5 5408/04-4	Dong National 80 U	54° 57'03" 08° 49'55"		1983-02-13 1983-03-09	Vest Lulu-2 5604/21-4	Chevron Dan Earl	56° 19'48" 04° 12'13"		1985-02-21 1985-04-23
Sten-1 5603/27-1	Chevron Dyvi Beta	56° 07'48" 03° 37'35"		1983-02-17 1983-04-17	Gert-2 5603/28-1	Chevron Mærsk Endeavour	56° 11'50" 03° 46'50"		1985-02-27 1985-07-29
Sydøst Igor-1 5505/14-1	Chevron Mærsk Explorer	55° 33'55" 05° 16'02"		1983-02-20 1983-04-01	Elna-1 5604/19-1	Chevron Dan Earl	56° 26'55" 04° 31'43"		1985-05-01 1985-06-14
Tønder-4 5408/04-5	Dong National 80 UE	54° 57'35" 08° 50'50"		1983-03-13 1983-03-30	Ugle-1 5505/09-2	BP Transocean 7	55° 43'15" 05° 12'10"	3057 m	1985-05-07 1985-06-24
Olaf-1 5503/03-1	Dansk Boreelskab Mærsk Explorer	55° 58'21" 03° 44'06"		1983-04-17 1983-07-26	Thisted-4 5708/31-2	Amoco Kenting 31	57° 01'19" 08° 42'07"	3418 m Permian	1985-05-19 1985-07-18
Nord Arne T-3 5604/25-3	Chevron Dyvi Beta	56° 10'44" 04° 10'48"		1983-04-23 1983-07-07	Terne-1 5611/23-1	Amoco Dyvi Epsilon	56° 20'39" 11° 30'20"	3361 m Pre-/Cambrium	1985-05-29 1985-08-16
Øst Rosa-1 5504/15-3	Chevron Dyvi Epsilon	55° 34'47" 04° 36'41"		1983-05-01 1983-07-03	John Flanke-1 5504/20-2	Chevron Dan Earl	55° 24'28" 04° 50'10"		1985-06-20 1985-07-19
Midt Rosa-2 5504/14-1	Chevron Dyvi Epsilon	55° 36'18" 04° 29'21"		1983-07-07 1983-09-08	Lone-1 5603/27-3	Chevron Mærsk Endeavour	56° 08'35" 03° 31'58"		1985-06-30 1985-09-03
Edna-1 5504/10-1	Chevron Mærsk Endeavour	55° 39'12" 04° 25'12"		1983-07-12 1983-10-08	Kværs-1 5409/02-1	Mærskolie og Gas Kenting 31	54° 56'28" 09° 28'49"		1985-07-27 1985-09-09

