Oil and Gas in Denmark

Exploration and Production

1989

MINISTRY OF ENERGY

Danish Energy Agency

The Danish Energy Agency is an institution under the Ministry of Energy. Other institutions are Risø Research Centre and the Mineral Resources Administration (Greenland). The Ministry further represents public interests in Dansk Olie og Naturgas A/S (D.O.N.G.).

The Agency was established by law in 1976. The Agency assists the Minister of Energy and other government authorities in energy matters. It is the responsibility of the Agency to follow and evaluate the Danish and international progress in the field of energy production, supply, and research.

The Agency in its executive capacity administrates energy legislation for power and heating supply, alternative energy, and production of oil and natural gas.

The Agency works closely with local, regional and departemental authorities, with energy distribution companies, license holders and consumers. The Danish Energy Agency also participates in international energy co-operation.

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Foreword

The report Oil and Gas in Denmark 1989 provides a review of hydrocarbon exploration and production activities. It is prepared by the Danish Energy Agency, and the English version is now published for the third time.

Included are the latest five year and twenty year production forecasts for oil and gas as well as the Reserves Assessment of Danish hydrocarbons per January 1st, 1990.

In addition to this, the perspectives are illustrated for further hydrocarbon recovery from the Danish fields, which for geological reasons are very difficult to exploit.

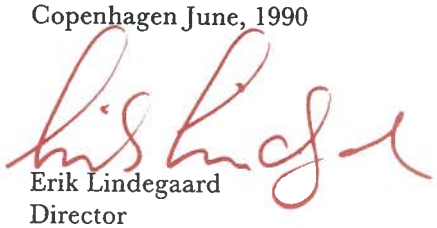
Exploration activities during 1989 have been influenced by the negotiations following the 3rd Danish Licensing Round, which resulted in allocation of 12 exploration licences.

The Agreement in Principle on increased gas deliveries was signed in early 1989 between the Danish Underground Consortium and Dansk Naturgas A/S. Among other things the Agreement provides the basis for exploitation of the gas fields Harald and Roar.

Development activities of the oil fields Dagmar, Kraka and Valdemar were progressing during 1989, with drilling of several production wells. The producing fields are characterized by a high level of activity as well. At Dan drilling of a number of horizontal wells has been continued, at Gorm a water injection project has been implemented, and at Tyra a horizontal gas well has been completed. At Skjold an extension of the water injection project is under implementation.

Oil and gas production have increased compared to last year. The rate of self-sufficiency of hydrocarbons now constitutes 82%, or 49% in relation to the total energy consumption. In 1973, the year of the first oil crisis, the rate of self-sufficiency was a mere 2%. Within the coming years, the Danish hydrocarbon production and the rate of self-sufficiency as such is expected to increase.

Copenhagen June, 1990



Erik Lindegaard
Director

Conversion Factors

Conversion Factors

1 m^3 Crude Oil = 0.85 ton ≃ 35.9 GJ

1 m^3 Motor Gasoline = 0.71 tons ≃ 43.8 GJ

1 m^3 Middle Distillate = 0.84 tons ≃ 42.7 GJ

1 m^3 Heavy Fuel Oil = 0.98 tons ≃ 40.4 GJ

1 Barrel = 0.159 m^3

1.000 Nm^3 Natural Gas = 37.239 scf ≃ 39.0 GJ

1.000 Sm^3 Natural Gas ≃ 1 t.o.e. (ton oil equivalent)

1 Nm^3 = 1.055 Sm^3

1 ton Steam Coal ≃ 25.2 GJ

Nm^3 (Normal cubic metre) at 0°C, 101.325 kPa

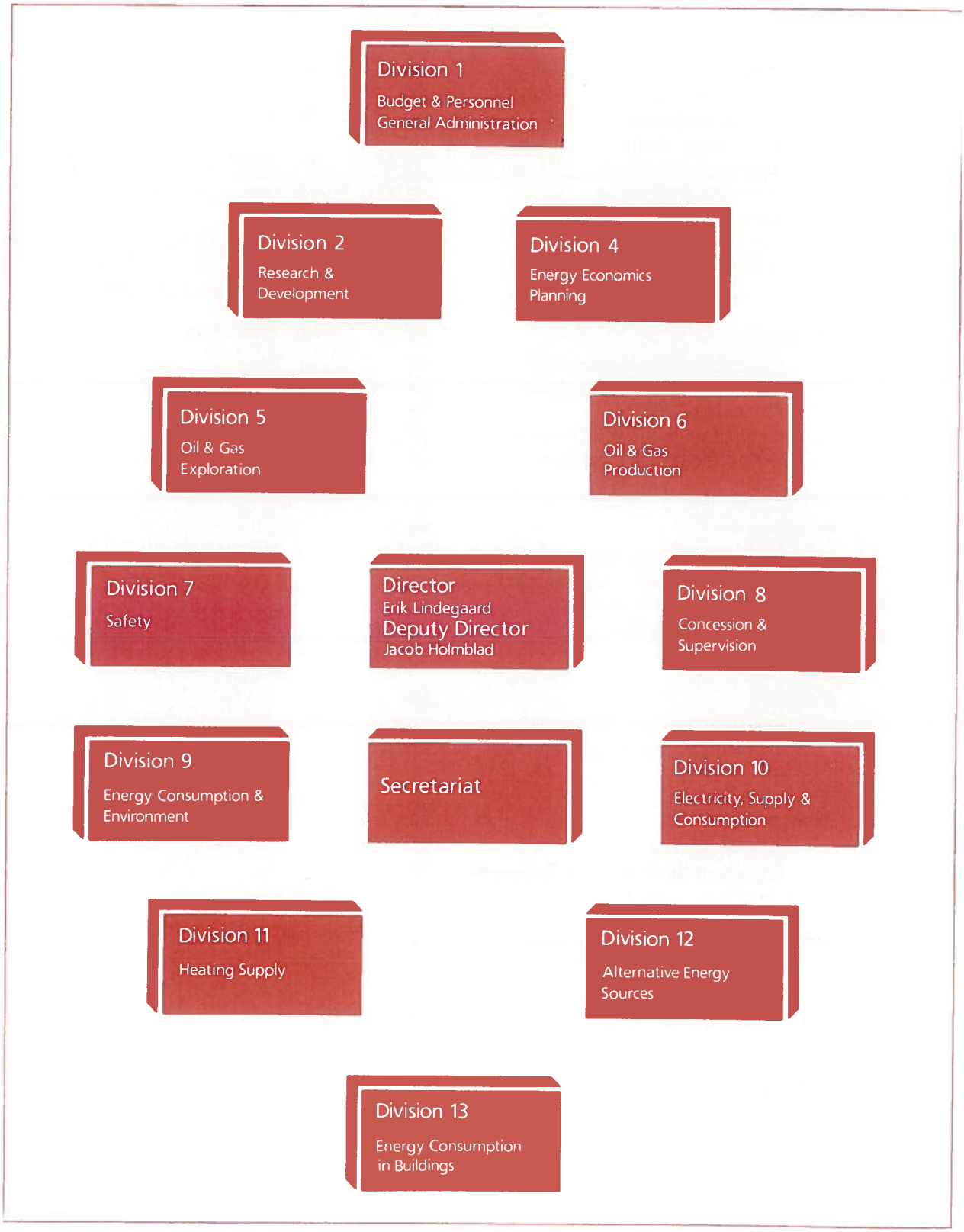
Sm^3 (Standard cubic metre) at 15°C, 101.325 kPa

SCF (Standard cubic metre), at 15.6°C, 101.56 kPa

Contents

Organisation

Fig. 1.1 Organisation of the Danish Energy Agency



The Energy Agency was the subject of reorganisation during early 1989 resulting in changes in the allocation of fields of responsibility between the Ministry of Energy and the Energy Agency.

Hence a number of tasks previously administered by the Ministry was transferred to the Agency, i.e. including the administration and coordination of research and development projects and the entire technical administration with regard to oil and gas field development. Furthermore the Agency assumed full responsibilities with regard to heat production planning and tasks dealing with professional and export promotion, energy saving and environmental issues, including the pursuance of the Brundtland Report.

The changed allocation of responsibilities was issued by the Ministry of Energy in the announcement No. 420 of June 15th, 1989.

In line with the continued efforts of rationalisation and cost saving the previous 3rd Division was discontinued and its work tasks transferred to the 2nd and 13th Divisions respectively.

The current organisation of the Energy Agency comprises 12 divisions whereof 6 Divisions are engaged in the exploration and production of oil and gas, i.e. the 2nd and the 4th-8th Divisions respectively.

The allocation of areas of responsibility of these six Divisions is summarised as follows:

The 2nd Division Research and Development

Planning and administration of projects under the Energy Research Programme and the financial support programmes for the development of energy technologies; acts as secretariate to the *Hydrocarbon Committee* and the *Advisory Energy Research Board;* participates in a number of international activities in this context.

The 4th Division Energy Economics and Planning

Advises on general economic conditions, hereinunder provision of economic valuations and basis for economic calculations and predictions, investment rates and profiles, prognoses and forecast analyses. Assumes responsibility for economic and administrative assignments in conjunction with the exploration and production of oil and gas in Denmark.

The 5th Division Exploration

Exploratory surveys, drilling supervision, drilling programmes and approvals and pursuance of drilling results and activities; licence awards, including recommending licensing strategy; participation and advisory functions in conjunction with licence negotiations.

The 6th Division Production

Hydrocarbon resources, reservoir engineering and geological assessments in conjunction with evaluations of commercial viability and developments plans; supervision of the current oil and gas production; reviews and updates field reserves, production and production forecasts.

The 7th Division Safety and Working Environment

Supervision of working environment issues with regard to permanent and mobile offshore installations; approves manpower and organisations plans; approves maritime construction and installation, including operation and maintenance of steel structures and equipment; approves the operation and installation of new processing facilities.

The 8th Division Legal and Supervision

Legal and administrative assignments, including legislation and guidelines, licence commitments, the utilisation and tariffs pertaining to the oil pipeline and the settlements of royalty and fees; acts in the function as secretariate to the *Coordination, Action* and *Emergency Committees* respectively.

The exploratory activities was marginally improved in 1989 as compared to the ten year low in 1988.

The closing of the Danish 3rd Round took place in December, 1989. Twelve new exploration licences were awarded by the Minister of Energy.

Rights for the exploration and production of hydrocarbons in Denmark are granted by the Minister of Energy in pursuance of the *Danish Subsoil Act of 1981*. Licence rights adhere to specific geographically defined areas and may be awarded for the combined activity spanning from reconnaissance to production or for isolated, closely specified exploratory programmes.

A review of the Licence Groups which retained rights for exploration and production in Denmark at the end of 1989 is included in Appendix A. A concession map highlighting the location of the pertaining licence areas is enclosed with this report (Appendix F).

Seismic Surveys

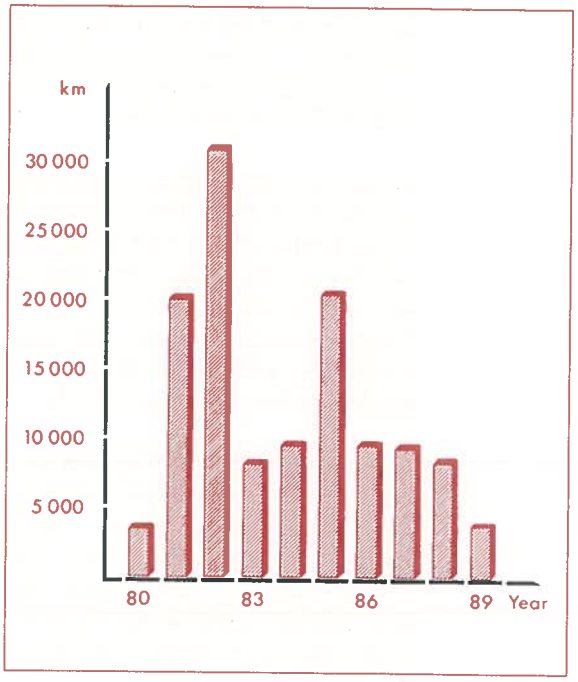
A total of 3,188 km of marine seismic data was collected in Denmark during 1989. With the exception of 390 km of nonexclusive data the remaining acquisition was conducted on an exclusive basis in conjunction with ongoing exploration and production. Two 3D surveys and a limited scientific programme in the Kattegat area were included in this activity.

The combined seismic activity declined in 1989 as compared to 1988. Part of the reason for this decline is related to the completion already in 1988 of the work programmes under the 2rd Round. The seismic work under the 3rd Round awards can only be initiated during 1990, i.e. comprising 2,260 km of 2D data and 3D acquisition covering 197 km^2.

The seismic acquisition during 1989 was conducted without interference with other activities.

Appendix C summarises the seismic surveying during 1989.

Fig. 2.1 Annual Seismic Survey Activities 1980-1989



The Gas Storage Project

The technical investigations with regard to the feasibility of the natural gas storage project at Stenlille were continued during 1989. Work activities included studies on the sealing capacity of the formation overlying the sand reservoir storage. Furthermore the injectivity and productivity characteristics of the sand reservoir were evaluated. In conjunction with this work 15 million cubic metres of nitrogen and natural gas were injected into the reservoir during 1989.
Following the performance of a production test the technical investigations will be completed in April, 1990. Further work is contingent on the decision whether to implement this gas storage facility.

Drilling Activities

Four exploratory wells were terminated during 1989. Towards the end of the year Mærsk Olie og Gas A/S spudded a delineation well at Gert, i.e. well Gert-4. In accordance with the drilling programme Gert-4 will be suspended with a view to later tie-in and production.

Totally 14 production wells were drilled and completed during 1989, i.e. ten wells in the areas of producing fields and four wells in areas of current development. Of these 14 wells eight were horizontal wells, i.e. three at Dan, one at Tyra and two at Kraka and Valdemar respectively. The production drilling is further highlighted under the section Production.

Seven jack-up drilling rigs were utilised in conjunction with the above drilling activity, i.e. Mærsk Endeavour, Mærsk Guardian, Glomar Baltic, Glomar Moray Firth, Neddrill Trigon, Shelf Driller and West Sigma. The total drilling time corresponded to 42 string months. Danish exploratory and appraisal wells are compilated in Appendix B.

Fig. 2.2 Exploration and Appraisal Wells 1980-1989

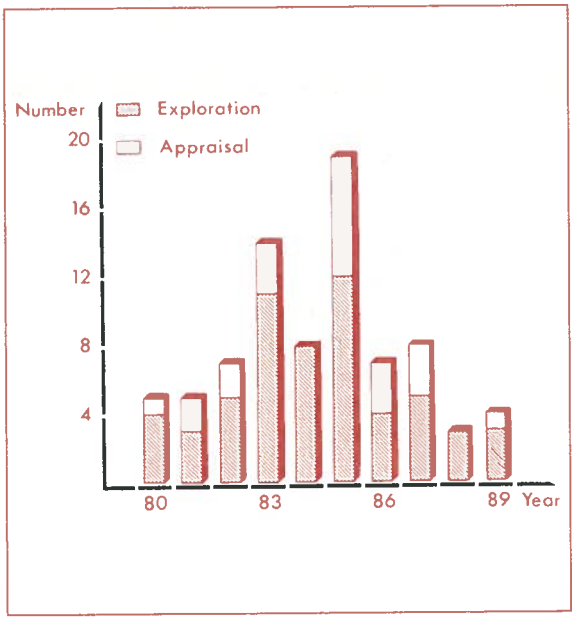
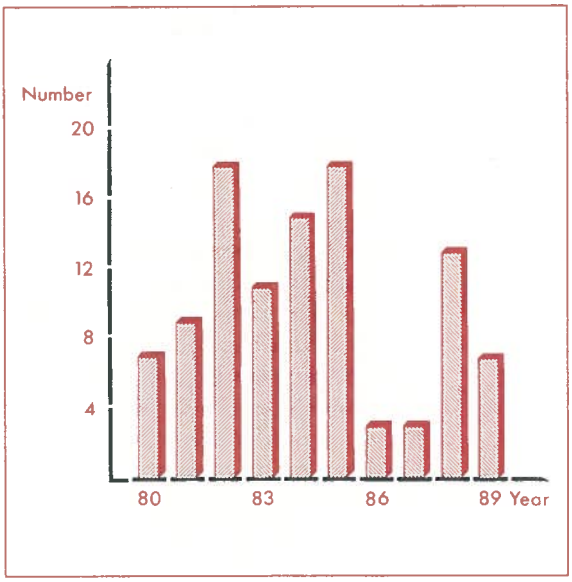


Fig. 2.3 Production Wells 1980-1989



Exploratory Wells

The following exploratory wells were terminated in 1989.

Stina-1 5414/07-1

Well Stina-1 was drilled between June-July, 1989 by Amoco, Denmark south of the island of Bornholm within the licence area awarded to the Amoco Group under the 2nd Round. Total depth was reached at 2,842 m in the Lower Paleozoic. The well was subsequently plugged and abandoned.

Pernille-1 5514/30-1

Well Pernille-1 was drilled by Norsk Hydro west of the island of Bornholm between April-June, 1989 under the work commitments of the 2nd Round. The well reached total depth at 3,588 m in Lower Paleozoic strata and was subsequently plugged and abandoned. Well Pernille-1 was the first exploratory well drilled in the Danish part of the Bornholm area.

Falk-1 5504/06-3

Well Falk-1 was drilled between July-September, 1989 by Amoco, Denmark in the Central Graben licence area awarded to the Amoco Group under the 1st Round. Total depth was reached in the Triassic at 4,200 m. Presence of hydrocarbons was detected while drilling, however the well was plugged and abandoned without testing.

Tordenskjold-1 5503/03-2

Well Tordenskjold-1 was drilled by the Dansk Operatørselskab I/S on behalf of the Norsk Hydro Group between December, 1988 and February, 1989. The well was drilled under the work commitment of the 2nd Round. Total depth was reached at 3,703 m in the Rotliegend. The well was plugged and abandoned without previously conducted testing. Oil shows were reported while drilling.

Appraisal Activities

The current appraisal activity comprises the evaluation of the Ravn discovery, made by the Amoco Group under the 1st Round.

Fig. 2.4 Wells in 1989

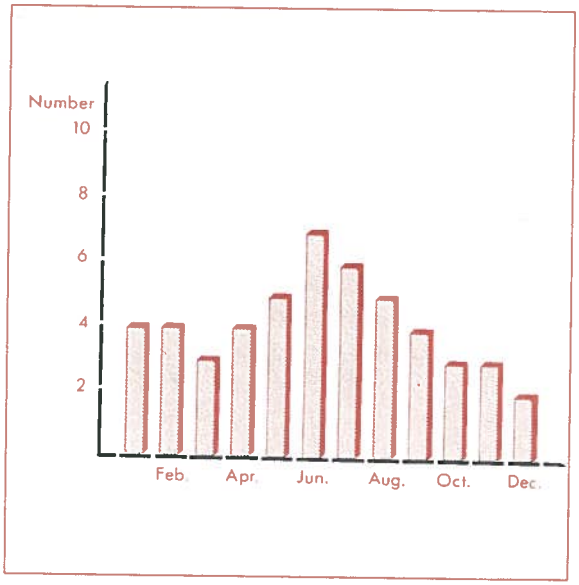
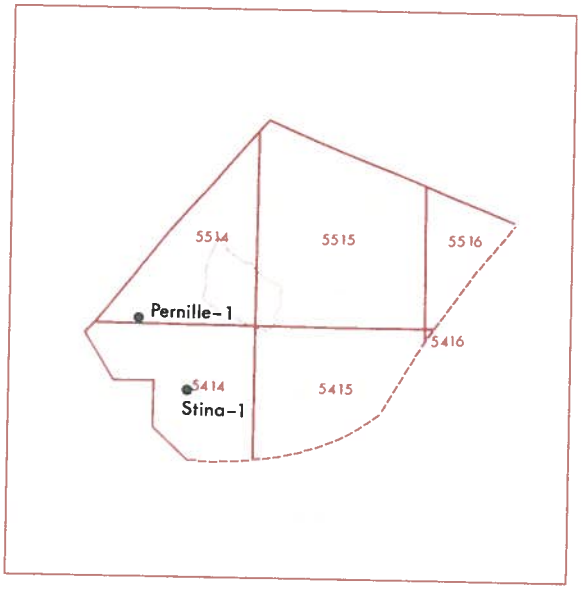


Fig. 2.5 Exploratory Wells 1989, Bornholm Area



Ravn 5504/01, 02, 05 and 06

The Ravn discovery was made in 1986 by the Amoco Group under the Danish 1st Round Licence Awards. Well Ravn-1 encountered oil bearing Jurassic sand; a production test confirmed the presence of producible oil at Ravn. The appraisal well Ravn-2 was subsequently drilled in 1987 and confirmed the existence of hydrocarbons. Well Ravn-2 was however plugged and abandoned without a previously conducted flow test.

The Ravn discovery is still under evaluation. An application for a two year extension of the appraisal period was forewarded by the Amoco group in 1989 and subsequently granted by the Minister of Energy in 1990.

Boundary Delineation

An agreement between Denmark and East Germany was reached in 1988 with regard to boundary settlements between the two countries within the southern and eastern Baltic Sea respecttively. The agreement was ratified by East Germany in 1988 and by Denmark in 1989.

The ratified boundaries are located in the waters south and southeast of the islands of Lolland, Falster and Møn (the western area) and in the waters southwest of Bornholm (the eastern area). In the western area the new boundary coincides with the median line between the two countries; in the eastern area (Bornholm) the boundary deviates from the median line due to a dispute with regard to the Adler Bank area.

Here the boundary extends in a notch like feature towards Bornholm, hence providing East Germany with a portion of the Adler Bank. This area gained by East Germany was compensated for by displacing the remaining boundary to the southwest of the median line.

Relinquishments

Part of the licence acreage awarded under the 1st and 2nd Rounds (1984 and 1986) respectively was relinquished in 1989.

The Amoco Group relinquished their licence acreage located in North and Central Jutland respectively, i.e. comprising the blocks and part of blocks 5708/30 and 31, 5608/03, 07, 11, 12, 27 and 28, 5609/25 and 5610/17 and 21.

Fig. 2.6 Exploratory Wells and Relinquished Area in the Central Graben 1989

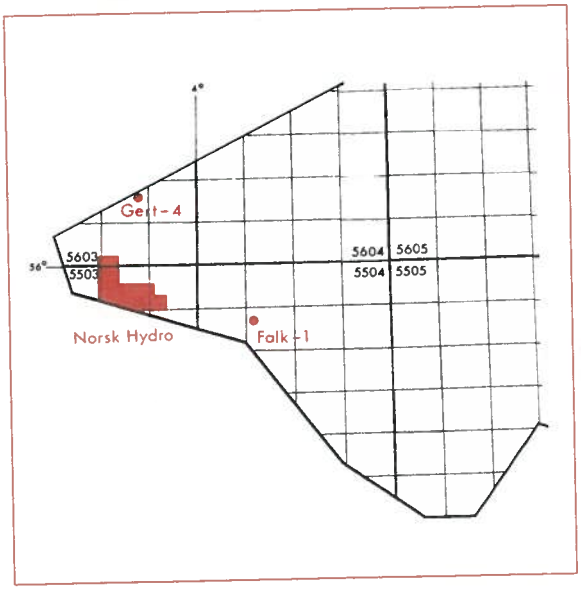
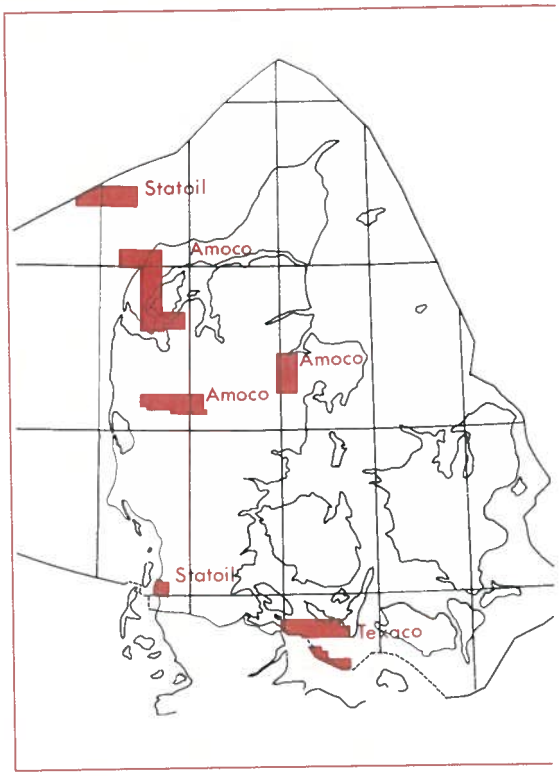


Fig. 2.7 Relinquished Acreage 1989 outside the Central Graben



The Norsk Hydro Group relinquished part of th licence acreage located in the northwestern p of the Central Graben area, i.e. comprising p of blocks 5503/03 and 04 and 5603/31.

The Statoil Group relinquished their licence ac age located in Skagerrak and in South Jutla respectively, i.e. comprising the blocks and p of blocks 5508/31 and 32, 5707/20 and 5708 and 18.

The Texaco Group relinquished their entire lice area located in the southern part of the Ba Sea, i.e. comprising the blocks and part of blo 5410/05, 06, 07, 10, 14 and 15.

The Danish 3rd Round

On the 20th of December, 1989 the Minister of Energy awarded 12 new concessions for the exploration of oil and gas in Denmark. The licence rights were granted to seven of the ten groups that forwarded licence applications to the Minister of Energy during March, 1989. The seven groups are:

The Amoco Group
The BEB Group
The Cluff Group
The Norsk Hydro Group
The Jordan Group
The Mærsk Group
The RWE-DEA Group

The conditions and commitments pertaining to the individual awards are the results of negotiations between the Minister of Energy and the applicants. The Energy Agency provided geological, technical and economic expertise and advice in conjunction with the negotiations.

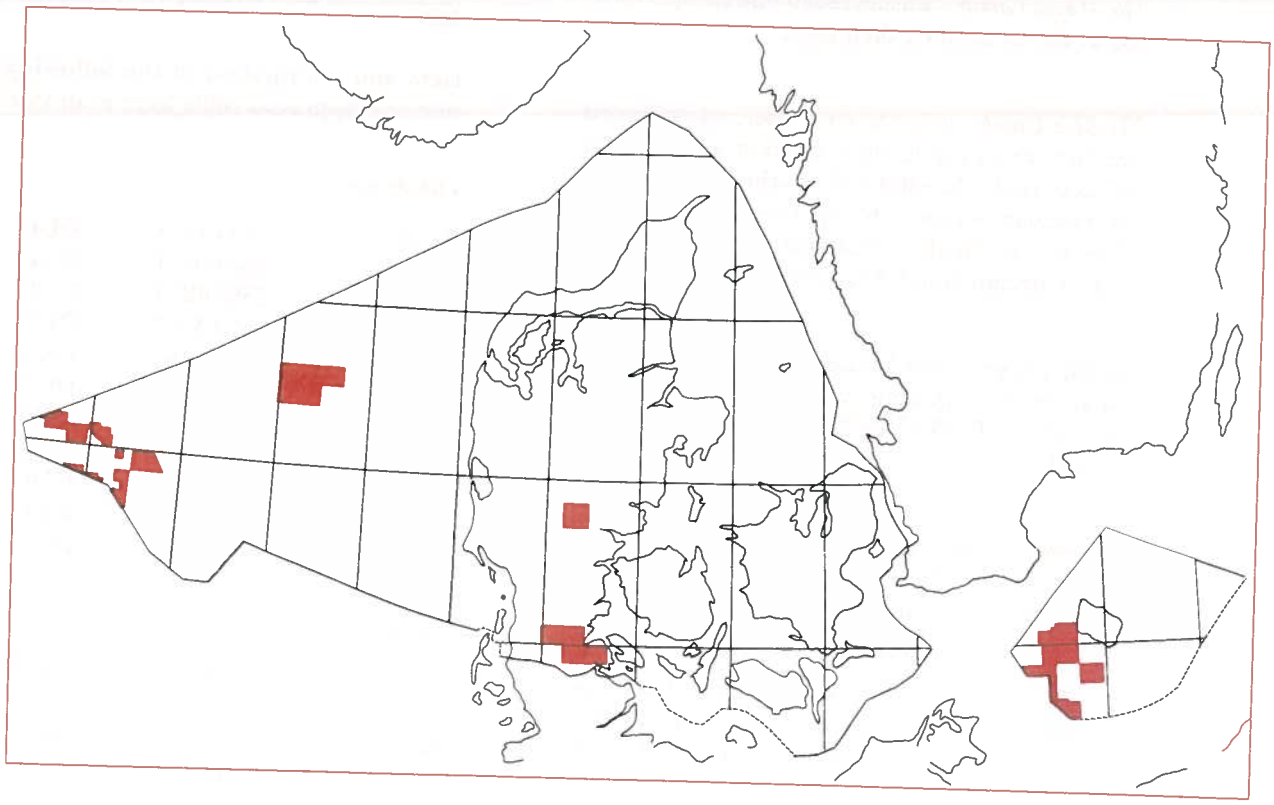
Revised Licence Conditions

Since the Danish 2nd Round in 1986 a number of countries including the North Sea States revised their concession legislation. Hence in order to stimulate continued exploratory activity in Denmark the economic conditions under the licensing were relaxed in conjunction with the Danish 3rd Round.

Important economic relaxations comprise:

* Exemption of royalty payments.
* Reduced state participation.
* Exemption of the profit element in the pipeline tariff outside the Central Graben area (previously five per cent of transportation).
* Dansk Olie og Gas Produktion A/S fully or partly participates on a shared interest basis in concessions operated by Dansk Operatørselskab I/S.

Fig. 2.8 3rd Round, Licence Distribution



Exploration

Licence Distribution

The 12 licence awards under the 3rd Round comprise 38 blocks of the 743 blocks offered.
The composition of 3rd Round licence groups are summarised in Appendix A, the locations of the various licence areas are shown in the enclosed concession map.

The Amoco Group – previous licence holder under both the 1st and 2nd Round, was awarded four new concessions, i.e. two located in the Central Graben area, one located offshore Bornholm and one located along the northern flank of the Ringkøbing-Fyn High in the North Sea. The latter licence area comprises acreage relinquished by the Phillips Group in 1988.

The Norsk Hydro Group – previous licence holder under the 2nd Round, was awarded two concessions within the Central Graben area, i.e. comprising block 5603/32, relinquished by the Phillips Group in 1988 and the previously announced hydrocarbon discoveries at Gwen, Arne and Nora; relinquished by A.P. Møller in 1987.

The Mærsk Group – was awarded one licence located in the Central Graben area.

The BEB Group – new licence holder, was awarded one licence in the Central Graben area located adjacent to the A/6-B/4 hydrocarbon discovery in the German sector. The operator, i.e. Brigitta-Elwerath Gmbh also maintains the operatorship of the German North Sea Consortium.

The Cluff Group – new licence holder, was awarded one licence comprising four blocks located along the southern flank of the Ringkøbing-Fyn High in South Jutland.

The Jordan Group – new licence holder, was awarded one licence located on the northern flank of the Ringkøbing-Fyn High in Central Jutland.

The RWE-DEA Group – new licence holder, was awarded two licences, i.e. one in the Central Graben and one located south of the island of Bornholm.

Work Programmes

The collective work programme under the 3rd Round awards comprises 6 well commitments and 11 contingent wells. For comparison the 2nd Round awards included 8 well commitments and 5 contingent wells. In addition the licence groups have been committed to conduct required seismic work, including a number of 3D surveys.

Exploratory Goals

The distribution of the Danish 3rd Round licence areas is considered beneficial in terms of geological spread. Hence both the northern and southern flanks of the Ringkøbing-Fyn High as well as the Bornholm area become the subject of continued exploration in addition to the Central Graben area.

Released Well Data

Generally, data and information retrieved under the Subsoil Act are protected by a five year confidentiality clause.
However, well data retrieved within relinquished acreage under the 1st and 2nd Round awards are released two years after the well termination date.

Data and information of the following exploration and appraisal wells were realeased in 1989.

Offshore:

Adda-3	5504/08-3	DUC
Cleo-1	5604/18-1	DUC
Elly-1	5504/06-1	DUC
Gert-1	5603/27-2	DUC
Ibenholt-1	5605/20-1	Phillips
Kraka A-3	5505/17-8	DUC
Liva-1	5503/04-1	DUC
Nils-2	5505/17-9	DUC
Nora-1	5504/02-2	DUC
West Lulu-1	5604/21-3	DUC
East Rosa-2	5504/15-4	DUC

Onshore:

Mejrup-1	5608/19-1	Phillips

Information with regard to the released well data is provided by the Danish Geological Survey.

Danish oil and gas production is maintained from five fields located within the southern part of the Central Graben area in the North Sea. Oil production mainly takes place at the Dan, Gorm, Skjold and Rolf fields, whereas gas production takes place at the Tyra field. In addition to the gas and condensate recovered at Tyra black oil is produced from a thin oil rim underlying the free gas accumulation. The entire production is owned and operated by the A. P. Møller Concessionaires in cooperation with their partners (Shell and Texaco) of the Danish Underground Consortium (DUC).

Oil and Gas Production, 1989

The total oil and gas production during 1989 amounted to 11.2 million tons oil equivalent (t.o.e.), of which 8.4 million t.o.e. were transported ashore as crude oil and natural gas.

This exceeds the 1988 production by 11 per cent. The 1989 oil and condensate production amounted to 6.5 million m^3 (5.5 million tons), exceeding the 1988 production by 16 per cent.

The total gas production for 1989 comprised 5.3 billion normal cubic metres (Nm^3), corresponding to a five per cent increase compared to 1988; sales gas constituted 2.7 billion Nm^3; 2.3 billion Nm^3 were reinjected at Gorm and Tyra; the remaining 0.3 billion Nm^3 comprised gas shrinkage.

The total domestic energy consumption for 1989 amounted to 18.9 million t.o.e., whereof 10.3 million t.o.e. comprised oil and gas. The rate of self-sufficiency in relation to hydrocarbons now corresponds to 82 per cent compared to 67 per cent in 1988.

Fig. 3.1 Annual Oil Production 1980-1989

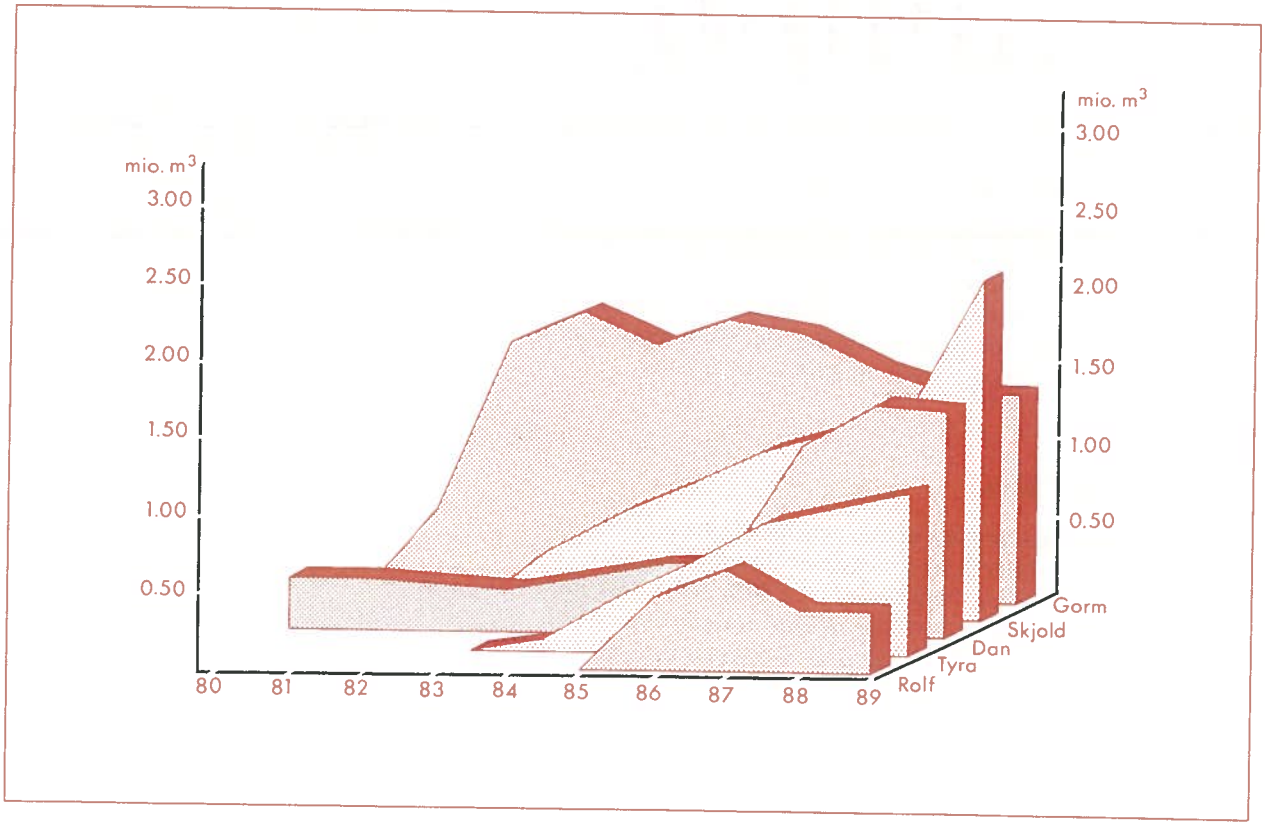
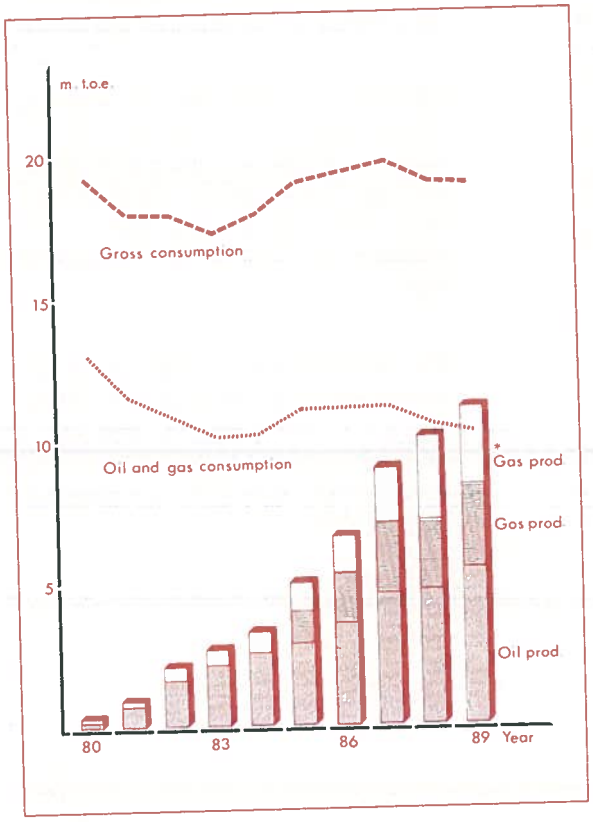


Fig. 3.2 Consumption and Production of Oil and Natural Gas 1980-1989



*) Gas shrinkage and injection gas

The annual oil and gas production from 1972 to 1989 is shown in Appendix D together with a survey of the monthly production for 1989. Further the composition of the Danish energy consumption from 1972 to 1989 is presented.

Gas Flaring

A small portion of the produced gas is flared as part of the safety measures in conjunction with operational disturbances. In 1989 total flare gas amounted to 0.11 billion Nm^3, a daily average of 0.30 million Nm^3. The daily maximum gas flaring currently permitted is 0.35 million Nm^3.

Flaring exceeding the permitted rate requires approval by the Energy Agency.

Oil and Condensate Recovery

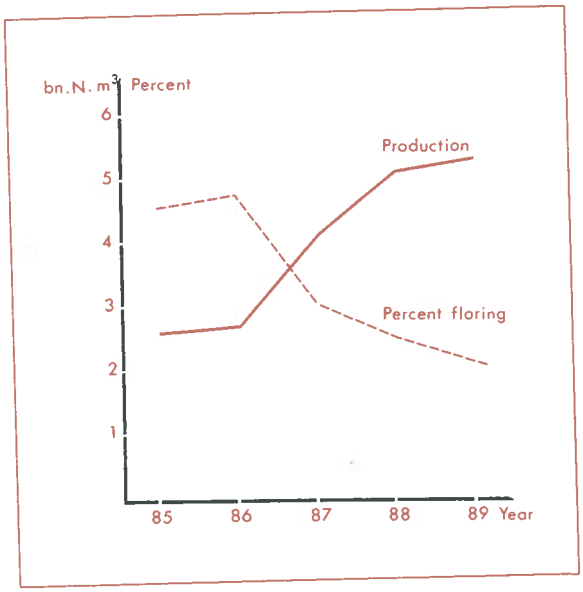
The Danish oil production was previously mainly performed through natural depletion. However, improved oil recovery through application of gas and water injection is becoming increasingly important. Hence a water injection project has been put on stream at the Gorm Field during 1989. The encouraging results of the water injection project, implemented at Skjold a couple of years ago, lead to the approval of an extension of this project by the Minister of Energy in early 1990. The water injection pilot project at Dan was continued during 1989.

Enhanced condensate recovery continues at Tyra through gas recycling.

Improved well productivity has been continued through increased application of horizontal well completions. Currently six horizontal production wells have been completed in the Dan Field. In 1989 the Minster of Energy approved a revised development plan including the drilling of another seven horizontal wells in the Dan Field during 1990 and 1991.

The development of three new oil fields was initiated in 1989, Dagmar, Kraka and Valdemar. In accordance with the approved development plans, oil production from these fields will be initiated during 1991.