Appendix B

Well name Number	Operator Rig	N. latt. E. long	Total Depth Formation	Spud Completed	Well name Number	Operator Rig	N. latt. E. long	Total Depth Formation	Spud Completed
Nord Jens-1 5504/07-5	Chevron Mærsk Endeavour	55° 49' 59" 04° 33' 35"		1985-08-07 1985-11-12	Jeppe-1 5603/28-3	Norsk Hydro Mærsk Guardian	56° 11' 04" 03° 54' 36"		1987-12-10
Sæby-1 5710/22-1	Dopas Baldon-41	57° 21' 24" 10° 23' 44"	1854 m Paleozoic	1985-08-07 1985-08-28					
Kegnæs-1 5410/05-1	Texaco Dyvi Epsilon	54° 50' 51" 10° 05' 15"	2591 m U.Permian	1985-08-21 1985-10-05					
Skive-2 5609/13-1	BP Baldon-41	56° 35' 37" 09° 00' 21"	1456 m U.Triassic	1985-09-02 1985-09-25					
Vest Lulu-3 5604/21-5	Chevron Mærsk Endeavour	56° 20' 58" 04° 12' 34"		1985-09-12 1985-12-11					
Kim-1 5603/30-1	Chevron Glomar Labrador 1	56° 07' 02" 03° 29' 53"		1985-10-03 1985-12-31					
Nord Jens-2 5504/07-6	Chevron Mærsk Endeavour	55° 49' 59" 04° 33' 36"		1985-11-16 1985-12-28					
Lulu-2 5604/22-2	Mærsk Olie og Gas Mærsk Endeavour	56° 19' 06" 04° 17' 31"		1985-12-15 1986-03-18					
Diamant-1 5603/32-2	Phillips Glomar Labrador 1	56° 00' 23" 03° 53' 44"	4242 m	1986-01-10 1986-03-18					
Øst Rosa-3 5504/15-5	Mærsk Olie og Gas Dyvi Epsilon	55° 35' 36" 04° 36' 31"		1986-01-20 1986-03-10					
Ravn-1 5504/01-2	Amoco Dyvi Epsilon	55° 52' 35" 04° 13' 52"	5013 m Permian	1986-03-24 1986-07-17					
Øst Rosa Fl.-1 5504/15-6	Mærsk Olie og Gas Mærsk Endeavour	55° 33' 51" 04° 37' 50"		1986-03-24 1986-04-30					
Midt Rosa Fl.-1 5504/15-7	Mærsk Olie og Gas Mærsk Endeavour	55° 35' 27" 04° 31' 33"		1986-05-04 1986-06-11					
Vest Lulu-4 5604/21-6	Mærsk Olie og Gas Mærsk Endeavour	56° 19' 05" 04° 10' 16"		1986-07-27 1986-09-12					
Gwen-2 5604/29-3	Mærsk Olie og Gas Mærsk Endeavour	56° 06' 52" 04° 04' 10"		1986-09-30 1986-12-15					
Mejrurp-1 5608/19-1	Phillips Kenting 36	56° 22' 39" 08° 40' 36"	2532 m Triassic	1987-03-22 1987-04-29					
Felicia-1 5708/18-1	Statoil Mærsk Guardian	57° 26' 18" 08° 18' 41"	5321 m Permian	1987-07-03 1987-12-03					
Gert-3 5603/28-2	Mærsk Olie og Gas Mærsk Endeavour	56° 12' 43" 03° 45' 49"		1987-07-21 1987-10-28					
Stenlille-2 5511/15-2	Danop Kenting 36	55° 32' 17" 11° 36' 18"		1987-07-27 1987-08-28					
Ibenholt-1 5605/20-1	Phillips Dyvi Sigma	56° 23' 26" 05° 58' 29"	2599 m Precambrium	1987-08-11 1987-09-24					
Dyb Gorm-1 5504/16-5	Mærsk Olie og Gas Zapata Scotian	55° 34' 04" 04° 45' 50"		1987-08-18 1987-12-04					
Stenlille-3 5511/15-3	Danop Kenting 36	55° 32' 17" 11° 36' 18"		1987-08-30 1987-09-16					
Ravn-2 5504/05-1	Amoco Dan Earl	55° 50' 35" 04° 13' 41"	4507 m Triassic	1987-09-16 1987-11-17					
Tostrup-11 5609/10-11	Danop Kenting 36	56° 37' 55" 09° 25' 24"		1987-10-10 1987-11-07					
Elly-2 5504/6-2	Mærsk Olie og Gas Neddrill Trigon	55° 47' 19" 04° 19' 05"		1987-11-15					

Seismic Surveys 1987

Investigation	Operator Contractor	Type	Initiated Completed	Area	Gathered in 1987
Non-exclusive surveys					
WG87C	Western Geophysical	Offshore	1987-10-04 1987-15-04	The Central Graben	172.4 km
SE 87B	Swedish Exploration Delft Geophysical	Offshore	1987-23-11 1987-18-12	The Baltic Sea Bornholm	536.0 km
Exclusive surveys					
DK87C	Mærsk Oil and Gas Geco	Offshore 3D	1987-26-09 1987-05-11	The Central Graben Gert	1551.6 km
DK87C	Mærsk Oil and Gas Horizon Exp.	Offshore 2D-3D	1987-15-10 1987-10-12	The Central Graben The Contiguous Area	3212.5 km
ST87T	DANOP Prakla Seismos	Onshore	1987-18-05 1987-15-06	Southern Jutland Tønder	52.5 km
NH87B	Norsk Hydro Digicon	Offshore	1987-04-07 1987-19-06	The Baltic Sea Bornholm	1188.1 km
AG87C	Agip Prakla Seismos	Offshore	1987-15-06 1987-27-06	The Central Graben	628.4 km
AG87H	Agip Prakla Seismos	Offshore	1987-03-07 1987-21-07	North Sea	978.5 km
PH87C	Phillips Prakla Seismos	Offshore	1987-27-06 1987-03-07	The Central Graben	319.9 km
ST87C	Statoil Western Geophysical	Offshore	1987-10-11 1987-22-11	The Central Graben	283.5 km
Other					
NH87C Speculative	Norsk Hydro (Norway) Geco	Offshore 3D	1987-06-07 1987-24-09	The Central Graben Gert	1884.5 km
ST87I Exclusive	DANOP Prakla Seismos	Onshore	1987-05-10 1987-25-11	Sealand Stenlille	89.8 km