Fig. 3.3 Gas Flaring 1985-1989



Extended Gas Sales

The current gas production takes place in accordance with the *Gas Sales Contract of 1979* between the Danish Underground Consortium and Dansk Naturgas A/S. However, an *Agreement in Principle* was signed in 1989 between the two parties outlining the general framework for extended gas sales. A final agreement for total gas deliveries of 93 billion Nm^3 by DUC until the year 2011 will be concluded not later than April 1st, 1990, superseding the Gas Sales Contract of 1979 and the Agreement in Principle of 1989.

Of the total 93 billion Nm^3 sales gas 63 billion Nm^3 will be delivered from Tyra, Roar, Dan and Gorm; 20 billion Nm^3 from Harald and 10 billion Nm^3 have been allocated to DUC's remaining fields.

Deliveries under the new extended Gas Sales Contract will commence already in 1990 resulting in a gradual increase in the annual sales gas plateau rate from 2.5 billion Nm^3 towards 4.4 billion Nm^3. In addition Dansk Naturgas A/S retains the option to increase the plateau rate up to 4.7 billion Nm^3 per year.

A joint revision of the gas reserves under the Gas Sales Contract will take place every three years, the first time in 1993. According to the agreement, increased gas deliveries as a result of upward adjustments of gas reserves can take place through corresponding adjustments of the plateau rate.

The Energy Agency has as of January 1st, 1990 assessed the gas reserves to an expected 140 billion Nm^3, hence indicating ample possibility for the inherent increase of gas delivery from the Danish oil and gas fields.

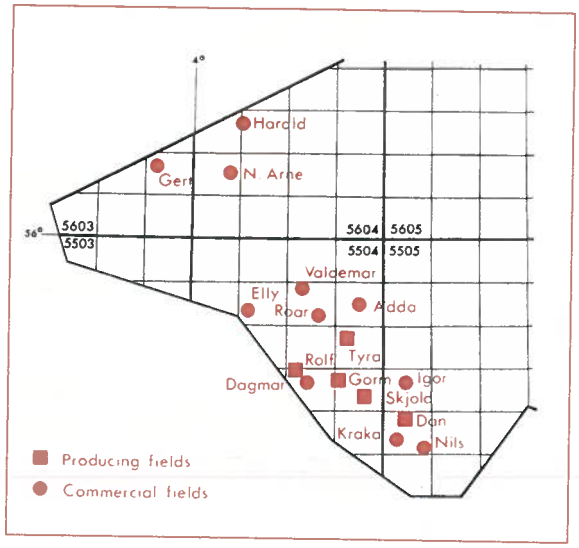
Producing Fields

Relevant data on fields in production and under development are summarized in Appendix E.

The Dan Field

Dan is a major oil field comprising a 100 metres thick oil zone with a free gas cap.

Fig. 3.4 Danish Oil and Gas Fields



The field has been subject to continuous development since 1972, when oil was first produced. By the end of 1989 the production installations comprised three six-slot wellhead platforms (A, D and E), two 12-slot wellhead platforms (FA and FB) two processing platforms (B and FC) and a gas flare stack; the produced oil is separated and processed at the FC platform and transported to Gorm (oil) and Tyra (gas) for export ashore. A total of 48 wells are in production, including one pilot water injector.

The first horizontal well was drilled and completed at Dan in 1987. The experience gained from this project provided the basis for continued development of Dan, and in 1988 the Minister of Energy approved phased development of the field based on production from further 18 horizontal wells.

Phase 1 of this development is now completed comprising the installation of five horizontal producers during 1988 and 1989.

The production experience is encouraging and confirms the previous indications of improved well productivity of 200-400 per cent for the horizontal wells compared to conventionall deviated wells. Phases 2 and 3 comprise installation of an additional wellhead platform and installation of

seven and six horizontal wells respectively. Phase 2 will be implemented in 1990-1991, whereas the work under Phase 3 is expected to be initiated during 1992.

A water injection pilot project at Dan was initiated in 1988. The purpose of the project is to establish the feasibility of full implementation of water flooding at the Dan Field.

Preliminary results of the pilot project are encouraging.

The 1989 oil production from Dan amounted to 1.47 million m^3 versus 1.50 million m^3 in 1988, while 0.71 billion Nm^3 of gas was produced.

The Gorm Field

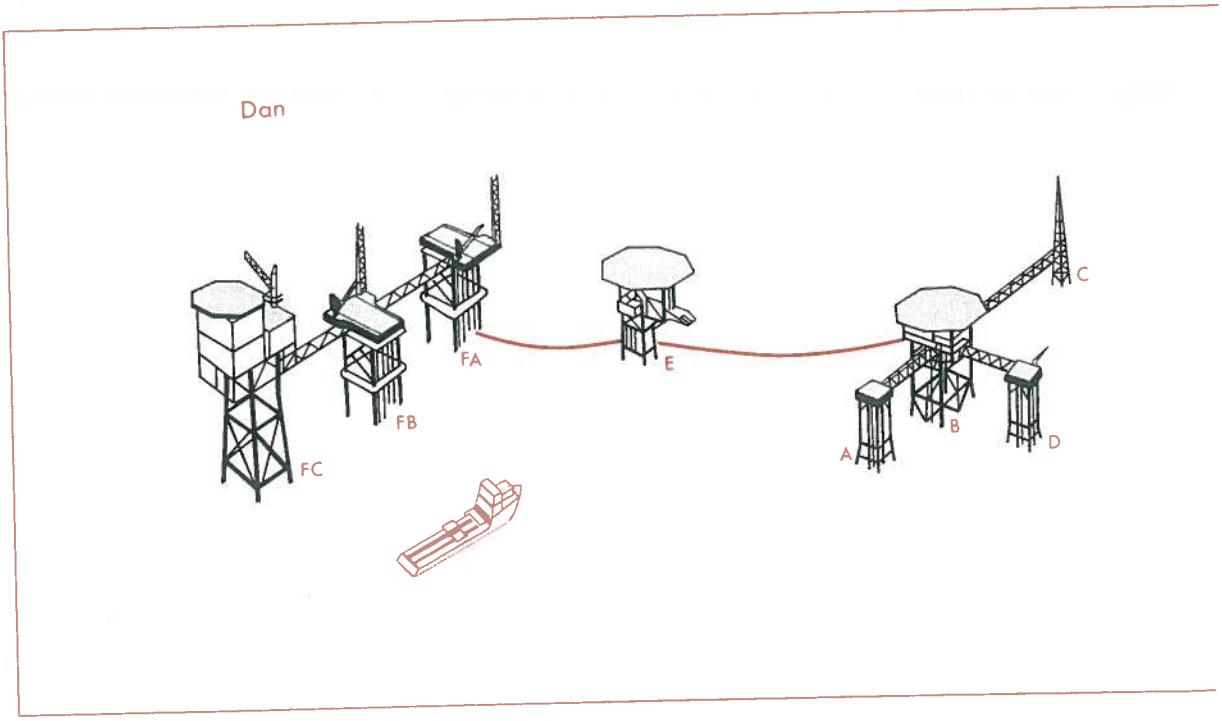
Gorm is located 27 km northwest of the Dan Field. Oil production was initiated at Gorm in 1981. The original development comprised two nine-slot wellhead platforms (A and B) attended by a processing platform (C) and a gas flare stack (D). An additional riser/booster platform (E) was installed in 1984.

In addition to the original 18 wells further two producers were put into production during 1988

A water injection pilot project in both reservoir blocks was implemented in 1989. The project comprises three injectors and three producers. Injection water is transported to Gorm via a inch flowline from a temporary water treatment plant located at Skjold. The water injection project is proceeding in accordance with plans. During 1990 an evaluation of the experience gained will be performed, aiming at an extension of the project.

Gas injection in the Western reservoir block has been continued through 1989.

Fig. 3.5 The Dan Complex



In order to meet the requirements of increased production from the fields tied in to Gorm C, i.e. Gorm, Skjold, Rolf and Dagmar, installation of a new multi-duty platform Gorm F adjacent to the Gorm complex was approved by the Minister of Energy in 1989. The Gorm F platform will accomodate sour service processing and permanent water treatment facilities, and it has been prepared for addition of 16 wells. The platform is designed for accomodation of future equipment foreseen for the handling of sour production and increasing water-cut resulting from the water injection.

Installations on Gorm F will be put into operation medio 1991.

The capacity of the oil pipeline between Gorm E and the Crude Oil Terminal at Fredericia has been increased to 23,000 m^3 per day by addition of 2 new pumping units.

In 1989 the oil production from Gorm was 1.35 million m^3, mainly unchanged from 1988, while 0.89 billion Nm^3 gas was produced. All the produced gas was reinjected.

The Skjold Field

Skjold is located 10 km southeast of Gorm. Oil production at Skjold was initiated in 1982. The development comprises one unmanned wellhead platform and temporary facilities for the treatment and injection of water, mounted on an adjacent jack-up drilling rig. Six wells were in operation, i.e. two oil producers, three water injectors and one observation well for registration of reservoir pressure and fluctuations in the free water level.

A plan for further development at Skjold was approved by the Minister of Energy primo 1990 comprising two additional producers, one water injector and a 12 inch pipeline connecting Skjold to the new facilities on Gorm F. The implementation of this project is expected to boost the daily oil production rate to 8,000 m^3. One producer and the injector will be completed in 1990, the second producer during 1991.

In 1989 the oil production from Skjold amounted to 2.21 million m^3 versus 1.37 million m^3 in 1988.

The Tyra Field

Tyra is located 15 km north of Gorm. The field consists of a large free gas accumulation over a thin black oil rim. Gas production was initiated in 1984. A gas recycling project for the purpose of enhanced condensate recovery was implemented in 1987.

The performance of the oil production well completed in late 1988 in the southwestern part of the field has proved very encouraging for the prospects of increasing the black oil recovery from Tyra. A plan for the continued evaluation and development of the oil zone of the field was submitted to the Energy Agency in July, 1989. In accordance with the plan two horizontal oil production wells will be drilled during the first half of 1990.

A horizontal gas producer was completed at Tyra in 1989. The well is located within a marginal part of the field, i.e. where the gas pay zone is thin and hardly producible from conventionally drilled production wells. This is the first time a horizontal gas production well completion has been performed in Denmark.

The total 1989 gas production at Tyra corresponded to 3.52 billion Nm^3 whereof 1.41 billion Nm^3 were reinjected in conjunction with the gas recycling project. The condensate production amounted to 0.82 million m^3, while the black oil production comprised 0.23 million m^3.

The Rolf Field

Rolf is located 15 km west of Gorm. Rolf is developed as a satellite to Gorm and oil production was initiated in 1986. The development comprises an unmanned wellhead platform and a two-phase pipeline to Gorm; oil production is maintained from one well. An observation well for surveillance of pressure and water level is located on the flank of the field.

A restimulation of the production well during the spring of 1989 stabilized and counteracted the decline of the oil rate maintaining the 1989 oil production at the 1988 level of 0.39 million m^3.

Field Developments in Progress

Satellite developments of Kraka, Dagmar and Valdemar for tie-in to the processing facilities at Dan, Gorm and Tyra respectively, are currently taking place.

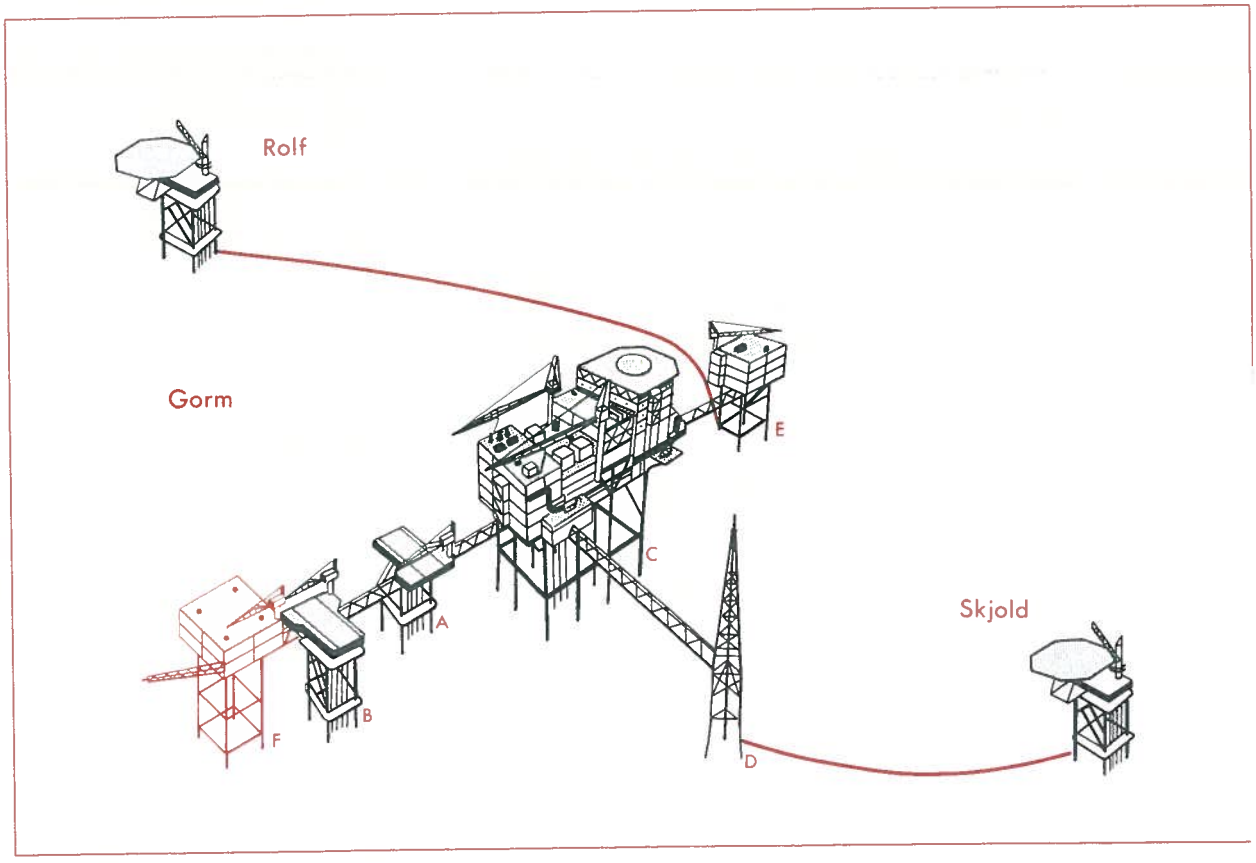
In connection with these projects Mærsk Olie & Gas A/S has developed a simplified and cost efficient wellhead platform, the STAR Platform. STAR consists of a leg supported caisson accomodating six well conductors. The platform deck is sufficiently spacious to allow for installation of simple top side facilities and a helideck.

The lightweight construction of STAR allows installation from a jack-up drilling rig. The platform is fixed at the sea bottom by driving of steel pillars through steering devices mounted on the supporting legs. Likewise the lift and installation of deck and top side facilities can be performed from the rig. Thus, the utilisation of STAR carries considerable cost savings compared to conventional steel jackets regarding expenditure for construction and installation.

The Dagmar Field

Dagmar is located 10 km west of Gorm; Dagmar was discovered in 1983 and a development plan was approved by the Minister of Energy in March, 1989.

Fig. 3.6 The Gorm Complex



In accordance with the plan, phased development will be applied at Dagmar. Phase 1 comprises the installation of a STAR Platform, installation of separate processing facilities on a new platform, Gorm F, and a two-phase pipeline connecting Dagmar to Gorm F. Two production wells are included in the Phase 1 development.

Oil production will be initiated by July 1st, 1991. The subsequent phases of the development are contingent on the results of Phase 1.

Initially the sour gas will be partly utilized as fuel on Gorm F, the remainder will be flared.

The Kraka Field

Kraka is located seven km southwest of Dan. Kraka comprises an oil accumulation with a small free gas cap. The discovery was made in 1966, and i 1988 the Minister of Energy approved development of Kraka as a satellite to Dan.

The plan implies phased development of Kraka. Phase 1 includes installation of a STAR Platform, tie-in to Dan via a 10 inch two phase pipeline and the drilling of two horizontal production wells.

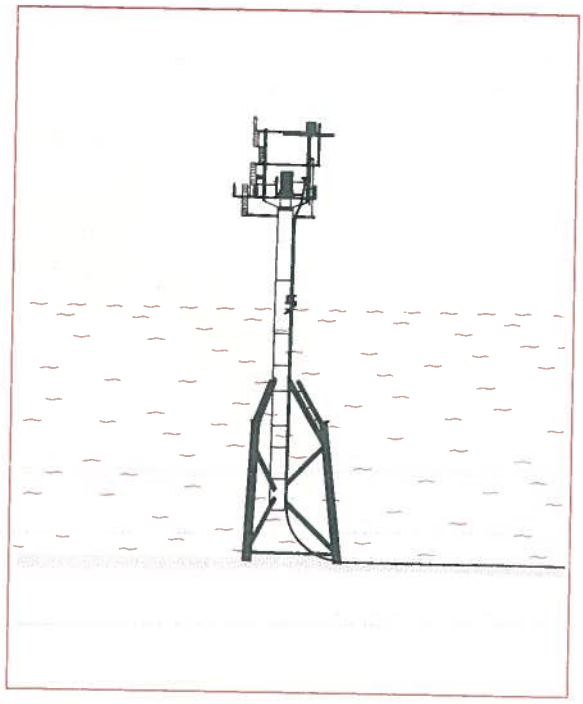
A template was installed on the seafloor, and two horizontal producers were drilled and tested during 1989. Tie-back of the wells and the remaining work will be performed during 1990; initiation of the oil production is expected towards the turn of 1990/1991.

The Valdemar Field

Valdemar comprises the largest hydrocarbon accumulation in Denmark with an area of approximately 200 km^2. The volatile oil bearing reservoir comprises layers of chalk and limestone of Barremian age with very low permeability, which makes recovery extremely difficult.

Several discovery wells have been drilled on this large structure including Bo-1 (1977), Boje-1 (1982) and North Jens-1 and 2 (1985). A phased development plan for Valdemar was approved by the Minister of Energy in 1988.

Fig. 3.7 The STAR Platform



The first phase of the development was initiated in 1989, comprising installation of a template and drilling, completion and testing of a horizontal well. A second horizontal well in the same area of the field was initiated, but the work was discontinued after testing of the pilot section of the well.

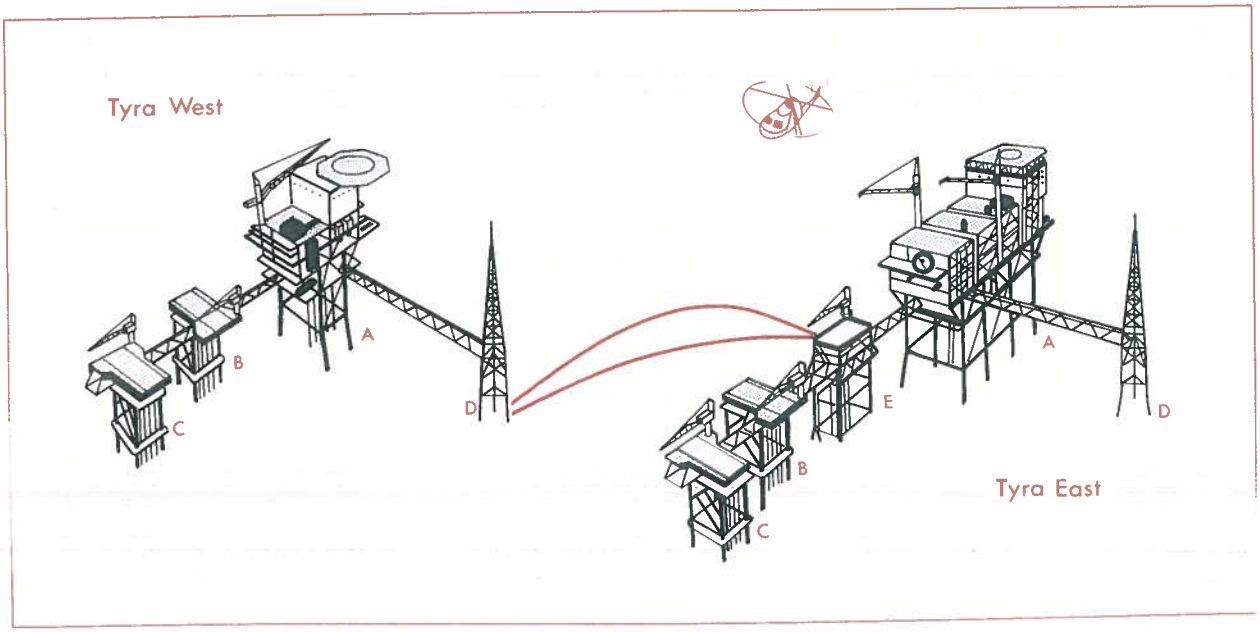
Both wells were subsequently plugged and temporarily abandoned.

The results of the testing were discouraging, confirming the tight nature of the reservoir rock.

Phase 2 is contingent on the results of Phase 1, including the installation of a STAR Platform, tie-in to Tyra East via an eight inch two-phase pipeline and drilling of two additional horizontal producers.

In order to optimize the trajectory of the horizontal section of the second well, the data obtained from the drilling of the development wells are currently under review. This may imply a delay of the development work. In accordance with the development plan oil production from Valdemar should be initiated not later than October 1st, 1991.

Fig. 3.7 The Tyra Complex



Future Field Developments

The signing of the *Agreement in Principle* of May, 1989 between DUC and Dansk Naturgas A/S implying delivery of increased amounts of gas provides a basis for the planning of additional Danish fields.

In compliance with the Agreement in Principle the development plans for Harald, Roar, Igor, North Arne and Adda were collectively approved in March 1990 by the Minister of Energy with special emphasis on the timing and phasing of these projects. The approval furthermore provides a basis for the development of the remaining fields declared commercially viable by DUC.

According to the 1990 approval the oil fields North Arne and Adda will be developed and brought into production when the necessary capacity of existing and planned processing and transportation systems is available, whereas the development of the gas fields Roar, Harald and Igor will be developed in accordance with the demand for gas deliveries to Dansk Naturgas A/S.

Development of the majority of the fields mentioned above will not be initiated in the near future. Therefore, further revisions and/or updates in the approved development concepts are likely to take place as a result of aquisition of new field information, technical improvements or introduction of new technology.

A decision with regard to the final layout of the infrastructure within the northern part of the Danish Central Graben area has not yet been taken. Current considerations are based on installation of a major processing centre at Haralc and on transportation ashore of the produced hydrocarbons via Tyra (gas) and Gorm (oil and condensate).

The Adda Field

Adda is located 10 km north of Tyra. Adda contains an oil accumulation in Upper Cretaceous chalk and a gas accumulation in Lower Cretaceous limestones. The Adda discovery was made in 1977.

A development plan for Adda was approved in March 1990 by the Minister of Energy. According to the plan Adda will be developed as a satellite to Tyra East. Tie-in to Tyra will take place via a two-phase pipeline.

Initiation of production at Adda is expected at the latest in 1999.

The North Arne Field

North Arne is located 60 km northwest of Tyra. The North Arne discovery was made in 1975. The field comprises two culminations of oil bearing chalk along a salt induced structural feature, separated by a saddle. The southern culmination was discovered in 1982 under the designation Otto.

A plan for the development of North Arne was approved by the Minister of Energy in March 1990.

According to the plan, North Arne will be developed as a satellite to Harald, located 20 km to the north. Tie-in to Harald will take place via a two phase pipeline.

Initiation of oil production from North Arne will take place in year 2000 at the latest.

The Elly Field

Elly comprises a gas accumulation located adjacent to the German sector 40 km west of Tyra. Elly was discovered in 1984 and declared commercially viable in 1988. The Minister of Energy has approved postponement of submittal of a development plan for the field until December 6th, 1991.

The Gert Field

Gert is an oil accumulation located 80 km northwest of Tyra.
The accumulation extends northwards into the Norwegian sector (the Mjolner prospect). Gert was discovered in 1984 and declared commercially viable in 1987.

The Minister of Energy has approved postponement of submittal of a development plan for Gert until December 30th, 1990.

The Harald Field

Harald comprises two separate major gas accumulations previously called Lulu and West Lulu. Lulu was discovered in 1980 and West Lulu in 1983. Harald is located 80 km north of Tyra close to the Danish/Norwegian sector boundary.

A development plan for Harald was approved by the Minister of Energy in March 1990. The plan includes installation of an integrated accomodation and processing platform adjacent to a wellhead and riser platform. The produced hydrocarbons will be transported to Tyra and Gorm for export ashore. The processing facilities at Harald will accomodate production from satellite fields located in the northern part of the Danish Central Graben area.

Production from the Harald will be initiated on October 1st, 1998.

The Igor Field

Igor is located 13 km north of Dan. Igor is a minor gas accumulation discovered in 1968. A plan implying satellite development at Igor tied in to Dan was approved in 1987 by the Minister af Energy. In March 1990 the approval was extended to include the timing of the development.

Initiation of production from Igor is expected in 1999.

The Nils Field

Nils is a small oil accumulation located 10 km southeast of Dan.
The discovery was made in 1979 and a development plan was approved by the Minister of Energy in 1988. The plan includes installation of a wellhead platform and tie-in to Dan via a two-phase pipeline.

Initiation of production from Nils is expected in 1994.

The Roar Field

Roar, located 10 km northwest of Tyra, comprises a free gas accumulation with a thin oil rim (compare Tyra). The discovery was made in 1968.

In 1980 it was approved by the Minster of Energy that gas deliveries under the Gas Sales Contract of 1979 should be fulfilled by Roar in addition to deliveries from Dan, Gorm and Tyra. The approval stipulated that an application for development of Roar allowing gas deliveries as per October 1st, 1989 should be filed at the latest in 1985.

As gas deliveries from Roar proved not to be required by the date stipulated development of the field was temporarily postponed.

In March 1990 the Minister of Energy approved a development plan comprising a revised time schedule for the start of production from Roar.

The field will be developed as an unmanned satellite to Tyra.

The produced hydrocarbons will be transported to Tyra via a two phase pipeline.

Production from Roar will be initiated on October 1st, 1993.

A review and assessment of the Danish oil and gas reserves is carried out on an annual basis by the Energy Agency.

The oil and gas reserves assessment of January 1st, 1990, has been subject to different systematics than previous assessments.
This was done in order to clearly differentiate between hydrocarbons that can be produced with a high degree of confidence based on existing and approved development plans and the considerable amounts of oil and gas that are expected to be produced not documented however by approved development plans.

The reserves assessments only include those amounts of oil and gas that can be produced from well known reservoires.

The oil and gas production from most of the Danish fields is hampered by extremely low reservoir rock permeability. Hence, even though a considerable portion of the oil and gas technically can be recovered, this recovery is attributed to costs exceeding acceptable levels in light of the current oil prices. The possibilities for increased oil and gas recovery are highlighted below in the section Potential Recovery.

In addition to previous reports, the 1989 Annual Report gives an analysis of the exploratory hydrocarbon potential contained within the Danish Central Graben area.

Method and Definitions

Only part of the hydrocarbons-in-place in a reservoir can be recovered. The recovery in terms of reserves that can be produced during a field's life time is referred to as the ultimate recovery. The difference between the reserves under ultimate recovery and the produced quantities of hydrocarbons corresponds to the remaining reserves at any given time.

The underlying calculations are based on probabilistic theory, hence resulting in a low, an expectation and a high value respectively for the oil and gas reserves and are calculated for each field. The expectation values provide the basis for estimations of the total Danish hydrocarbon reserves.

Reserves

Ongoing or planned hydrocarbon production is categorised under established, decided and planned recovery respectively. The three categories are defined as follows:

Established Recovery

Established recovery comprises oil and gas reserves that are recoverable from the currently existing wells and production facilities. In this context it is assumed that the required maintenance of the facilities is performed.

Decided Recovery

Reserves under decided recovery are calculated with regard to hydrocarbon discoveries for which development plans have been approved. Further reserves under this category apply to approved extensions and modifications of existing production facilities.

Planned Recovery

Reserves under planned recovery comprise the producible amounts of oil and gas that can be calculated for prospects described in development plans submitted to the authorities, however not yet approved by the Minister of Energy. Further reserves under planned recovery include oil and gas reserves from prospects that have been declared commercial by the licence holders.

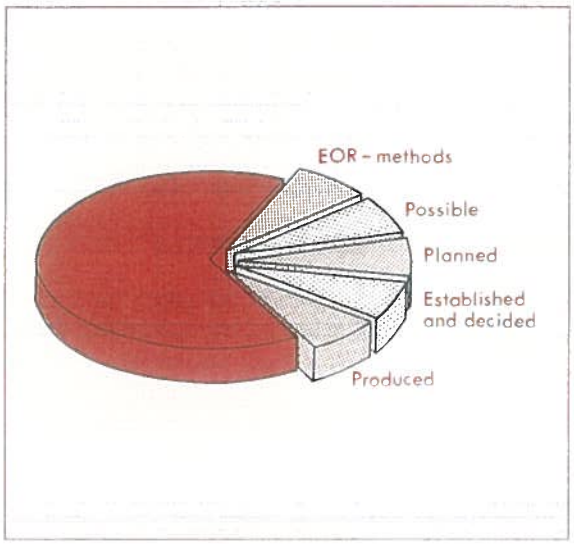
Potential recovery

Reserves under potential recovery have been subdivided into possible and enhanced oil recovery respectively as follows:

Possible recovery

Possible recovery comprises oil and gas that can be produced by the utilisation of known technologies and under compatible conditions with those in other parts af the North Sea.
Furthermore the category includes production from marginal fields.

Fig. 4.1 Reserves Categories



Enhanced Oil Recovery

Enhanced oil recovery procedures comprise novel technologies and concepts with the purpose of releasing the physical properties hampering the flow of oil from the reservoir into the well bore and the production string.

The reserves categories are illustrated in Figure 4.1.

The 1990 Reserves Assessment

The oil and gas reserves assessments prepared by the Energy Agency of January 1st, 1990 are summarised in Tables 4.1. and 4.2. respectively.

A number of adjustments were made in the 1990 reserves assessment compared to 1989, hence resulting in an increase of the oil and gas reserves under the established and decided category with a corresponding decline in the reserves under planned recovery. These adjustments are primarily related to the fact that five development plans were approved by the Minister of Energy, thus transferring the pertaining reserves into the decided and established category from their previous allocation under planned recovery. Other adjustments were made in view of improved production experience and new data.

Additional oil reserves under planned recovery were assessed in accordance with the plan comprising the drilling and completion of two further horizontal producers in the Tyra oil zone and extended planned development at Dagmar.
The reserves are shown in Figure 4.2.

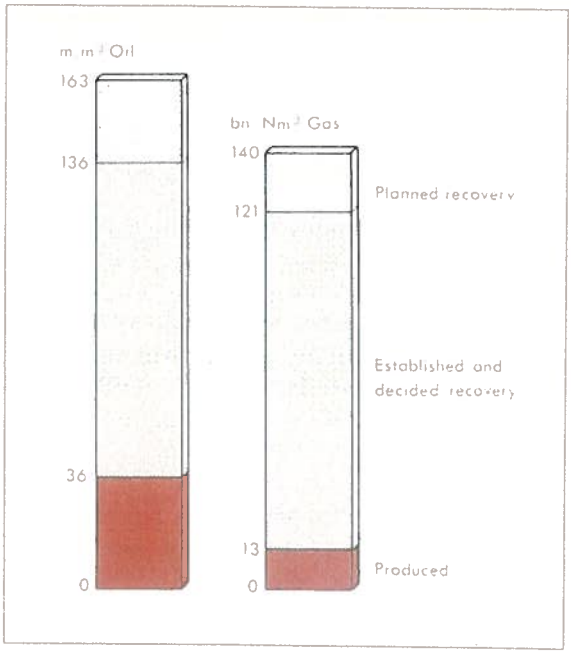
Potential Recovery

Possible Recovery

The energy Agency has evaluated the possibilities for increasing the recovery by use of well known technology.

Reserves under the category possible recovery were calculated as the result of the expanded implementation of water injection in the currently producing oil fields, in particular at Dan and Gorm. An essential contribution to the possible reserves comprises improved production conditions with regard to the tight Barremian reservoirs at Valdemar and Adda. Further reserves under possible recovery were also calculated due to the possible extended development at Dagmar and the new development of currently marginal fields as a result of future cost effective technology or increased oil prices or both.

Fig. 4.2 Oil and Gas Reserves



Tabel 4.1 Oil and Condensate Reserves, million m^3

	Ultim. Rec.			Prod.	Reserves		
	Low	Exp.	High		Low	Exp.	High
Established and Decided Recovery:							
Dan	34	41	50	9	25	32	41
Gorm	20	26	33	13	7	13	20
Skjold	22	29	36	8	14	21	28
Rolf	2	3	4	2	<1	1	2
Tyra	10	12	15	4	6	8	11
Dagmar	1	2	3	–	1	2	3
Kraka	1	2	4	–	1	2	4
Valdemar	1	4	9	–	1	4	9
Adda	<1	1	2	–	<1	1	2
Nord Arne	4	7	10	–	4	7	10
Harald	4	5	7	–	4	5	7
Igor	<1	<1	<1	–	<1	<1	<1
Nils	<1	<1	1	–	<1	<1	1
Roar	3	4	5	–	3	4	5
Sub total		*136* (116)		*36* (30)		*100* (86)	
Planned Recovery:							
Dan	3	4	5	–	3	4	5
Tyra	<1	1	1	–	<1	1	1
Valdemar	2	8	15	–	2	8	15
Kraka	1	2	2	–	1	2	2
Dagmar	1	1	2	–	1	1	2
Gert	6	11	17	–	6	11	17
Elly	<1	<1	1	–	<1	<1	1
Sub total		*27* (49)				*27* (49)	
Total		*163* (165)		*36* (30)		*127* (135)	

Tabel 4.2 Gas Reserves, billion Nm^3

	Ultim. Rec.			Prod.	Reserves		
	Low	Exp.	High		Low	Exp.	High
Established and Decided Recovery:							
Dan	14	16	20	3	11	13	17
Gorm	5	6	8	<1	5	6	8
Skjold	2	3	3	1	1	2	2
Rolf	<1	<1	<1	<1	<1	<1	<1
Tyra	36	46	54	9	27	37	45
Dagmar	<1	<1	1	–	<1	<1	1
Kraka	<1	1	2	–	<1	1	2
Valdemar	2	6	12	–	2	6	12
Adda	1	1	2	–	1	1	2
Nord Arne	1	2	3	–	1	2	3
Harald	20	25	31	–	20	25	31
Igor	1	2	3	–	1	2	3
Nils	<1	<1	<1	–	<1	<1	<1
Roar	9	13	17	–	9	13	17
Sub total		*121* (89)		*13* (10)		*108* (79)	
Planned Recovery:							
Dan	1	1	2	–	1	1	2
Tyra	<1	<1	<1	–	<1	<1	<1
Valdemar	5	13	24	–	5	13	24
Kraka	1	1	1	–	1	1	1
Dagmar	<1	<1	<1	–	<1	<1	<1
Gert	1	1	2	–	1	1	2
Elly	1	3	5	–	1	3	5
Sub total		*19* (47)				*19* (47)	
Total		*140* (136)		*13* (10)		*127* (126)	

The total Danish oil and gas reserves including the possible reserves discussed above only divert sligthly from those reported in the 1988 Annual Report.
The results of these calculations are summarised in Table 4.3.

Enhanced Oil Recovery

The total oil reserves assessed under the established, decided, planned and possible categories correspond to approximately 14% of the oil-in-place contained in the currently known Danish reservoirs.

Extended recovery requires the introduction of novel technologies and concepts with the purpose to release the physical properties hampering the flow of oil from the reservoir into the well bore and the production string. Such technologies are collectively referred to as enhanced oil recovery procedures, EOR.

The methods which are relevant under Danish conditions are injection of various chemical compounds and miscible gasses.

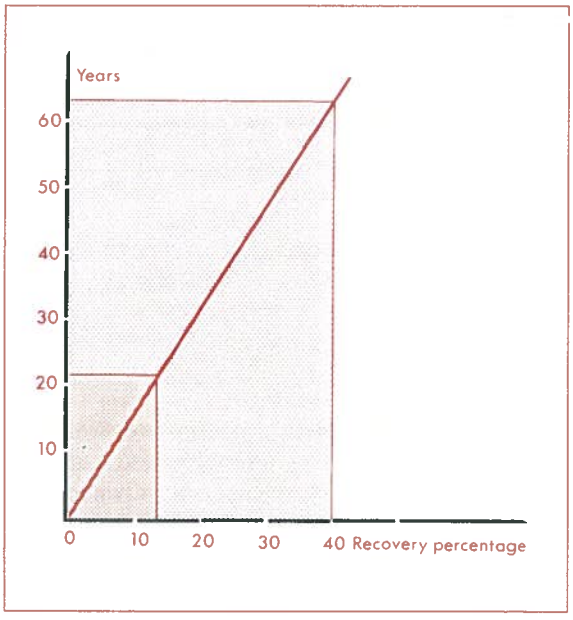
These techniques aim at a reduction of the influence of the inter alia capillary forces and the surface tensions of the reservoir fluids which prevent a conventional recovery of most of the oil contained in the reservoir rock.

It is common to most enhanced oil recovery procedures that they are extremely cost demanding and cannot therefore readily be implemented due to economic constaints.

Research and development of techniques and procedures for an economic implementation of enhanced oil recovery within the North Sea area are performed both in Denmark and abroad. The results of these research projects are promising, indicating oil recoveries up to 50% and higher based on laboratory experiments, however under currently nonacceptable economic conditions.

Only one per cent's increase in the currently assessed oil reserves means an additional oil recovery of 16 million m^3, corresponding to 1.6 years of domestic oil consumption.

Fig. 4.3 Recovery Percentage and Domestic Oil Consumption



Tabel 4.3 Possible Recovery

	1989 oil mio.m^3	1989 gas bn. Nm^3	1990 oil mio.m^3	1990 gas bn.Nm^3
Producing fields	33	8	35	13
Comm.fields	8	12	5	12
Pot.fields	17	24	16	24
Possible Recovery	*58*	*44*	*56*	*49*
Reserves and Possible Recovery	223	180	219	189

The oil recovery as plotted versus the domestic oil consumption is shown in Figure 4.3. The plot reveals that the total reserves assessed (14%), including the possible oil recovery would satisfy the domestic oil demand for 22 years. An increase of this oil recovery to, say, 40 per cent of the oil-in-place implies a rate of self-sufficiency corresponding to 64 years of oil supply.

As the eventual implementation of enhanced oil recovery methods could carry the production well into the next century, there are a number of important issues that require review and reconsideration, inter alia oil price development, licence conditions and problematics related to fatigue of the existing and planned offshore installations and production facilities.

The Central Graben Exploration Potential

In addition to the annual assessment of discovered oil and gas reserves, the Agency has completed an evaluation of the hydrocarbon potential of undrilled hydrocarbon prospects in the Central Graben, and includes licenced and unlicenced blocks.

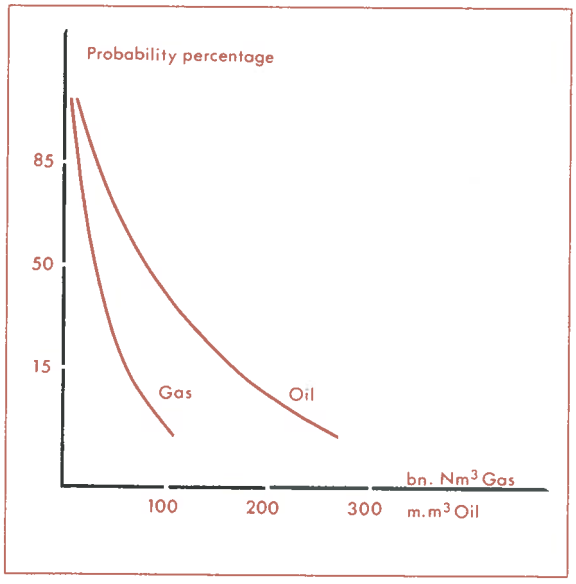
This area is considered still to be the most prospective Danish geological province. In order to avoid confusion with reserves pertaining to oil and gas discoveries, the potential of undrilled prospects is designated *Hypothetical Resources* in this passage. The purpose of this evaluation exercise is to provide realistic estimates of oil and gas resources which may be discovered by future exploration drilling. the resource evaluation as of January 1st, 1990 comprises exclusively mapped prospects in the Central Graben.

Hypothetical Resources

Hypothetical resources have been defined as the volumes of oil and gas which potentially could be produced from mapped, but yet undrilled prospects. Hypothetical resources thus differ from reserves in that producible hydrocarbons in the former case have not been proved by drilling. Only seismically well defined geologocal structures supported with near-by well data are considered as prospects to be evaluated under hypothetical resources.

Detailed analysis have been made for each prospect of the accumulated and producable volumes of hydrocarbons. In addition, estimates of the chance of a hydrocarbon discovery have been made for each structure.

Fig. 4.4 Probability of Reserves



Based on the above evaluations, probabilistic calculations of the combined prospect potential have been carried out for the Central Graben.

Results of the calculations indicate that with continued exploration in the Central Graben it can be expected to find 95 million m^3 oil and 40 billion Nm^3 gas from new discoveries. It should be stressed that the uncertainty in these figures is reflected in the range of possible volumes linked to these expected volumes. In the case of oil potential the range is 30-170 million Nm^3. In the case of gas potential the range is 15-70 billion Nm^3. A probability distribution has been used that corresponds to the definitions used in the evaluation of reserves. Using a conversion of approximately 1 billion Nm^3 of gas to 1 million tons of oil equivalent, it is apparent that the oil potential is anticipated to be considerably greater than that of gas.

Maintaining the current exploration activity level in the Central Graben over the next 15 to 20 years, calculations indicate new discoveries by oil companies, could increase current oil and gas reserves by 60% and 30 % respectively. In addition, the hydrocarbon potential of a number of less mature prospects in the Central Graben has yet to be assessed and the hydrocarbon potential of all areas outside the Central Graben has yet to be quantitively assessed.