Appendix D

Danish Oil Production 1972-1987, million m³

Year	Dan	Gorm	Skjold	Tyra	Rolf	Total
1972	0,11					0,11
1973	0,15					0,15
1974	0,10					0,10
1975	0,19					0,19
1976	0,23					0,23
1977	0,58					0,58
1978	0,49					0,49
1979	0,49					0,49
1980	0,34					0,34
1981	0,34	0,53				0,88
1982	0,31	1,64	0,02			1,97
1983	0,28	1,84	0,40			2,52
1984	0,36	1,63	0,65	0,07		2,71
1985	0,45	1,80	0,85	0,35		3,46
1986	0,47	1,72	1,07	0,57	0,47	4,29
1987	1,23	1,50	1,21	0,84	0,63	5,41
Total	6,13	10,66	4,21	1,83	1,10	23,93

Danish Gas Production 1972-1987, billion Nm³

Year	Dan	Gorm	Skjold	Tyra	Rolf	Sales gas
1972	0,02					
1973	0,03					
1974	0,03					
1975	0,06					
1976	0,07					
1977	0,17					
1978	0,16					
1979	0,16					
1980	0,07					
1981	0,08	0,08				
1982	0,08	0,27				
1983	0,08	0,43	0,04			
1984	0,13	0,51	0,06	0,26		0,22
1985	0,21	0,65	0,08	1,12		1,04
1986	0,24	0,78	0,10	1,63	0,02	1,80
1987	0,44	0,88	0,10	2,65	0,03	2,30
Total	2,04	3,60	0,38	5,66	0,05	5,36

Part of the gas has been reinjected.

Danish Production of Liquid Hydrocarbons 1987, thousand m³

	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	1987
Dan	41	36	29	53	146	135	145	132	135	129	128	124	1232
Gorm	124	126	134	131	134	126	128	117	114	128	111	125	1499
Skjold	101	92	102	104	107	105	106	101	104	76	104	109	1212
Tyra	82	71	77	72	60	57	64	63	64	72	76	86	842
Rolf	80	44	53	48	50	47	56	60	54	53	45	45	634
Total	429	370	394	407	497	470	498	473	470	457	464	489	5419

Danish Production of Gas 1987, million Nm³

	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	1987
Dan	19	17	14	12	43	43	48	46	46	48	49	50	436
Gorm	64	68	76	71	74	73	76	73	73	84	72	80	884
Skjold	9	8	9	8	9	9	9	8	8	6	8	9	100
Tyra	262	225	244	225	154	139	187	187	204	233	267	326	2653
Rolf	4	2	2	2	2	2	2	3	2	2	2	2	27
Total	358	320	345	318	282	265	322	317	334	374	398	467	4100

Appendix E

Field Name: Dan
Former Name: Abby
Location: Block 5505/17
Concessionaire: A.P. Møller
Operator: Mærsk Oil and Gas
Discovered in Year: 1971
In Operation: 1972

Number of Producing Wells: 44
Water Depth: 40 m
Area: 30 km²
Reservoir Depth: 1,850 m
Reservoir Rock: Chalk
(Danian and Maastrichtian)

Resources per January 1988

Ultimate Recovery:
(Developed, Decided and Planned)
Oil: 44 million m³
Gas: 13 billion Nm³

Accumulated Production:
Oil: 6,1 million m³
Gas: 2,0 billion Nm³

Geological Outline:

The structure is an anticline of the layers. A major fault divides the field into two separate reservoirs which are penetrated by a number of minor faults. The chalk has a fair porosity, but a very low permeability.

Installations:

The Dan field has been developed with five well-head platforms A, D, E, FA and FB, two processing/accommodation platforms B and FC, and a gas flare jacket C.