The production and expenditure forecasts for exploration and exploitation of hydrocarbons in Denmark are based on the 1990 Reserves Assessment, prepared by the Danish Energy Agency.

The present five year forecast reflects the expectations of the Energy Agency, as well as an evaluation of the self-sufficiency of energy and the net currency expense for energy imports. The economic consequences of the five year forecast are highlighted in the section Economics.

Furthermore, a twenty year oil and gas production forecast is included in this report.

Fig. 5.1 Energy Consumption and Production 1990-1994

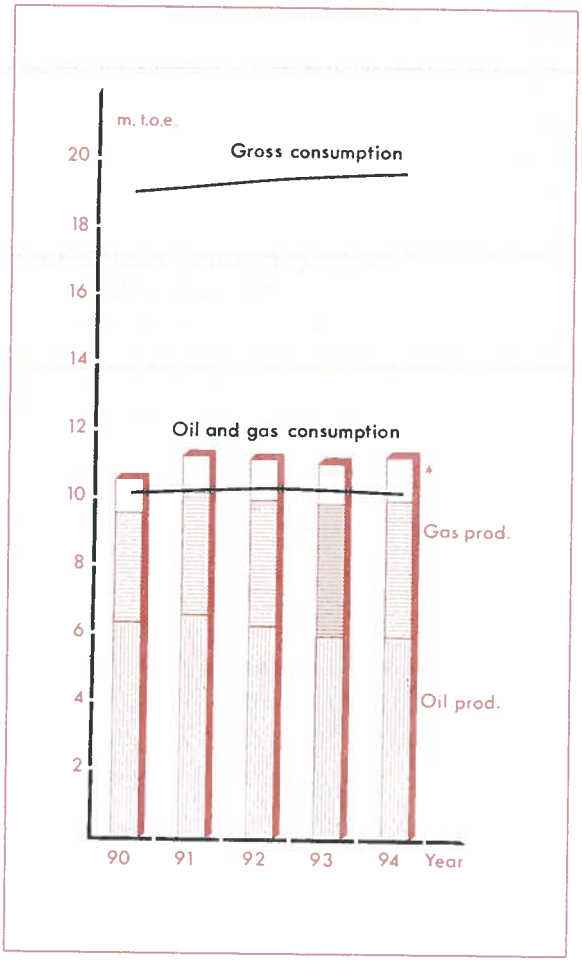


Table 5.1 Oil and Condensate Production Forecast, million m^3

	1990	1991	1992	1993	1994
Established and Decided Production					
Dan	1.8	2.1	2.1	2.2	2.3
Gorm	1.3	1.2	1.0	1.0	0.8
Skjold	3.0	2.7	2.3	1.9	1.5
Rolf	0.3	0.2	0.2	0.1	0.1
Tyra	0.8	0.7	0.5	0.3	0.2
Dagmar	–	0.3	0.5	0.4	0.4
Kraka	0.1	0.3	0.2	0.2	0.3
Valdemar	–	–	0.4	0.4	0.4
Roar	–	–	–	0.1	0.3
Nils	–	–	–	–	0.4
Sub Total	*7.3*	*7.5*	*7.2*	*6.6*	*6.7*
Planned Production	0.2	0.3	0.2	0.4	0.4
Expected Production	*7.5*	*7.8*	*7.4*	*7.0*	*7.1*
April 1989	6.4	7.8	7.5	6.6	

Five Year Production Forecast

The five year production forecast is based on the systematics of the Reserves Assessment per January 1st, 1990 (Ref. Tables 4.1 and 4.2).

The oil and condensate production forecast assumes the utilization of currently existing facilities and further includes the planned extensions of these facilities.

With regard to natural gas, the production forecast reflects the expected delivery of sales gas to Dansk Naturgas A/S.

Compared to the 1988 annual report this five year forecast reveals a certain increase of the oil production during 1990, then staying at the same level during the remaining four years.

Changes in the allocation of reserves categories took place during 1989 after approval of new and extended development, including the timing and phasing of the pertaining work.

Table 5.2 Sales Gas Production Forecast, billion Nm^3

	1990	1991	1992	1993	1994
Established and Decided Production					
Dan center	0.7	0.8	0.8	0.9	1.0
Gorm center	0.3	0.3	0.3	0.4	0.3
Tyra center	2.2	2.5	2.6	2.6	2.7
Sub Total	*3.2*	*3.6*	*3.7*	*3.9*	*4.0*
Planned Production	0.0	0.0	0.0	0.0	0.0
Expected Production	*3.2*	*3.6*	*3.7*	*3.9*	*4.0*
April 1989	2.8	3.1	3.2	3.4	

Accelerated and extended development at Skjold is expected to be implemented already during 1990, rather than in 1991 as previously planned.

Changes in allocation of reserves categories resulted in an increase of recovery under established and decided production and a corresponding decline under the category planned production.

Hence the category planned production during the five year period comprises two new horizontal producers in the Tyra oil zone and is contingent on extended development at Dagmar.

Regarding the disposal of natural gas, the Agreement in Principle of 1989 between the Danish Underground Consortium (DUC) and Dansk Naturgas A/S implies increased expectations from the gas production. The distribution of the gas production between the three currently existing processing centres is shown in Table 5.2.

The expected rate of investment and operational costs for the forecast period are summarized in Tables 5.3 and 5.4 respectively; the rate of investment from 1990 onwards is expected to reach a considerably higher level than is envisaged in the 1988 annual report.

Table 5.3 Investments, Development Projects, DKK billion (1990)

	1990	1991	1992	1993	1994
Established and Decided Projects					
Dan	0.4	0.4	0.5	0.5	–
Gorm	0.2	–	–	–	–
Skjold	0.8	–	–	–	–
Rolf	–	–	–	–	–
Tyra	–	–	–	–	–
Dagmar	0.2	0.3	0.3	0.1	–
Kraka	0.5	0.2	–	–	–
Valdemar	0.4	0.4	–	–	–
Roar	0.2	0.6	0.6	–	–
Nils	–	–	–	0.3	–
Sub Total	*2.6*	*1.4*	*1.4*	*1.5*	*0.0*
Planned Projects	0.1	0.1	0.2	0.7	1.0
Expected Investments	*2.7*	*1.5*	*1.6*	*2.2*	*1.0*
April 1989	1.1	1.8	2.0	0.5	

Table 5.4 Operation and Maintenance Costs, DKK billion (1990)

	1990	1991	1992	1993	1994
Established and Decided Costs					
Dan	0.3	0.3	0.3	0.3	0.3
Gorm	0.2	0.2	0.2	0.2	0.2
Skjold	0.2	0.2	0.2	0.2	0.2
Rolf	0.0	0.0	0.0	0.0	0.0
Tyra	0.4	0.4	0.4	0.4	0.4
Dagmar	–	0.0	0.0	0.1	0.1
Kraka	0.0	0.0	0.0	0.0	0.0
Valdemar	–	–	0.0	0.0	0.0
Roar	–	–	–	0.1	0.1
Nils	–	–	–	–	0.0
Sub Total	*1.2*	*1.2*	*1.2*	*1.3*	*1.3*
Planned Costs	0.0	0.0	0.0	0.0	0.0
Expected Costs	*1.2*	*1.2*	*1.2*	*1.3*	*1.3*
April 1989	1.2	1.2	1.3	1.3	

Table 5.5 Transportation Costs, the Oil Pipeline, DKK billion (1990)

	1990	1991	1992	1993	1994
Total	*0.8*	*0.8*	*0.8*	*0.8*	*0.8*
April 1989	0.7	0.7	0.7	0.7	

Expenditure with regard to exploratory and appraisal activities is summarized in Table 5.6. Upward adjustments of the 1988 expenditure were made in the light of the 3rd Licensing Round Awards in 1989.

Table 5.6 Exploration and Appraisal Costs, DKK billion (1990)

	1990	1991	1992	1993	1994
Total	*0.4*	*0.2*	*0.4*	*0.3*	*0.1*
April 1989	0.5	0.3	0.2	0.2	

Self-Sufficiency and Net Currency Expenditure for Energy Imports

The expected production of oil and natural gas is compared to the domestic oil and gas demand (A) and to the total energy demand (B). In (C) the rate of self-sufficiency is calculated in relation to the total energy consumption – including renewable energy production. The compilation is shown in Table 5.7.

The net currency expenditure is expressed as its immediate effect on the trade balance. This calculation does not include the imports in connection with field development or profits transferred abroad.

The energy consumption and production are summed in tons oil equivalents (t.o.e.) for convenient comparison.

Twenty Year Production Forecast

Like the five year forecast the twenty year production forecast was prepared on the basis of the systematics of the Reserves Assessment. However, the twenty year forecast also comprises the reserves under possible recovery, which are not included in the five year production forecast.

Crude Oil and Natural Gas Production Forecast

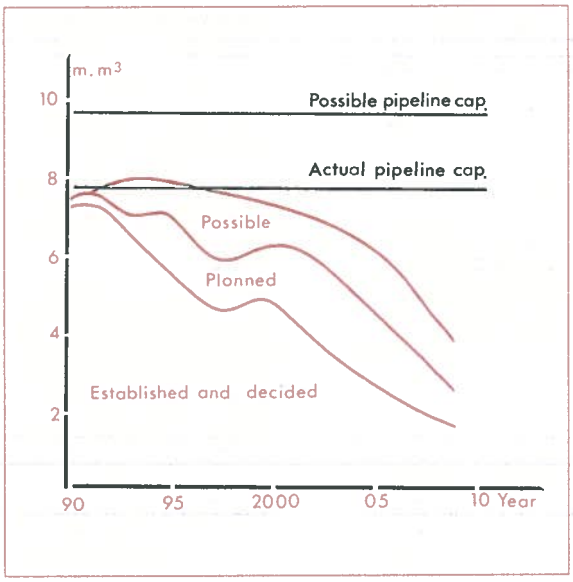
Three scenarios for the production of crude oil and condensate are illustrated in Figure 5.2, which shows recovery under the category established and decided, the planned and the possible categories respectively.

Table 5.7 Rate of Self-sufficiency and Net Currency Expenditure for Energy Imports

	1990	1991	1992	1993	1994
Production					
Crude Oil (million m^3)	7.5	7.8	7.4	7.0	7.1
Natural Gas (billion Nm^3)	3.2	3.6	3.7	3.9	4.0
Total Energy Consumption (PJ)	*809*	*822*	*830*	*835*	*838*
Rate of Self-sufficiency (%)					
A)	92	97	94	93	95
B)	49	51	50	49	50
C)	54	57	56	55	56
Net Currency Expenditure (DKK billion)	5.9	6.2	6.8	7.4	7.5
Crude Oil Price USD/barrel	19	21	23	25	27
DKK/USD	7.00	7.00	7.00	7.00	7.00

A) Oil and gas production versus domestic oil and gas consumption
B) Oil and gas production versus total domestic energy consumption.
C) Total energy production versus total domestic energy consumption

Fig. 5.2 Oil and Condensate Production 1990-2009, million m³



The production under established and decided recovery categories indicates a gradual decline until the turn of the century followed by a marked increase, this reflects the initiation of production from the major field Harald and the satellite fields North Arne, Igor and Adda.

The scenario under the category planned recovery reflects the extended development at Dan and Tyra and is further contingent on a number of the fields, where development will be implemented during the next few years; planned recovery includes production from Gert and Elly.

With regard to possible production, the forecast is primarily based on improved recovery at Dan and Gorm due to increased implementation of water injection; increased recovery is further assumed at Rolf, Dagmar, Valdemar and Adda.

The forecast indicates that an annual oil and condensate production of 7-8 million m³ may be preserved until the mid 1990"s. Including the additional production under the scenario of possible production this level may be prolonged into the 2000's.

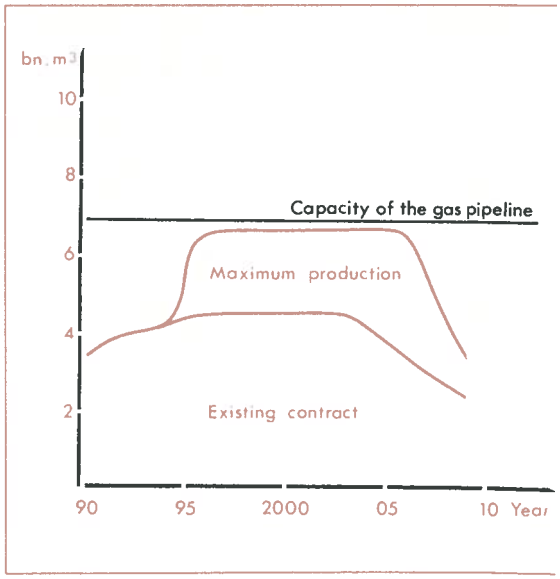
The scenarios are based on currently availabl technology and prevailing economic conditions Implementation of enhanced oil recovery woul increase and prolong the production level wel into the 2000's.

Changes and adjustments in the present twenty year production forecast compared to the 198 forecast are primarily attributed to recently ap proved time schedules for further phased deve lopment of a number of fields.

In contrast to the oil production, sales gas pro duction requires approved contracts specifyin long term gas deliveries.

The perspectives related to gas production ar shown in Figure 5.3, illustrating the delivery b the DUC of a total of 93 billion Nm³ sales gas t Dansk Naturgas A/S until the year 2011 and a maximum gas delivery of 120 billion Nm³ ga during the same period. The higher gas deliver is attributed to the maximum capacity of th currently existing gas pipeline connecting th gas export outlet at Tyra with the gas treatmen facilities located at Nybro on the west coast o Jutland. The difference between the two scena

Fig. 5.3 Sales Gas Production 1990-2009, billion Nm



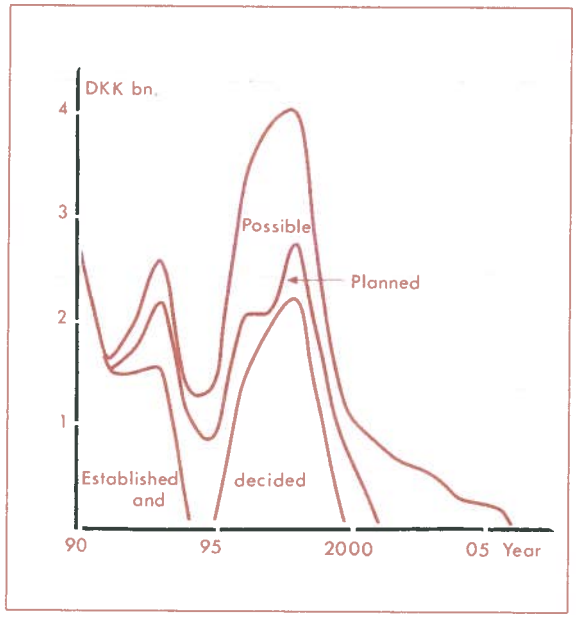
rios serves to illustrate the available transportation capacity with a view to extended delivery of sales gas, i.e. up to 120 million Nm^3 during the period 1984-2009.

Capital Expenditure and Operational Costs

Figures 5.4 and 5.5 illustrate the rates of investment and operational costs pertaining to the production scenarios mentioned above.

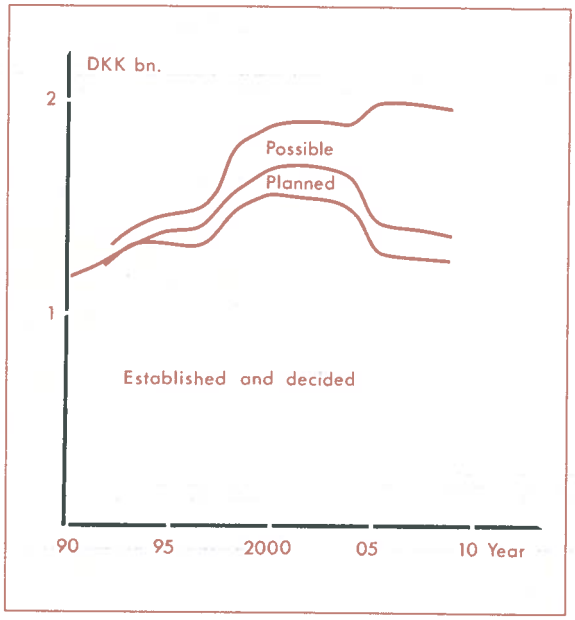
The high rate of investment under the category decided recovery as indicated during the late 1990"s is related to the new developments in the northern Central Graben area (Harald, North Arne).

Fig. 5.4 Rate of Investment 1990-2009, DKK billion



Capital expenditures for the planned developments are considerably lower than indicated in the previous forecast, primarily due to the transfer of several development projects from the previously planned to the category decided production.

Fig. 5.5 Operational Costs 1990-2009, DKK billion



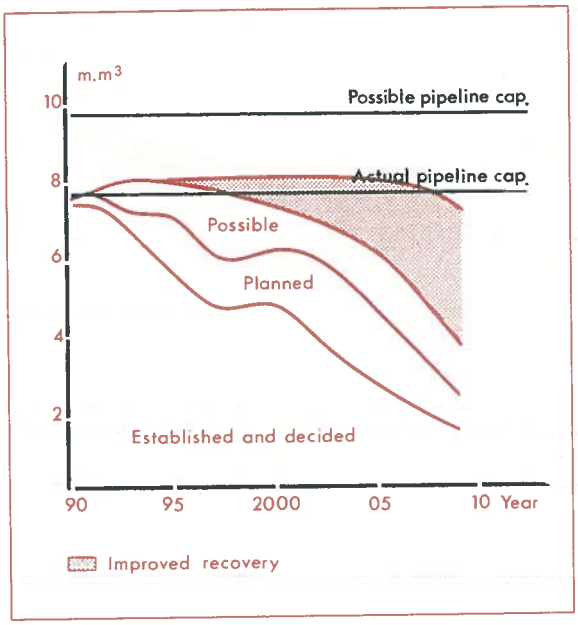
A high rate of investment has been allocated to possible recovery during the late 1990's, principally related to implementation of new and extended water injection projects.

The time schedule for these capital expenditures as well as for other investments under the scenario of possible production is subject to considerable uncertainty. Therefore the investment rate is averaged over a longer period.

The total decided capital expenditure amounts to approximately DKK 13 billion; planned activities require investments corresponding to DKK 6 billion; a total investment of additionally DKK 9 billion was estimated in order to realise the recovery under the scenario for possible production.

Operational costs will gradually increase and are estimated to approach DKK 2 billion per year towards the end of the forecast period.

Fig. 5.6 Possible Oil Production Scenarios at Implementation of Enhanced Oil Recovery, million m^3



Improved Oil Recovery Methods

The oil production scenarios discussed above are not to be regarded as an absolute upper limit of a possible Danish production potential.

Further improvements are contingent on intensified efforts and continued development, but they are not restricted to enhanced oil recovery procedures. Other subjects of importance comprise the pursuance of less costly development concepts and drilling and completion of some additional horizontal production wells.

At present, the moderate oil prices prevent development and implementation of more advanced recovery measures. A scenario describing improved oil production under assumed acceptable technical and economic conditions is shown in Figure 5.6.

The international crude oil price underwent a rising trend in 1989 as compared to the low price levels during the previous years. Hence the average Brent oil price reached above USD 18 per barrel during 1989. This development is due to increased global oil demands and the cease of the 1986 oil glut.

As compared to 1988 the 1989 crude oil prices increased by 28 per cent; the average rate for the US dollar increased by nine per cent.

The combined Danish oil and gas production brought ashore during 1989 amounted to 8.4 million tons oil equivalent, an increase of 11 per cent as compared to 1988.

The increased production in combination with the rising oil price and the improved rate of the US dollar resulted in a considerably higher sales value of the Danish oil and gas production for 1989 as compared to 1988. The 1989 sales value corresponded to DKK 6.8 billion as compared to the DKK 4.9 billion in 1988 (Ref. table 6.1).

Fig. 6.1 Sales Value and Production of Oil and Gas

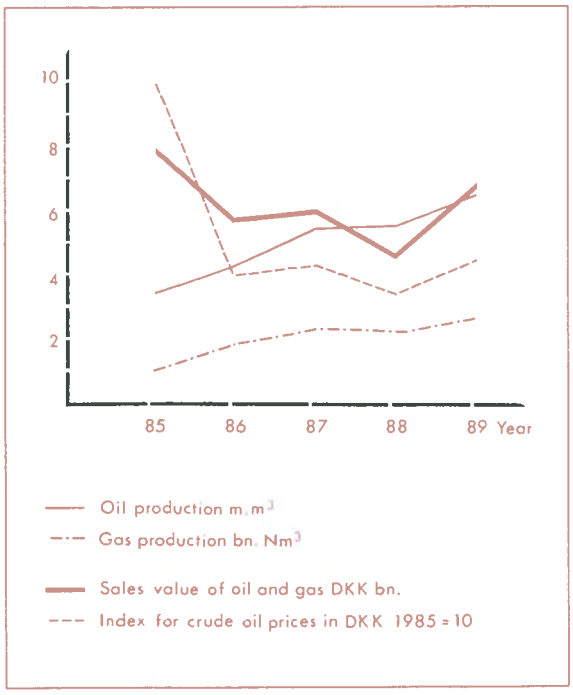


Table 6.1 Sales Value and Production of Oil and Gas

	1985	1986	1987	1988	1989*)
Sales Value (DKK million)					
Oil	6,280	3,270	4,270	3,500	5,350
Gas	1,680	2,440	1,660	1,355	1,410
Total	*7,960*	*5,710*	*5,930*	*4,855*	*6,760*
Production					
Oil million m^3	3.46	4.29	5.42	5.57	6.48
Gas billion Nm^3	1.04	1.80	2.30	2.27	2.69
International Crude Oil Price *(Brent)*					
USD/barrel	27.61	14.45	18.38	14.94	18.11
DKK/USD	10.60	8.09	6.84	6.74	7.32
DKK per m^3	1.841	735	791	633	834

Nominal prices, *) Estimate

Exploratory, Development And Operation Expenditures

Table 6.2 summarises the combined capital outlays for the exploration and production of oil and gas in Denmark. The compilation indicates a total 1989 expenditure of DKK 2.7 billion. In addition DKK 0.8 billion were spent in conjunction with the transportation of the crude.

The transportation cost for the crude comprises operational costs, financing costs and depreciation on the capital expenditure with regard to the transportation facilities. In addition the oil pipeline tariff includes a profit element corresponding to five per cent of the value of the transported crude oil. The oil pipeline is owned by Dansk Olierør A/S which transfers 90 per cent of the income under the profit element to the treasury. All currently incurred transportation costs are covered by the Danish Underground Consortium, sole producer of oil and gas in Denmark.

The 1989 capital costs were primarily allocated to drilling activities, i.e. including three exploratory wells and 14 production wells. The exploratory expenditure has been declining whereas costs allocated to development drilling have been rising.

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

	1985	1986	1987	1988	1989*)
Exploration and appraisal					
DUC	873	309	234	110	80
Licence Groups 1st and 2nd Rounds	500	304	505	449	220
Total	*1,373*	*613*	*739*	*559*	*300*
Development (DUC)	2,023	1,764	914	897	1,285
Operations (DUC) (DUC)	756	981	995	1,000	1,100
Transportation Costs	884	617	650	604	765

Nominal prices, *) Estimate

Development expenditures as allocated to the individual fields are summarised in Table 6.3; the 1989 figures are estimates. Non allocated costs comprise common field expenses, certain costs incurred in conjunction with accounting and costs allocated separately to the individual companies.

Table 6.3 Development Investments by the DUC, DKK million

	1985	1986	1987	1988	1989*)
Dan	1,266	1,303	641	223	365
Gorm	21	23	11	262	200
Skjold	92	44	62	236	45
Rolf	366	163	10	–	20
Tyra	137	134	188	107	150
Kraka	–	–	–	4	195
Valdemar	–	–	–	7	225
Not Allocated	143	99	2	58	85
Total	*2,025*	*1,766*	*914*	*897*	*1,285*

Nominal prices, *) Estimate

The combined expenditures with regard to the currently implemented development corresponds to approximately DKK 28 billion in nominal prices, i.e. for the time span 1971-1989.

The results before tax with regard to activities by the Danish Underground Consortium are compilated in table 6.4 for the period 1985-1988. The sensitivity of the results due to fluctuations in the currency rate becomes apparent.

Transportation costs were included under operation costs in the compilation.

Direct state revenues resulting from the oil and gas production are summarised in table 6.5. for the period 1985-1989 in 1990 prices.

Table 6.4 Earnings of the DUC Companies 1985-88, DKK million

	1985	1986	1987	1988
Income	8.022	5.633	5.823	5.103
Costs	2.028	1.706	1.663	1.591
Interests	991	529	492	628
Exchange Rate Adjustments	+1.861	+1.385	+943	-324
Gross Income	6.864	4.723	4.611	2.560
Depreciations	1.775	1.539	1.586	1.495
Earnings Before Tax	*3.629*	*1.951*	*1.650*	*551*

Nominal prices

As a statement of account with regard to 1989 is not yet available the 1989 figures are uncertain and subject to adjustment. This is particularly evident for the estimate with regard to the calculation of the corporate tax in view of fluctuations in currency rates.

State Revenues

The allocated revenues are assessed on a yearly basis.

Table 6.5 State Revenues 1985-1989, DKK million (1990)

	1985	1986	1987	1988	1989*)
Hydrocarbon Tax	578	0	0	0	0
Corporate Tax	153	802	827	0	259
Royalty	735	520	494	389	527
Profit Element	287	136	191	141	221
Total	*1,753*	*1,458*	*1,512*	*530*	*1,007*

*) Estimate

Settlement of the corporate tax takes place ten months subsequently to the year of income; the hydrocarbon tax is settled during the year of income; the royalty settlement six months after the year of income. The profit element of the oil pipeline tariff is settled monthly in arrears.

Table 6.6 Investments and Operational Costs 1990-1994, DKK billion (1990)

	1990	1991	1992	1993	1994
Oil Production (mio. m^3)	7.5	7.8	7.4	7.0	7.1
Natural Gas Production (bn. Nm^3)	3.2	3.6	3.7	3.9	4.0
Crude Oil Price USD/BBL	'19.0	21.0	23.0	25.0	27.0
Investments:					
Exploration:	0.4	0.2	0.4	0.3	0.1
Field Development	2.7	1.5	1.6	2.2	1.0
Natural Gas System	0.7	0.8	1.1	1.0	0.4
Operations:					
Production Plants	1.2	1.2	1.2	1.3	1.3
Natural Gas System	0.9	0.9	0.9	0.9	0.9
Oil Pipeline	0.1	0.1	0.1	0.1	0.1
Total	*6.0*	*4.7*	*5.2*	*5.6*	*3.6*

Table 6.7 State Revenues 1990-1994, DKK billion (1990)

	1990	1991	1992	1993	1994
Hydrocarbon Tax	0.0	0.0	0.0	0.0	0.0
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Corporate Tax	1.5	2.0	2.2	2.3	2.7
	(1.5)	(1.7)	(1.7)	(1.5)	(1.7)
Royalty	0.6	0.8	0.8	0.8	0.9
	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)
Profit Element	0.3	0.3	0.3	0.3	0.4
	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)
Total	*2.4*	*3.0*	*3.3*	*3.4*	*4.0*
	(2.5)	(2.6)	(2.6)	(2.4)	(2.6)

The total state revenues for the period 1972-1989 corresponds to DKK 8.8 billion, in 1990 prices which are allocated as follows:

– Corporate tax	DKK 2.3 billion
– Hydrocarbon tax	DKK 0.7 billion
– Royalty	DKK 4.6 billion
– Profit element	DKK 1.3 billion.

The hydrocarbon tax has not been applied since 1985, primarily as a result of the declining oil prices.

Based on the five year production forecast discussed in the foregoing the state revenues were calculated for the same period. The basic assumptions underlying these calculations are summarised in table 6.6.

An oil pricing schedule was applied implying rising oil prices during the forecast period from USD 19 per barrel in 1990 to USD 27 per barrel in 1994. In order to compensate for the uncertainties related to the oil pricing schedule the revenue calculations were also carried out using a constant oil price at USD 20 per barrel for the entire period. The revenues calculated based on the constant oil price are indicated in parenthesis in the compilation. The compilation is shown in table 6.7.

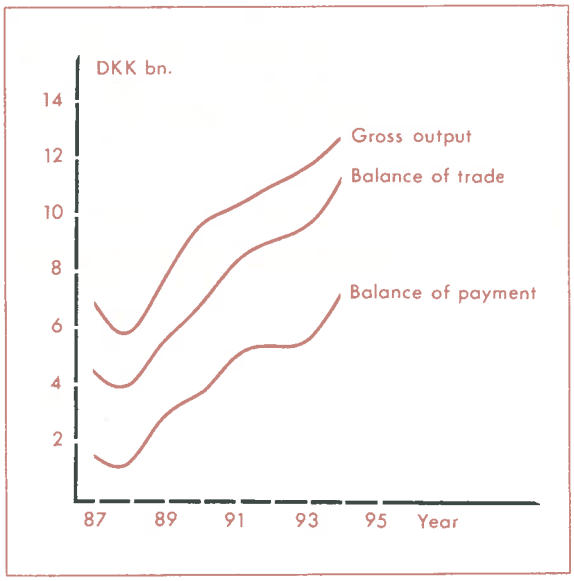
It is emphasised that the increasing oil pricing schedule does not imply the application of hydrocarbon tax for the period. The revenue under the corporate tax carries considerable uncertainty due to currency rate fluctuations.

Impact on the Balance of Payments

Based on the assumptions compiled in Table 6.6 the effects of the Danish oil and gas production were calculated on the balance of payment and trade respectively.

The balance of payment is improved as a result of the oil and gas production, partly due to export revenues and partly due to the savings of the foreign currency payments in conjunction with otherwise required energy imports. With this in mind the economic value of the production was calculated for the period 1987-1994. Subtraction of import costs related to investment and operations provides the effect on the balance of goods and services. Further subtraction of transfers of interest and returns abroad offers the opportunity to calculate the effect on the Balance of Payment. The results of the calculations are summarised in Table 6.8 and further illustrated in Figure 6.2.

Fig. 6.2 Impact on the Balance of Payment 1987-1994, DKK billion (1990)



It is emphasised that the underlying calculations are based on models with applied standard assumptions with regard to imports etc., hence not based on actual accounting statements and figures. This does not change the circumstance however, that Danish oil and gas production has a considerable beneficial effect on the Balance of Payment.

The state revenues in the long term are illustrated in Figure 6.3, both based on a rising oil pricing schedule from USD 20 per barrel to USD 38 per barrel in year 2010 and under a constant oil price for the entire period at USD 20 per barrel.

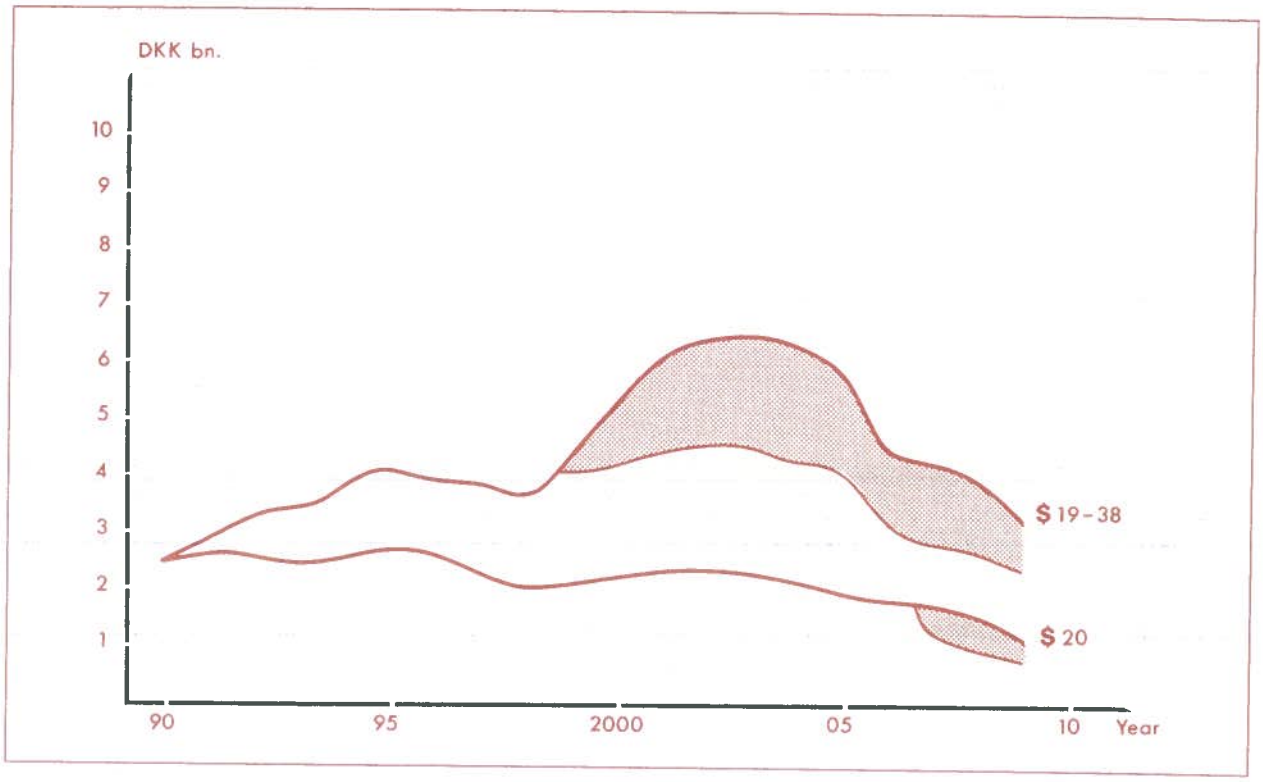
Discounting of the oil production was based on the 20 year production forecast including decided recovery. The disposal of the gas is based on the five year production forecast and the deliveries under the Agreement In Principle of 1989 between the Danish Underground Consortium and Dansk Naturgas A/S.

It becomes apparent that the magnitude of direct state revenues resulting from the oil and gas production are primarily dependent on the future development of the crude oil price.

Table 6.8 Impact on the Balance of Payments, DKK billion (1990)

	87	88	89	90	91	92	93	94
Gross Output Value	6.8	5.5	7.6	8.8	10.2	11.0	11.6	12.7
Import Content	2.1	1.9	1.8	2.3	1.6	1.9	2.1	1.3
Balance of Goods and Services	4.7	3.6	5.8	6.5	8.6	9.1	9.5	11.4
Transfer of Interests and Returns	3,0	2.7	26	3.0	3.4	3.6	4.3	4.1
Effect on Balance of Payment	1.7	0.9	3.2	3.5	5.2	5.5	5.2	7.3

Fig. 6.3 State Revenues 1990-2009, DKK billion (1990)



The Energy Agency provides supervision with regard to safety and working environment in offshore areas in conjunction with the exploration and production of oil and gas. The work is carried out in cooperation with the Marine Authorities regarding questions on mobile offshore facilities.

Supervision by the Agency is increasingly aimed at the application of the operator's internal control systems. Spot checks and system operation tests are conducted in order to ensure the reliability of functions at all levels. Particular emphasis is placed on the supervision of activities that are not part of the internal control system or in areas of inherent conflict of interest. During 1989 the Agency selected a few items with a view to more thorough regulatory control, inter alia including the performance of drilling activities simultaneously with production.

New Regulations

Guidelines for the Design of Unmanned Platforms

Continued marginal development in the Danish North Sea comprises unmanned well head platforms tied in to major processing facilities. As the previously existing guidelines only addressed the construction of major manned installations the requirement for new regulations with a view to the construction, installation and operation of unmanned structures becomes apparent.

In October, 1989 the Energy Agency issued the *Guidelines for design of unmanned structures*. The guidelines were authored in cooperation with Mærsk Olie og Gas A/S after liaison with certifying groups and companies including the trade unions. This procedure is novel and the resulting guidelines are the first of their kind in the North Sea area.

Working Environment

The regulatory work concerning safety and health on marine installations was continued during 1989 in pursuance of the *Act on Certain Marine Installations of 1981* in cooperation with the *Coordination Committee*.

The *Coordination Committee* completed their proposals with regard to the requirements for health officers and recreation facilities on mobile marine installations. The pertaining instructions will be effective as of January 15th, and April 1st., 1990 respectively.

EEC Coordination

The coordination in 1989 of safety regulations within the European Community included preparations of proposed guidelines or importance for marine installations; the work was performed by Danish Autohrities in cooperation with the Coordination Committee and comprises:

- Minimum requirements for safety and health at work.
- Minimum requirements for safety and health in conjunction with employees' use of machines, apparatus and installations.
- Minimum requirements for the use of personal safety equipment at work by employees.
- Construction of personal safety equipment.

Supervision of Mobile Offshore Facilities

During 1989 the Energy Agency initiated the preparation of guidelines under supervision for mobile offshore facilities. The work is carried out in pursuance of order No. 711, issued by the Minister of Energy in 1987 and entitled Safety etc., on Marine Installations.

The guidelines are primarily aimed at the assurance of the availability of documentation on the mobile facilities that the design, construction and operation are in accordance with current regulations and standards. This documentation shall include procedures for maintenance, work performance etc.

Regarding permanent facilities the operator assumes the supreme responsibility with regard to the availability of an internal contral system comprising all activities on the facility. Spot checks and other control measures are maintained by the Agency in order to ensure adherence to the control system by the operator.

Supervision of Permanent Offshore Facilities

The preparation of guidelines for internal control systems with regard to engineering, construction and installation of permanent facilities was initiated during 1988 and continued in 1989. Completion of this work is expected during 1990.

Safety And Working Environment

All permanent offshore installations were inspected by the Energy Agency during 1988 with emphasis placed on safety and working conditions, in particular with regard to fire protection procedures end equipment.

The organisation and mode of operation with regard to safety on the permanent offshore facilities follows the same regulations as those applicable onshore. This includes the establishment of a safety committee and a number of safety groups on each installation for the maintenance of safety for all work activities.

Procedures for Approval of Mobile Offshore Facilities

Approval for utilisation is required by the Energy Agency with regard to mobile offshore facilities.

Facilities under foreign registration are usually inspected prior to entry into Danish waters. Approval for utilisation requires that the facilities satisfy Danish regulations with regard to safety, working environment and maritime conditions.

The Energy Agensy issued approval for utilisation of the following mobile offshore facilities (drilling equipment) during 1989:

- Neddrill Trigon, Holland.
- Mærsk Endeavor, Denmark.
- Mærsk Guardian, Denmark.
- Glomar Baltic I, USA.
- Glomar Moray Firth I, USA.
- Shell Driller, UK.
- West Sigma, Norway.

Zeepipe

Statoil was granted approval in 1989 for the partly installation of a 40 inch gas pipeline in Danish waters. The pipeline will connect the Norwegian Troll and Sleipner Fields to Zeebrugge in Belgium and extend over the Danish North Sea sector along 20 kilometres located in the area adjacent to the UK sector.
Installation in Danish water is expected during 1991; implementation of the Zeepipe project is estimated during the summer of 1993.

Accidents and Injury

A total of 16 work accidents were reported in offshore activities during 1989, i.e. 11 on mobile and 5 on permanent installations respectively. There was no report of fatal accidents or serious personal injury during the year. In terms of accidents versus man hours the reported accident rate corresponds to 3.4 accidents per million work hours for the permanent installations and 12.7 accidents per million work hours for the mobile facilities. The accident frequency for the permanent installations are summarised in Table 7.1.

Table 7.1 Accident Frequency, Permanent Installations

	1984	1985	1986	1987	1988	1989
Accidents per million man hours	36	34	40	40	10	3.4

The decline in the accident frequency shall be seen in light of intensified information and educational activity.

Training

In conjunction with the licence awards under the 1st, 2nd and 3rd Rounds, agreements were made between the licence groups and the Ministry of Energy concerning research commitments and training/educational offers.

The utilisation of the educational activities as offered by the companies has taken place according to plan, three training commitments currently remain outstanding from the Danish 2nd Round.

The agreements on educational support by the companies furthermore provided scholarships with regard to oil and gas related studies at universities and organisations abroad, guest professorships in Denmark and the implementation of a video educational programme.

Research and Development

A total of DKK 80 million was allocated to research and development under the Danish 1st, 2nd and 3rd Rounds awards.
At the end of 1989 DKK 56 million had been used in conjunction with related project completion and initiation.

The funds were primarily allocated to:

- Geology and Geophysics
- Reservoir conditions
- Installation and Platforms
- Environmental protection
- Automation, sound and signals
- Computer software.

The Energy Research Programme, 1990.

The Energy Agency assumes the responsibility for the evaluation of project applications with regard to the oil and gas activities.

A total of 65 applications had been received at the expiry of the application period on the 1st August, 1989 with a combined request for financial support corresponding to DKK 159 million. The Ministry of Energy recommended financial support comprising 16 projects corresponding to DKK 14 million.

EEC Hydrocarbon Research Programme.

The collective annual financial support from the European Community corresponds to approximately DKK 290 million.

Project support may be provided up to 40 per cent of the total project cost. Four projects including Danish content received financial support from the EEC research programme during 1989.