Field Name: Gorm
Former Name: Vern
Location: Block 5504/15, 16
Concessionaire: A.P. Møller
Operator: Mærsk Oil and Gas
Discovered in Year: 1971
In Operation: 1981

Number of Producing Wells: 16
Number of Injection Wells: 2
Water Depth: 39 m
Area: 12 km²
Reservoir Depth: 2,200 m
Reservoir Rock: Chalk
(Danian and Maastrichtian)

Resources per January 1988

Ultimate Recovery:
(Developed, Decided and Planned)
Oil: 27 million m³
Gas: 6 billion Nm³

Accumulated Production:
Oil: 10.7 million m³
Gas: 3.6 billion Nm³
Gas Injection: 3.5 billion Nm³
Net Gas Production: 0.1 billion Nm³

Geological Outline:

The structure is an anticline of the layers. A major fault divides the field into two separate reservoirs. The chalk layers are hereby displaced by approximately 75 m.

Installations:

The Gorm field has been developed with two well-head platforms A and B, a processing/accommodation platform C, a gas flare jacket D, and a riser/booster platform E.

Field Name: Skjold
Former Name: Ruth
Location: Block 5504/16
Concessionaire: A.P. Møller
Operator: Mærsk Oil and Gas
Discovered in Year: 1977
In Operation: 1982

Number of Producing Wells: 1
Number of Water Injection Wells: 1
Water Depth: 40 m
Area: 10 km²
Reservoir Depth: 1,600 m
Reservoir Rock: Chalk
 (Danian and Maastrichtian)

Resources per January 1988

Ultimate Recovery:
 (Developed, Decided and Planned)
Oil: 29 million m³
Gas: 3 billion Nm³

Accumulated Production:
Oil: 4.2 million m³
Gas: 0.4 billion Nm³

Geological Outline:

The structure is an anticline of the layers. The structure is penetrated by a series of rim faults at the flanks, while innumerable and more randomly orientated minor faults penetrate the top. At the crest of the structure the reservoir has shown remarkably good production characteristics.

Installations:

The Skjold field is developed as a satellite to Gorm. The installation comprises one unmanned well head platform and a two phase flow line to Gorm.

Field Name: Tyra
Former Name: Cora
Location: Block 5504/11, 12
Concessionaire: A.P. Møller
Operator: Mærsk Oil and Gas
Discovered in Year: 1968
In Operation: 1984

Number of Producing Wells: 28
Number of Injection Wells: 8
Water Depth: Tyra East 37 m,
 Tyra West 40 m
Area: 52 km²
Reservoir Depth: 2,000 m
Reservoir Rock: Chalk
 (Danian and Maastrichtian)

Resources per January 1988

Ultimate Recovery:
 (Developed, Decided and Planned)
Oil and Condensate: 12 million m³
Gas: 45 billion Nm³

Accumulated Production:
Oil and Condensate: 1.83 million m³
Gas: 5.66 billion Nm³
Gas Injection: 0.63 billion Nm³
Net Gas Production: 5.03 billion Nm³

Geological Outline:

The structure is a flat anticline of the layers. A marked hardground with low permeability separates the chalk layers of Danian and Maastrichtian age.

Installations:

The Tyra field has been developed with two platform complexes, Tyra West and Tyra East. Tyra West comprises two wellhead platforms TWB and TWC, a processing/accommodation platform TWA, and a flare gas jacket TWD. Tyra East comprises two wellhead platforms TEB and TEC, a processing/accommodation platform TEA, a gas flare jacket TED, and a riser platform TEE.

Appendix E

Field Name: Rolf
Former Name: Middle Rosa
Location: Block 5504/14, 15
Concessionaire: A.P. Møller
Operator: Mærsk Oil and Gas
Discovered in Year: 1981
In Operation: 1986

Number of Producing Wells: 1
Water Depth: 34 m
Reservoir Depth: 1,800 m
Reservoir Rock: Chalk
(Danian and Maastrichtian)

Resources per January, 1988

Ultimate Recovery:
(Developed, Decided and Planned)
Oil: 2 million m³
Gas: 1 billion Nm³