Appendices

Concessionaires in Denmark

(31st. December, 1990)

Group	Share
Dansk Undergrunds Consortium (DUC):	
A.P. Møller (Concessionaires)	39.00%
Shell Olie- og Gasudvinding Danmark	46.00%
Texaco Denmark Inc.	15.00%
Mærsk Olie og Gas A/S is operator	
1st. Round:	
Amoco Denmark Exploration Co.	
Block 5504 (operator)	66.67%
FLS-Energy A/S	10.00%
DOPAS	23.33%
Amoco Denmark Exploration Co.	
Block 5611 (operator)	75.00%
FLS-Energy A/S	10.00%
DOPAS	15.00%
Britoil Danmark (operator)	38.75%
Amerada Hess (Denmark) A/S	38.75%
Dansk Landbrugs Grovvare-selskab a.m.b.a.	1.25%
Danoil Exploration A/S	1.19%
Olieselskabet Danmark a.m.b.a.	0.06%
DOPAS	20.00%
2nd Round:	
Agip Danmark Olie- og Gasefter-forskning ApS (operator)	40.00%
Fina Exploration Denmark S.A.	28.80%
ÖMV Erdöl-Aufsuchungsges. m.b.H.	11.20%
DOPAS	20.00%
Amoco Denmark Exploration Co.	
(operator)	75.00%
FLS-Energy A/S	5.00%
DOPAS	20.00%

Group	Share
Norsk Hydro Udforskning a.s.	
(operator)	19.50%
Enterprise Petroleum Ltd.	19.50%
Gas Council (Exploration) Ltd.	13.70%
Amerada Hess (Denmark) A/S	9.80%
Dansk Oliesøgning K/S	7.50%
Korn- og Foderstof Kompagniet A/S	2.50%
DENERCO K/S	7.50%
DOPAS	20.00%
DANOP is operator in licence no. 4/86, Dogger West	
Statoil Efterforskning og Produktion A/S (operator)	26.50%
BHP Petroleum Inc.	21.00%
Total Marine Danmark	12.00%
LD Energi A/S	7.50%
EAC Energy A/S	4.00%
DENERCO K/S	9.00%
DOPAS	20.00%
3rd. Round:	
A.P. Møller	26.66%
Shell Olie- og Gasudvinding Danmark	26.66%
Texaco Denmark Inc.	26.66%
DOPAS	20.00%
Mærsk Olie og Gas A/S is operator	
Amoco Denmark Exploration Co.	
(operator) Block 5603, 5504	70.00%
FLS-Energy A/S	5.00%
DENERCO K/S	5.00%
DOPAS	20.00%
Amoco Denmark Exploration Co.	
(operator) Block 5606, 5514, 5414	80.00%
FLS-Energy A/S	5.00%
DENERCO K/S	5.00%
DOPAS	10.00%

Appendix A

Group	Share
Elwerath Erdgas und Erdöl GmbH	14.17%
Brigitta Erdgas und Erdöl GmbH	15.15%
C. Deilmann AG	6.60%
Deutsche Schachtbau- und Tiefbohrgesellschaft GmbH	7.58%
RWE-DEA AG	5.15%
Elf Aquitaine Deutschland GmbH	8.70%
Wintershall AG	7.58%
Preussag AG	7.58%
DENERCO K/S	7.50%
DOPAS	20.00%
BEB is operator	
Danop is cooperator	
Cluff Oil plc. (operator)	63.00%
Zenith Resources Ltd.	27.00%
DOPAS	10.00%
Norsk Hydro Udforskning (operator)	21.75%
Du Pont E & P No. 6 B.V.	29.00%
Gas Council Ltd.	18.31%
Danoil Exploration A/S	1.81%
Korn- og Foderstof Kompagniet A/S	1.81%
DENERCO K/S	7.50%
DOPAS	20.00%
Danop is operator in licence 8/89	
Jordan Dansk Corporation	25.00%
G.B.T. Northern Corporation	60.00%
DENERCO K/S	5.00%
DOPAS	10.00%
Danop is operator	
RWE-DEA AG Block 5504	36.25%
Wintershall AG	36.25%
DENERCO K/S	7.50%
DOPAS	20.00%
Danop is operator	
RWE-DEA AG Block 5414	42.50%
Wintershall AG	42.50%
DENERCO K/S	5.00%
DOPAS	10.00%
Danop is operator	

Exploration and Appraisal Wells, 1978-1989

Well name Number	Operator Rig	Lat. North Long. East	Total depth Formation	Spud Completed
Tostrup-3	DONG	56°38'06"	1593 metres	1978-04-21
5609/10-3	DST SMG FB-291	09°24'06"		1978-05-26
Tostrup-3	DONG	56°38"06'	1593 metres	1978-04-21
5609/10-3	DST SMG FB-291	09°24"06'		1978-05-26
Tove-1	Chevron	55°15"17'	1878 metres	1978-08-09
5505/21-3	Mærsk Explorer	05°09"45'	U. Permian	1978-10-15
Vagn-2	Chevron	55°19"21'	1930 metres	1978-08-09
5505/21-2	Mærsk Explorer	05°09"44'	U. Permian	1978-09-04
Per-1	Chevron	55°47"30'	2781 metres	1978-10-18
5505/05-1	Mærsk Explorer	05°05"01'	Precambrian	1978-11-23
Års-1/1A	Dong	56°47"44'	3401 metres	1978-11-06
5606/07-1	CH 1400E	09°30"32'	U. Triassic	1979-09-03
Nils-1	Chevron	55°23"15'	2033 metres	1978-12-03
5505/17-5	Mærsk Explorer	05°13"37'	U. Permian	1979-02-19
Tostrup-4	Dong	56°39"06'	1610 metres	1979-03-10
5609/10-4	DST 1400/23	09°20"39'		1979-10-22
Dan M-9	Chevron	55°26"48'	2093 metres	1979-09-10
5505/17-6	Mærsk Explorer	05°06"33'	U. Cretaceous	1979-12-04
Linde-1	Elsam	56°26"04'	2237 metres	1979-11-22
5608/18-2	Cabot Franks 900	08°26"35'	U. Triassic	1980-01-24
Lulu-1	Chevron	56°20"03'	3720 metres	1980-01-03
5604/22-1	Sedco J.	04°17"37'	U. Permian	1980-09-17
Tostrup-5	Dong	56°38"32'	1609 metres	1980-04-21
5609/10-5	Ideco BIR-800	09°24"59'		1980-10-19
Stenlille-1	Dong	55°32"38'	1664 metres	1980-06-07
5511/15-1	Ideco BIR-800	11°37"06'	U. Triassic	1980-07-10
Tostrup-6	Dong	56°38"24'	1614 metres	1980-07-14
5609/10-6	Ideco BIR-800	09°25"17'		1980-08-27
Løgumkloster-1	Dansk Boreselskab	55°02"33'	2724 metres	1980-07-31
5508/32-1	Deutag T-14	08°57"04'	Ordovician	1980-10-31
Tostrup-7	Dong	56°38"40'	1746 metres	1980-08-30
5609/10-7	Ideco BIR-800	09°25"22'		1980-10-13
Tønder-3	Dansk Boreselskab	54°57"30'	1840 metres	1980-10-10
5408/04-3	Deutag T-14	08°51"28'	L. Triassic	1980-11-10
Varnæs-1	Dansk Boreselskab	55°02"13'	2236 metres	1980-11-20
5509/31-1	Deutag T-14	09°35"32'	Pre U.Permian	1980-12-23
Adda-2	Chevron	55°48"20'	2743 metres	1981-01-03
5504/08-2	Dyvi Beta	04°50"41'	U. Jurassics	1981-03-03
Brøns-1/1A	Dansk Boreselskab	55°12"04'	2539 metres	1981-01-11
5508/27-1	Deutag T-14	08°44"08'	Pre U.Permian	1981-04-11
Midt Rosa-1	Chevron	55°35"39'	2143 metres	1981-03-16
5504/15-2	Dyvi Beta	04°30"05'	U. Permian	1981-06-06
Tostrup-8	Dong	56°38"20'	1435 metres	1981-05-31
5609/10-8	Ideco BIR-8085	19°24"56'		1981-07-14
Tostrup-9	Dong	56°38"10'	1456 metres	1981-07-19
5609/10-9	Ideco BIR-8085	09°25"15'	1981-08-30	
Roar-2/2A	Chevron	55°45"10'	2683 metres	1981-08-08
5504/07-3	Dyvi Beta	04°39"56'	L. Cretaceous	1981-11-07
Tostrup-10	Dong	56°38"14'	1594 metres	1981-09-03
5609/10-10	Ideco BIR-8085	09°24"34'		1981-10-21
Farsø-1	Dong	56°46"53'	2952 metres	1981-10-22
5609/06-2	Ideco BIR-8055	09°21"50'	U. Triassic	1982-01-24
Otto-1	Chevron	56°09"07'	2682 metres	1981-12-21
5604/25-2	Dyvi Beta	04°11"23'	U. Permian	1982-03-20

Well name Number	Operator Rig	Lat. North Long. East	Total depth Formation	Spud Completed
Thisted-2	Dong	56°57"56'	3287 metres	1982-02-04
5608/03-1	Ideco BIR-8085	08°42"57'	Triassic	1982-03-28
Jens-1	Chevron	55°42"49'	4420 metres	1982-03-24
5504/11-2	Dyvi Beta	04°32"12'	Triassic	1982-09-23
Boje-1	Chevron	55°50"02'	2779 metres	1982-04-01
5504/07-4	Dan Earl	04°40"40'	U. Jurassic	1982-06-08
Mona-1	Chevron	56°16"36'	4239 metres	1982-10-03
5604/21-1	Dyvi Beta	04°00"16'	U. Jurassic	1983-02-09
Emma-1	Chevron	55°29"31'	2736 metres	1982-10-26
5505/18-1	Mærsk Explorer	05°21"28'	Triassic	1982-11-28
Søllested-1	Dansk Boreselskab	54°48"05'	2694 metres	1982-10-27
5411/06-1	Deutag T-14	11°17"55'	L. Permian	1982-12-11
Dan M-10	Dansk Boreselskab	55°28"30'	2018 metres	1982-12-16
5505/17-7	Mærsk Explorer	55°05"07'	Cretaceous	1983-02-16
Elin-1	Chevron	55°56"51'	4719 metres	1983-01-27
5504/02-1	Dyvi Epsilon	04°22"21'	U. Jurassics	1983-04-27
Tønder-5	Dong	54°57"03'	1915 metres	1983-02-13
5408/04-4	National 80 U	08°49"55'	L. Triassicsic	1983-03-09
Sten-1	Chevron	56°07"48'	4115 metres	1983-02-17
5603/27-1	Dyvi Beta	03°37"35'	Jurassic	1983-04-17
Sydøst Igor-1	Chevron	55°33"55'	3297 metres	1983-02-20
5505/14-1	Mærsk Explorer	05°16"02'	U. Jurassics	1983-04-01
Tønder-4	Dong	54°57"35'	1870 metres	1983-03-13
5408/04-5	National 80 UE	08°50"50'	L. Triassic	1983-03-30
Olaf-1	Dansk Boreselskab	55°58"21'	4395 metres	1983-04-17
5503/03-1	Mærsk Explorer	03°44"06'	Jurassic	1983-07-26
Nord Arne T-3	Chevron	56°10"44'	2819 metres	1983-04-23
5604/25-3	Dyvi Beta	04°10"48'	U. Permian	1983-07-07
Øst Rosa-1	Chevron	55°34"47'	1525 metres	1983-05-01
5504/15-3	Dyvi Epsilon	04°36"41'	U. Permian	1983-07-03
Midt Rosa-2	Chevron	55°36"18'	2069 metres	1983-07-07
5504/14-1	Dyvi Epsilon	04°29"21'	U. Permian	1983-09-08
Edna-1	Chevron	55°39"12'	4125 metres	1983-07-12
5504/10-1	Mærsk Endeavour	04°25"12'	Triassic	1983-10-08
Karl-1	Chevron	56°17"43'	4717 metres	1983-07-12
5604/21-2	Dyvi Beta	04°03"12'	L. Permian	1983-10-04
Hans-1	Dansk Boreselskab	56°21"55'	3031 metres	1983-08-04
5612/21-1	Mærsk Explorer	12°00"51'	Permian	1983-10-09
Thisted-3	Dong	56°57"59'	1242 metres	1983-08-10
5608/03-2	Kenting 21E	08°44"26'	Trias./Juras.	1983-08-26
Vest Lulu-1	Chevron	56°20"26'		1983-09-11
5604/21-3	Dyvi Epsilon	04°13"28'		1984-01-18
Nora-1	Chevron	55°58"09'		1983-10-10
5504/02-2	Dyvi Beta	04°24"04'		1984-02-28
John-1	Chevron	55°24"48'	817 metres	1983-10-24
5504/20-1	Mærsk Endeavour	04°48"45'	U. Permian	1983-11-10
Øst Rosa-2	Chevron	55°35"14'		1983-11-14
5504/15-4	Mærsk Endeavour	04°35"08'		1984-01-25
Kraka A-3	Chevron	55°23"38'		1984-01-31
5505/17-8	Mærsk Endeavour	05°04"47'		1984-06-04
Cleo-1	Chevron	56°23"23'		1984-02-06
5604/18-1	Dyvi Epsilon	04°25"23'		1984-04-29
Gert-1	Chevron	56°13"09'		1984-05-01
5603/27-2	Dyvi Epsilon	03°43"57'		1984-07-29

Appendix B

Well name Number	Operator Rig	Lat. North Long. East	Total depth Formation	Spud Completed
Elly-1	Chevron	55°47″15′		1984-06-08
5504/06-1	Mærsk Endeavour	04°17″40′		1984-08-15
Liva-1	Chevron	55°55″32′		1984-08-02
5503/04-1	Dyvi Epsilon	03°49″31′		1984-09-30
Adda-3	Chevron	55°47″50′		1984-08-31
5504/08-3	Dan Earl	04°53″26′		1984-10-25
Nils-2	Chevron	55°23″10′		1984-10-31
5505/17-9	Dan Earl	05°13″41′		1984-12-29
Iris-1	Britoil	56°06″45′		1984-11-05
5604/30-1	Dan King	04°18″21′	Jurassic	1985-02-24
Dyb Adda-1	Chevron	55°48″13′		1985-01-01
5504/08-4	Dan Earl	04°58″24′		1985-02-17
Vest Lulu-2	Chevron	56°19″48′		1985-02-21
5604/21-4	Dan Earl	04°12″13′		1985-04-23
Gert-2	Chevron	56°11″50′		1985-02-27
5603/28-1	Mærsk Endeavour	03°46″50′		1985-07-29
Elna-1	Chevron	56°26″55′		1985-05-01
5604/19-1	Dan Earl	04°31″43′		1985-06-14
Ugle-1	BP	55°43″15′	3057 metres	1985-05-07
5505/09-2	Transocean 7	05°12″10′	Paleozoic	1985-06-24
Thisted-4	Amoco	57°01″19′	3418 metres	1985-05-19
5708/31-2	Kenting 31	08°42″07′	Permian	1985-07-18
Terne-1	Amoco	56°20″39′	3361 metres	1985-05-29
5611/23-1	Dyvi Epsilon	11°30″20′	Pre-/Cambrian	1985-08-16
John Flanke-1	Chevron	55°24″28′		1985-06-20
5504/20-2	Dan Earl	04°50″10′		1985-07-19
Lone-1	Chevron	56°08″35′		1985-06-30
5603/27-3	Mærsk Endeavour	03°31″58′		1985-09-03
Kværs-1	Mærsk Olie og Gas	54°56″28′		1985-07-27
5409/02-1	Kenting 31	09°28″49′		1985-09-09
Nord Jens-1	Chevron	55°49″59′		1985-08-07
5504/07-5	Mærsk Endeavour	04°33″35′		1985-11-12
Sæby-1	Dopas	57°21″24′	1854 metres	1985-08-07
5710/22-1	Boldon-41	10°23″44′	Paleozoic	1985-08-28
Kegnæs-1	Texaco	54°50″51′	2591 metres	1985-08-21
5410/05-1	Dyvi Epsilon	10°05″15′	U. Permian	1985-10-05
Skive-2	BP	56°35″37′	1456 metres	1985-09-02
5609/13-1	Boldon-41	09°00″21′	U. Triassic	1985-09-25
Vest Lulu-3	Chevron	56°20″58′		1985-09-12
5604/21-5	Mærsk Endeavour	04°12″34′		1985-12-11
Kim-1	Chevron	56°07″02′		1985-10-03
5603/30-1	Glomar Labrador 1	03°29″53′		1985-12-31
Nord Jens-2	Chevron	55°49″59′		1985-11-16
5504/07-6	Mærsk Endeavour	04°33″36′		1985-12-28
Lulu-2	Mærsk Olie og Gas	56°19″06′		1985-12-15
5604/22-2	Mærsk Endeavour	04°17″31′		1986-03-18
Diamant-1	Phillips	56°00″23′	4242 metres	1986-01-10
5603/32-2	Glomar Labrador 1	03°53″44′	L. Permian	1986-03-18
Øst Rosa-3	Mærsk Olie og Gas	55°35″36′		1986-01-20
5504/15-5	Dyvi Epsilon	04°36″31′		1986-03-10
Ravn-1	Amoco	55°52″35′	5013 metres	1986-03-24
5504/01-2	Dyvi Epsilon	04°13″52′	Permian	1986-07-17

Well name Number	Operator Rig	Lat. North Long. East	Total depth Formation	Spud Completed
Øst Rosa Fl.-1	Mærsk Olie og Gas	55°33″51′		1986-03-24
5504/15-6	Mærsk Endeavour	04°37″50′		1986-04-30
Midt Rosa Fl.-1	Mærsk Olie og Gas	55°35″27′		1986-05-04
5504/15-7	Mærsk Endeavour	04°31″33′		1986-06-11
Vest Lulu-4	Mærsk Olie og Gas	56°19″05′		1986-07-27
5604/21-6	Mærsk Endeavour	04°10″16′		1986-09-12
Gwen-2	Mærsk Olie og Gas	56°06″52′		1986-09-30
5604/29-3	Mærsk Endeavour	04°04″10′		1986-12-15
Mejrup-1	Phillips	56°22″39′	2532 metres	1987-03-22
5608/19-1	Kenting 36	08°40″36′	Triassic	1987-04-29
Felicia-1	Statoil	57°26″18′	5321 metres	1987-07-03
5708/18-1	Mærsk Guardian	08°18″41′	Permian	1987-12-03
Gert-3	Mærsk Olie og Gas	56°12″43′		1987-07-21
5603/28-2	Mærsk Endeavour	03°45″49′		1987-10-28
Stenlille-2	Danop	55°32″17′		1987-07-27
5511/15-2	Kenting 36	11°36″18′		1987-08-28
Ibenholt-1	Phillips	56°23″26′	2599 metres	1987-08-11
5605/20-1	Dyvi Sigma	05°58″29′	Precambrian	1987-09-24
Dyb Gorm-1	Mærsk Olie og Gas	55°34″04′		1987-08-18
5504/16-5	Zapata Scotian	04°45″50′		1987-12-04
Stenlille-3	Danop	55°32″17′		1987-08-30
5511/15-3	Kenting 36	11°36″18′		1987-09-16
Ravn-2	Amoco	55°50″35′	4507 metres	1987-09-16
5504/05-1	Dan Earl	04°13″41′	Triassic	1987-11-17
Tostrup-11	Danop	56°37″55′		1987-10-10
5609/10-11	Kenting 36	09°25″24′		1987-11-07
Elly-2	Mærsk Olie og Gas	55°47″19′		1987-11-15
5504/06-2	Neddrill Trigon	04°19″05′		1988-05-31
Jeppe-1	Norsk Hydro	56°11″04′	5050 metres	1987-12-10
5603/28-3	Mærsk Guardian	03°54″36′	Permian	1988-03-02
Borg-1	Danop	55°02″57′	3074 metres	1988-04-18
5508/32-2	Kenting 34	08°48″23′	Paleozoic	1988-05-29
Gulnare-1	Statoil	56°10″13′	4735 metres	1988-06-02
5604/26-1	Mærsk Endeavour	04°26″41′	Jurassic	1988-09-19
Stenlille-4	Danop	55°31″06′		1988-07-19
5511/15-4	Kenting 36	11°35″14′		1988-08-09
Stenlille-5	Danop	55°32″08′		1988-08-14
5511/15-5	Kenting 36	11°37″33′		1988-09-03
Stenlille-6	Danop	55°33″29′		1988-09-07
5511/15-6	Kenting 36	11°39″09′		1988-09-27
Tordenskjold-1	Danop	55°56″19′	3703 metres	1988-12-14
5503/03-2	Neddrill Trigon	03°32″31′	L. Permian	1989-02-04
Pernille-1	Norsk Hydro	55°00″54′		1989-06-12
5514/30-1	Glomar Moray Firth	14°18″43′		1989-06-06
Stina-1	Amoco	54°47″20′		1989-06-12
5414/7-1	Glomar Moray Firth	14°37″44′		1989-07-11
Falk-1	Amoco	55°50″01′		1989-07-23
5504/6-3	Glomar Moray Firth	04°18″50′		1989-09-05
Gert-4	Mærsk Olie og Gas	56°13″18′		1989-11-02
5603/27-4	Mærsk Endeavour	03°43″48′		

Exploratory Surveys, 1989

Survey	Operator Contractor	Type	Initiated Terminated	Area	Acquistion
Seismic Surveys					
AM89C	Amoco Denmark Teledyne Exploration	Offshore 3D	1989-03-22 1989-04-20	Central Graben	798 km
AM89C	Amoco Norway	Offshore	1989-09-27	Central Graben	30 km
BE89C	BEB Erdöl u. Erdgas Prakla Seismos AG	Offshore 3D	1989-05-27 1989-06-16	Central Graben	633 km
DK89C	Mærsk Olie og Gas A/S Western Geophysical	Offshore	1989-03-18 1989-04-09	Central Graben	1.267 km
LG89K	Lab. f. Geofysik	Offshore	1989-09-09 1989-09-14	Kattegat	760 km
NP89C	Nopec A/S (spekulativ) CGG	Offshore	1989-12-02	Central Graben	390 km