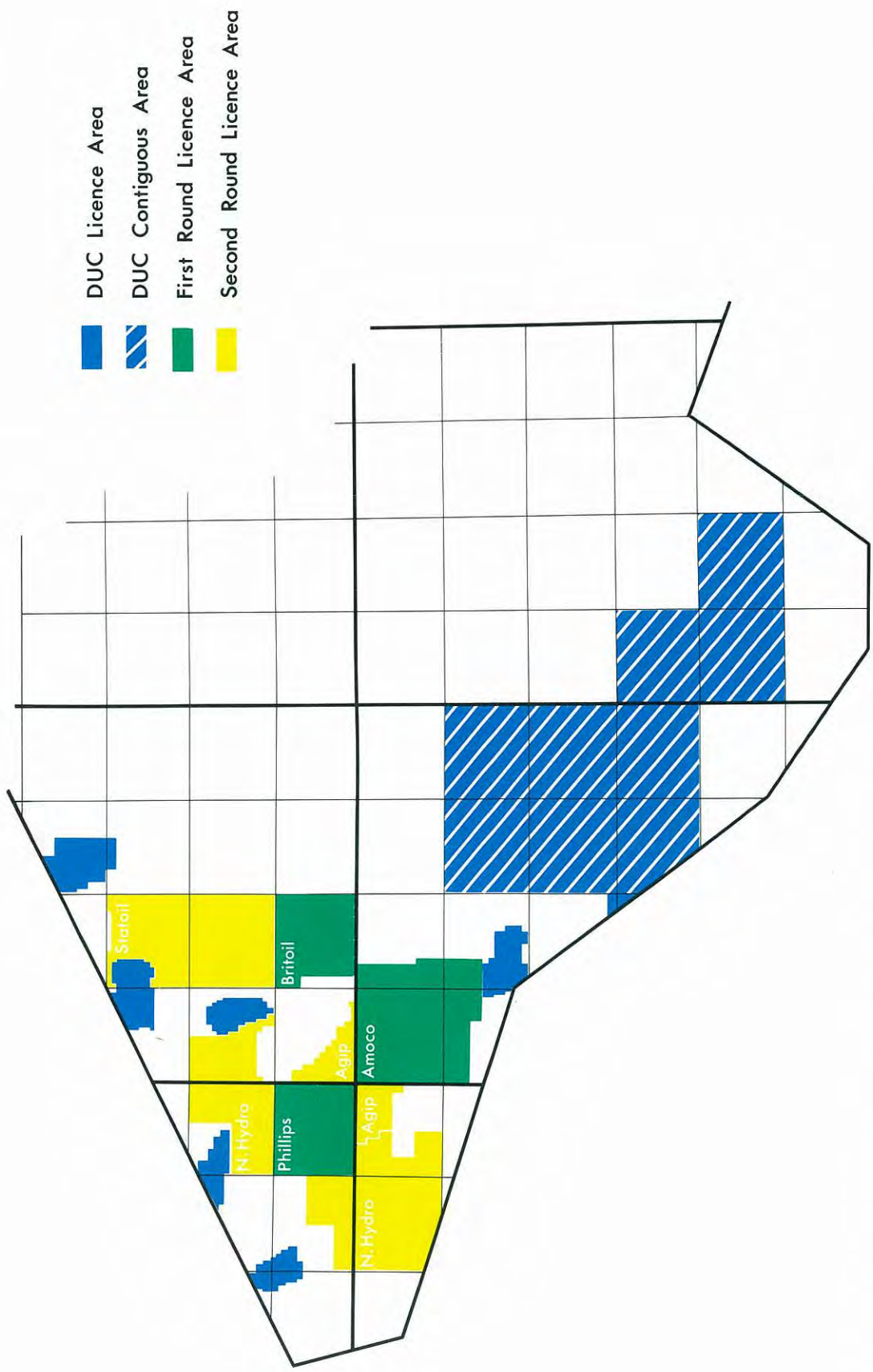
Accumulated Production:
Oil: 1.1 million m³
Gas: 0.05 billion Nm³

Geological Outline:

The structure is an anticline of the layers. The reservoir rock is, like the Skjold field, highly fractured and shows remarkably good production characteristics.

Installations:

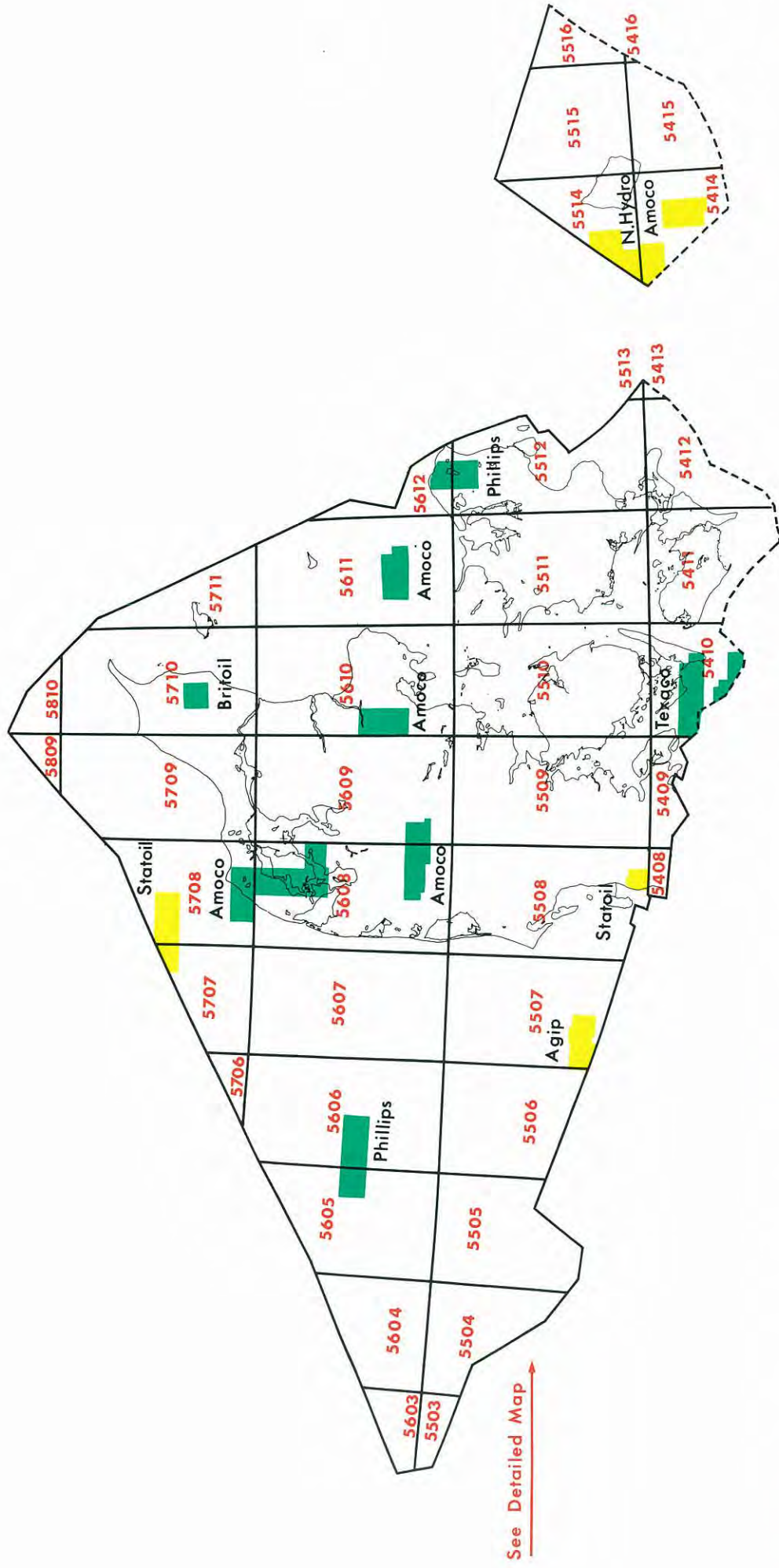
The Rolf field is developed as a satellite to Gorm. The installations comprise one unmanned well-head platform and a two phase flow line to Gorm.



Danish Licences in the Western Offshore Area



The Danish Licence Area January, 1 1988



■ First Round Licence Area
 ■ Second Round Licence Area





MINISTRY OF ENERGY

Danish Energy Agency

11 Landemærket · DK-1119 Copenhagen K · Phone +45 1 92 67 00
Tele +22 450 6696 · Telex +45 1 11 47 43