Appendix D

Danish Oilproduction 1972-1989, million m^3

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	0.65	*5.41*
1988	1.50	1.35	1.37	0.95	0.40	*5.57*
1989	1.47	1.35	2.21	1.05	0.40	*6.48*
Total	*9.10*	*13.36*	*7.79*	*3.83*	*1.90*	*35.98*

Danish Gasproduction 1972-1989, billion Nm^3

Year	Dan	Gorm	Skjold	Tyra	Rolf	*Total*	Sold
1972	0.02					*0.02*	
1973	0.03					*0.03*	
1974	0.03					*0.03*	
1975	0.06					*0.06*	
1976	0.07					*0.07*	
1977	0.17					*0.17*	
1978	0.16					*0.16*	
1979	0.16					*0.16*	
1980	0.07					*0.07*	
1981	0.08	0.08				*0.16*	
1982	0.08	0.27				*0.35*	
1983	0.08	0.43	0.04			*0.55*	
1984	0.13	0.51	0.06	0.26		*0.96*	0.22
1985	0.21	0.65	0.08	1.12		*2.06*	1.04
1986	0.24	0.78	0.10	1.63	0.02	*2.77*	1.80
1987	0.44	0.88	0.10	2.65	0.03	*4.10*	2.30
1988	0.60	0.98	0.11	3.36	0.02	*5.07*	2.27
1989	0.71	0.89	0.19	3.52	0.02	*5.32*	2.68
Total	*3.35*	*5.47*	*0.68*	*12.54*	*0.09*	*22.12*	*10.31*

Part of the gas has been reinjected

Danish Production of Oil and Condensate, 1989 thousands

	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	*1989*
Dan	114	101	118	114	118	123	127	126	125	126	137	144	*1473*
Gorm	109	107	116	125	115	114	116	113	99	107	109	120	*1350*
Skjold	168	158	177	190	197	181	188	194	191	194	188	188	*2214*
Tyra	102	95	91	91	88	68	63	87	81	89	97	97	*1049*
Rolf	27	23	27	35	38	38	40	37	34	35	31	29	*394*
Total	*520*	*484*	*529*	*555*	*556*	*524*	*534*	*557*	*530*	*551*	*562*	*578*	*6480*

Danish Gas Production, 1989 million Nm^3

	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	*1989*
Dan	52	48	56	54	54	57	62	61	59	63	68	71	*705*
Gorm	79	73	81	75	73	67	76	72	61	71	74	90	*892*
Skjold	14	13	15	15	16	16	17	17	17	18	17	16	*191*
Tyra	356	325	290	302	295	217	202	298	268	307	335	324	*3519*
Rolf	1	1	1	1	2	2	2	2	2	1	1	1	*17*
Total	*502*	*460*	*443*	*447*	*440*	*359*	*359*	*450*	*407*	*460*	*495*	*502*	*5324*

Appendix D

Domestic Energy Consumption 1972-89, Distributed on Fuels, Energy Production and Rate of Self-sufficiency (mio.t.o.e)

	Oil	Gas	Coal	Alternative Energy	*Total*	Energy. Prod.	Self-sufficiency
1972	17.7	-	1.2	0.2	*19.1*	0.3	2
1973*)	17.4	-	1.9	0.2	*19.5*	0.3	2
1974*)	15.9	-	1.7	0.2	*17.8*	0.3	2
1975	15.2	-	2.1	0.3	*17.6*	0.4	2
1976	15.9	-	2.8	0.3	*19.0*	0.5	2
1977	16.0	-	3.2	0.3	*19.5*	0.8	4
1978	16.0	-	4.0	0.3	*20.3*	0.7	4
1979	15.9	-	4.7	0.4	*21.0*	0.8	4
1980	13.1	-	5.8	0.4	*19.3*	0.7	4
1981	11.6	0.0	6.0	0.5	*18.0*	1.3	7
1982	10.9	0.0	6.2	0.5	*17.6*	2.3	13
1983	10.2	0.0	6.6	0.6	*17.4*	2.9	16
1984	10.1	0.2	7.1	0.6	*18.0*	3.3	18
1985	10.5	0.6	7.3	0.7	*19.1*	4.7	25
1986	10.1	1.1	7.4	0.8	*19.4*	6.3	33
1987	9.6	1.5	7.7	0.9	*19.7*	7.9	40
1988	9.0	1.6	7.6	0.9	*19.1*	8.1	42
1989*)	8.6	1.8	7.5	1.0	*18.9*	9.3	49

Climatic correction has not been considered. This survey indicates gross energy consumption i.e. including shrinkage.

Domestic Energy Consumption 1972-1989 Distributed on Utilization (mio. t.o.e.)

	Residential	Process	Transport	El Appliances	Non-energy	Total
1972	7.3	4.9	3.3	2.6	1.0	*19.1*
1973*)	7.5	5.2	3.3	2.6	0.9	*19.5*
1974*)	6.3	4.9	3.1	2.6	0.9	*17.8*
1975	6.3	4.6	3.2	2.6	0.9	*17.6*
1976	6.9	5.0	3.3	2.9	0.9	*19.0*
1977	7.0	5.2	3.3	3.1	0.9	*19.5*
1978	7.0	5.5	3.6	3.3	0.9	*20.3*
1979	7.4	5.8	3.6	3.3	0.9	*21.0*
1980	6.3	5.5	3.4	3.3	0.8	*19.3*
1981	5.7	5.0	3.2	3.4	0.7	*18.0*
1982	5.6	4.7	3.3	3.3	0.7	*17.6*
1983	5.3	4.6	3.4	3.3	0.8	*17.4*
1984	5.3	4.9	3.6	3.4	0.8	*18.0*
1985	6.1	5.0	3.6	3.5	0.9	*19.1*
1986	6.0	5.2	3.7	3.6	0.9	*19.4*
1987	6.1	5.1	3.8	3.7	1.0	*19.7*
1988	5.4	5.2	3.7	3.8	1.0	*19,1*
1989*)	5.1	5.3	3.7	3.8	1.0	*18.9*

Including shrinkage, climatic correction has not been considered in this survey.

**) Estimates.*

Field name:	**Dan**
Prospect:	Abby
Location:	Block 5505/17
Concessionaire:	A.P. Møller
Operator:	Mærsk Olie & Gas A/S
Discovered:	1971
Year on stream:	1972
Producing wells:	47
Injection wells:	1
Water depth:	40 m (131 ft)
Acreage:	30 km^2 (7,400 acres)
Reservoir depth:	1,850 m (6,070 ft)
Reservoir rock:	Chalk (Danian/Maastricht.)

Reserves Expectation

Oil:	45 million m^3 (283 MM bbls)
Gas:	17 billion Nm^3 (633 BSCF)

Cumulative Production

Oil:	9.1 million m^3 (57 MM bbls)
Gas:	3.4 billion Nm^3 (127 BSCF)

Review of Geology

Dan is an anticlinal structure induced through salt tectonics of the Zechstein/Triassic. The chalk reservoir has an adequate porosity, although strongly reduced permeability. A major northeast-southwest fault divides the field into two independent reservoirs.

Production Facilities

The field installation comprises five well head platforms (A, D, E, FA and FB), two processing/accommodation platforms (B and FC) and one gas flare stack (C).

Processing of the produced oil and gas mainly takes place at Dan FC, the older processing facilities at Dan B are only used for temporary, individual well production testing. Final processing of the produced oil is performed at Dan FC prior to export ashore via the booster platform at Gorm E. The Gas is pre-processed at Dan FC and further transported to Tyra East for final processing and export ashore. Water treatment and pumping facilities for water injection were also installed at Dan FC. The accommodation capacity at the Dan Field corresponds to 91 persons.

Field name:	**Gorm**
Prospect:	Vern
Location:	Blocks 5504/15 and 16
Concessionaire:	A.P. Møller
Operator:	Mærsk Olie & Gas A/S
Discovered:	1971
Year on stream:	1981
Producing wells:	21
Gas injection wells:	2
Water injection wells:	3
Water depth:	39 m (128 ft)
Acreage:	12 km^2 (3,000 acres)
Reservoir depth:	2,200 m (7,218 ft)
Reservoir rock:	Chalk (Danian/Maastricht.)

Reserves Expectation

Oil:	26 million m^3 (164 MM bbls)
Gas:	6 billion Nm^3 (223 MSCF)

Cumulative production

Oil:	13.4 million m^3 (84 MM bbls)
Sales gas:	0.3 billion Nm^3 (11 BSCF)
Injection gas:	5.2 billion Nm^3 (194 BSCF)

Review of Geology

Gorm is an anticlinal structure due to Zechstein salt tectonics. A major fault extending north-south divides the field into two individual reservoirs. The western reservoir block is considerably fractured.

Production Facilities

The Gorm Field consists of two wellhead platforms (A and B), one processing/accommodation platform (C), one gas flare stack (D) and one riser/booster platform (E).

Appendix E

Final processing of oil and gas takes place at Gorm C prior to export ashore via Gorm E (oil) and Tyra East (gas). The gas reinjection facilities are installed at Gorm C. Total accommodation facilities correspond to 98 persons.

Field name:	**Skjold**
Prospect:	Ruth
Location:	Block 5504/16
Concessionaire:	A.P. Møller
Operator:	Mærsk Olie & Gas A/S
Discovered:	1977
Year on stream:	1982
Producing wells:	2
Water injection wells:	3
Observation well:	1
Water depth:	40 m (131 ft)
Acreage:	10 km^2 (2,500 acres)
Reservoir depth:	1,600 m (5,250 ft)
Reservoir rock:	Chalk (Danian/Maastricht.)

Reserves Expectation

Oil:	29 million m^3 (182 MM bbls)
Gas:	3 billion Nm^3 (112 BSCF)

Cumulative Production

Oil:	7.8 million m^3 (49 MM bbls)
Gas:	0.7 billion Nm^3 (26 BSCF)

Review of Geology

The Skjold Field is an anticlinal structure induced through Zechstein salt tectonics. The structure is heavily fractured which has resulted in favourable reservoir conductivity, in particular within the crestal part of the structure.

Production Facilities

The Skjold Field comprises a satellite development to the Gorm Field, including one unmanned well platform. The produced oil and gas are transported by pipeline to Gorm C for processing and export ashore.

Temporary water treatment and injection facilities have been installed on a modified jack-up drilling rig attendant to the Skjold wellhead platform.

Field name:	**Tyra**
Prospect:	Cora
Location:	Blocks 5504/11 and 12
Concessionaire:	A.P. Møller
Operator:	Mærsk Olie & Gas A/S
Discovered:	1968
Year on stream:	1984
Producing wells:	29
Gas injection wells:	8
Water depth:	37-40 m (121-131 ft)
Acreage:	52 km^2 (12,800 acres)
Reservoir depth:	2,000 m (6,562 ft)
Reservoir rock:	Chalk (Danian/Maastricht.)

Reserves Expectation

Oil:	2 million m^3 (13 MM bbls)
Condensate:	11 million m^3 (69 MM bbls)
Gas:	46 billion Nm^3 (1.7 TSCF)

Cumulative Production

Oil	0.7 million m^3 (4.4 MM bbls)
Condensate:	3.1 million m^3 (19.5 MM bbls)
Sales Gas:	8.9 billion Nm^3 (331 BSCF)
Injection gas:	3.6 billion Nm^3 (134 BSCF)

Review of Geology

The Tyra Field is an anticlinal structure, probably related to tectonic inversion or salt tectonics or both. A marked hardground separates the Danian and the Maastrichtian chalk reservoir rocks.

Production Facilities

The production facilities include two major production complexes, Tyra West and Tyra East, each consisting of two wellhead platforms, one processing/accommodation platform, and one gas flare stack; a riser platform at Tyra East houses the gas export outlet into the main gas pipeline.

Final processing of gas and stabilization of condensate take place at Tyra East. The stabilized condensate is transported to Gorm E for export ashore. Gas recycling facilities have been installed at Tyra West for enhanced condensate recovery.

The total accommodation facilities at the Tyra Field hold 176 persons (96 at Tyra East and 80 at Tyra West).

Field name:	**Rolf**
Prospect:	Middle Rosa
Location:	Blocks 5504/14 and 15
Concessionaire:	A.P. Møller
Operator:	Mærsk Olie & Gas A/S
Discovered:	1981
Year on stream:	1986
Producing well:	1
Observation well:	1
Water depth:	34 m (112 ft)
Acreage:	5 km^2 (1200 acres)
Reservoir depth:	1,800 m (5,900 ft)
Reservoir rock:	Chalk (Danian/Maastricht.)

Reserves Expectation

Oil:	3 million m^3 (19 MM bbls)
Gas:	1 billion Nm^3 (37 BSCF)

Cumulative Production

Oil:	1.9 million m^3 (12 MM bbls)
Gas:	0.1 billion Nm^3 (4 BSCF)

Review of Geology

Rolf is an anticlinal structure due to Zechstein salt tectonics. The chalk reservoir is heavily fractured resulting in favourable reservoir conductivity (compare Skjold).

Production Facilities

The Rolf Field is a satellite development to the Gorm Field with an unmanned wellhead platform. The produced oil and gas are transported to the Gorm C platform via pipeline.

Field name:	**Dagmar**
Prospect:	East Rosa
Location:	Block 5504/15
Concessionaire:	A.P. Møller
Operator:	Mærsk Olie & Gas A/S
Discovered:	1983
Year on stream:	1991 (planned)
Producing wells:	2
Water depth:	34 m (112 ft)
Acreage:	9 km^2 (2.200 acres)
Reservoir depth:	1.400 m (4.600 ft)
Reservoir rock:	Chalk (Danian/Maastricht.)

Reserves Expectation

Oil:	3 million m^3 (19 MM bbls)
Gas:	1 billion Nm^3 (37 BSCF)

Review of Geology

The Dagmar field is an anticlinal structure, induced through Zechstein salt tectonics. The structure is heavily fractured, resulting in favourable reservoir conductivity.

Production Facilities

The Dagmar field will be developed as a satellite to Gorm including one unmanned production platform of the STAR type.

The produced oil and gas will be transported to a new platform Gorm F for processing and export ashore.

Appendix E

Field name: Valdemar

Prospect:	Bo, Boje, North Jens
Location:	Block 5504/7 and 11
Concessionaire:	A.P. Møller
Operator:	Mærsk Olie & Gas A/S
Discovered:	1977 (Bo), 1982 (Boje) and 1985 (North Jens)
Year on stream:	1991 (planned)
Producing wells:	4
Water depth:	38 m (125 ft)

Upper Cretaceous reservoir:

Acreage:	16 km^2 (4,000 acres)
Reservoir depth:	2,000 m (6,560 ft)
Reservoir rock:	Chalk

Lower Cretaceous reservoir:

Acreage:	200 km^2 (50.000 acres)
Reservoir depth:	2,600 m (8,530 ft)
Reservoir rock:	Limestone

Reserves Expectation

Oil:	12 million m^3 (76 MM bbls)
Gas:	19 billion Nm^3 (708 BSCF)

Review of Geology

Valdemar is comprised by several separate reservoirs, i.e. oil and gas reservoirs in chalk of Danian/Maastrichtian and Campanian age and oil reservoirs in limestone of Aptian/Barremian age (Tuxen formation). The properties of the Upper Chalk reservoirs are comparable to other Danish fields as Gorm and Tyra, while the Aptian/Barremian limestones possess very difficult production properties. Some fracturing has been indicated in certain areas of the limestone reservoir, which improves the productivity.

Production Facilities

Valdemar will be developed as a satellite to Tyra, including an unmanned production platform of the STAR type. The produced oil and gas is transported to Tyra East for processing and export ashore.

Field name: Kraka

Prospect:	Anne
Location:	Block 5505/17
Concessionaire:	A.P. Møller
Operator:	Mærsk Olie & Gas A/S
Discovered:	1966
Year on stream:	1990 (planned)
Producing wells:	2
Water depth:	45 m (148 ft)
Acreage:	50 km^2 (12,500 acres)
Reservoir depth:	1,800 m (5,900 ft)
Reservoir rock:	Chalk (Danian/Maastricht.)

Reserves Expectation

Oil:	4 million m^3 (25 MM bbls)
Gas:	2 billion Nm^3 (75 MSCF)

Review of Geology

Kraka is an anticlinal structure induced through Zechstein salt tectonics, which has to a certain degree caused fracturing in the chalk. The chalk reservoir has adequate porosity, although reduced permeability. The thin oil pay zone is further characterized by high water saturations.

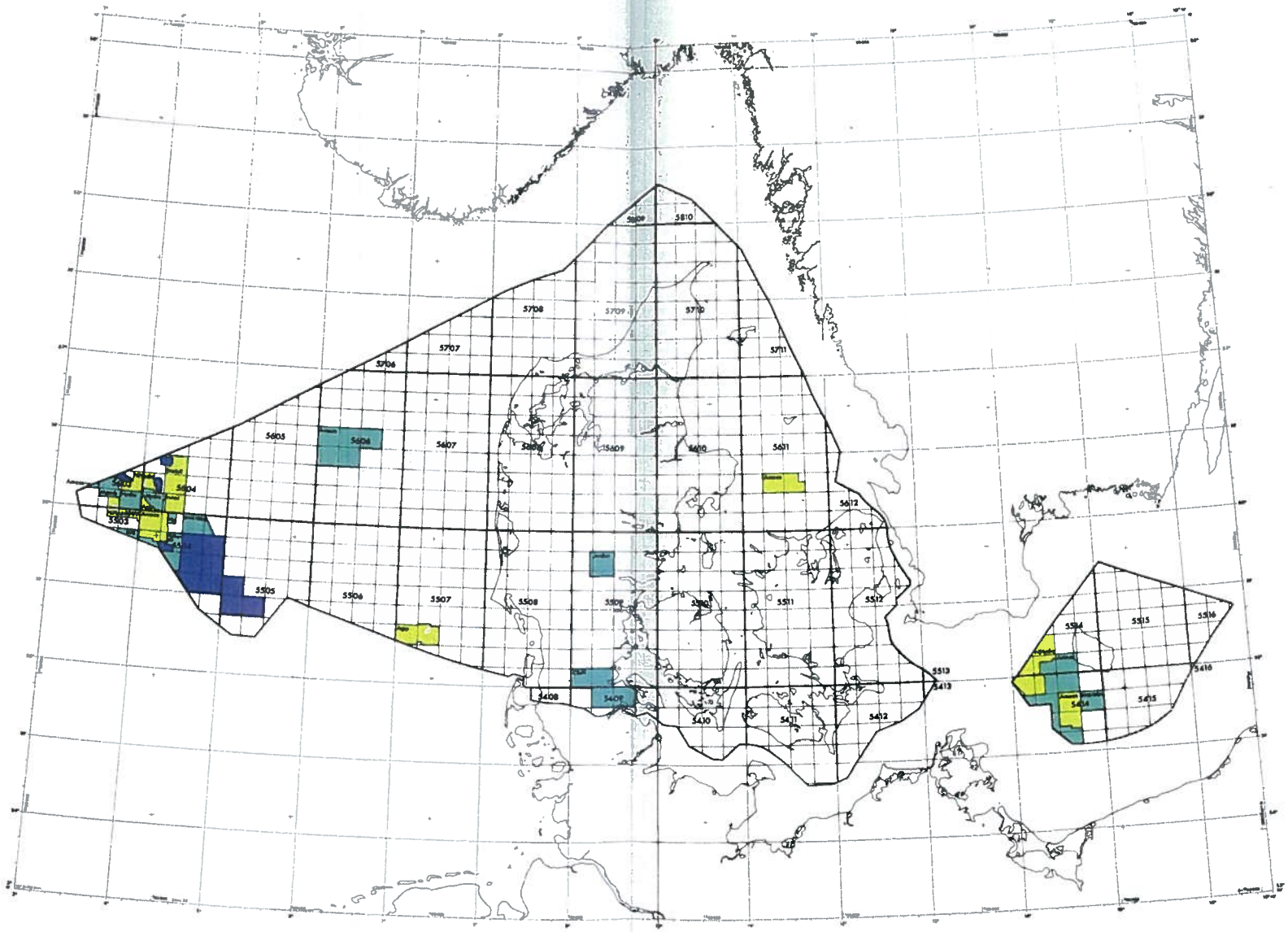
Production Facilities

Kraka will be developed as a satellite to Dan, including an unmanned production platform of the STAR type. The produced oil and gas is transported to Dan FC for processing and export ashore.

Prospect and Field Designations

Prospect Name	Field Name
Abby	Dan
Vern	Gorm
Cora	Tyra
Ruth	Skjold
Middle Rosa	Rolf
Bent	Roar
Anne	Kraka
Lulu/West Lulu	Harald
East Rosa	Dagmar
Bo/Boje/North Jens	Valdemar

The Danish Licence Area January,1 1990



DUC Licence Area

1.&2. Round Licence Area

3. Round Licence Area

Danish Energy Agency

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