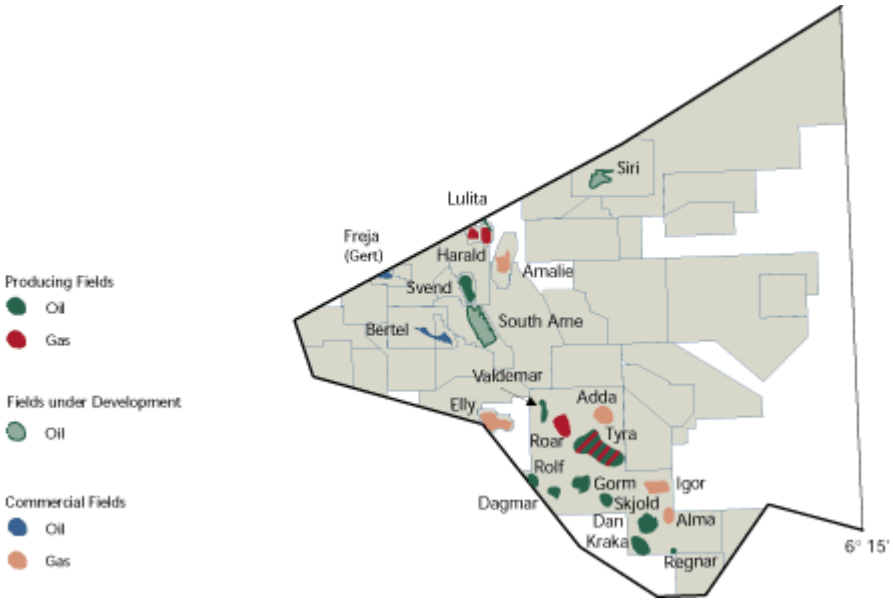
2. DEVELOPMENT AND PRODUCTION

In 1998, Danish oil and gas production came from 13 fields: the oil fields of Dan, Gorm, Skjold, Rolf, Kraka, Dagmar, Regnar, Valdemar, Svend and Lulita, and the Tyra, Roar and Harald gas fields. The Svend, Harald and Lulita Fields are situated in the northern part of the Central Graben, while all other fields are situated in the Contiguous Area in the southern region of the Central Graben. On behalf of the operator, Mærsk Olie og Gas AS is in charge of recovery from all 13 fields. Dansk Undergrunds Consortium (DUC) and the Statoil group handle recovery from the Lulita Field, while the other fields are operated by DUC alone.

Fig. 2.1 is a map showing the location of the Danish producing fields and new field developments.

Fig. 2.1 Danish Fields in the North Sea



1998 DEVELOPMENT PROJECTS

The type of development projects carried out in the North Sea in 1998 differed from those undertaken in previous years.

Where the majority of development projects were previously implemented in fields where Mærsk Olie og Gas AS is the operator, the 1998 development projects concentrated on the Siri and South Arne Fields, for which Statoil

and Amerada Hess are the operators. A development project was also carried out at the Harald Centre in connection with commencing production from the Lulita Field, for which DUC and the Statoil group hold the licence, with Mærsk Olie og Gas AS as the operator. In addition, the level of drilling activity remains high in the fields for which Mærsk Olie og Gas AS is the operator.

The Lulita Field is situated a little to the north of the Harald Field. Production from the field, which is Middle Jurassic sandstone, was commenced in June 1998.

The Siri Field is an oil accumulation in Tertiary sandstone, about 25 km east of the Central Graben. The Siri Field development in 1998 provided for the installation of a combined platform housing wells, processing facilities and accommodation. The platform and oil storage tank were shipped out to the field for installation in November 1998. The platform is placed on an oil storage tank situated on the sea bed. Production will take place from six horizontal oil wells and three injection wells for co-injecting water and gas, and in 1998 one well of each type was drilled. The field was brought on stream in March 1999.

In the South Arne Field, the platform is expected to be installed in the first half of 1999. South Arne is a chalk field situated in the northern part of the Central Graben due south of the Svend Field. Production is expected to commence from this field in 1999. The Siri and South Arne field developments are discussed in more detail towards the end of this section.

In December 1998, the Danish Energy Agency received an application for further development of the Skjold Field, consisting of drilling another seven wells. The drilling operations have been scheduled for 1999. The application was approved in February 1999.

In 1998, 23 new horizontal or highly deviated production and injection wells were drilled in connection with developing Danish fields in the North Sea. The increase in the number of wells drilled in 1998 as compared to 1997 is mainly attributable to the numerous wells drilled in the Dan Field.

The wells contributing to Danish production in 1998 totalled 227. The number of horizontal wells in operation in 1998 totalled 127: 95 production wells and 31 water-injection wells. In the Tyra Field, five wells were alternately used for production and injection in 1998. In calculating the above figures, these five wells were classified as production wells.

In 1998, DONG laid a new gas pipeline in the North Sea for transporting gas from the South Arne Field via the Harald Field to the gas processing facilities at Nybro. At the same time, the capacity of DONG's oil pipeline from the Gorm Field to shore has been expanded to 270,000 barrels per day.

SUCCESSFUL PRODUCTION OF OIL CONTAINING WAX

As previously mentioned, the Lulita Field was brought on stream in June 1998. The oil produced from the Lulita Field has a large content of wax. Experience shows that this causes problems in the processing and transportation systems, and the startup of production from this field was therefore a technical challenge.

The production from the Lulita wells is separated into liquids (unstabilized oil with water) and gas on the Harald platform. The liquids are conveyed to Tyra East through a 16" pipeline together with the liquid production from Harald and the total production of hydrocarbons from Svend. After processing to meet the sales specifications, gas from the Lulita Field is transported together with gas from Harald through a 24" pipeline to Tyra.

The high content of wax in the crude oil from Lulita means that under certain operating conditions, primarily in the case of cooling below a critical temperature, the oil may solidify during transportation through the pipeline to Tyra. For instance, if the oil from Lulita is cooled down to sea temperature, the oil will harden into solid wax. If the fall in temperature occurs en route in the Harald-Tyra pipeline, a "wax candle" may theoretically be formed along the whole length of the pipeline. In practice, subsequently removing solidified crude oil from the pipeline will not be feasible. The operator, Mærsk Olie og Gas AS, has conducted laboratory tests to find a suitable additive, an inhibitor, that will reduce the risk of wax precipitation.

Another method for reducing the risk of wax precipitation is to "dilute" the Lulita oil with the liquids produced at Harald. Mærsk Olie og Gas AS has performed a number of tests to ascertain the degree of dilution required.

Moreover, in connection with starting up production from the Lulita Field, the amount of water produced together with the oil proved to be much larger than originally foreseen. This fact, combined with the increase in the production of water from Svend with a relatively high barium content, may result in scaling, i.e. the precipitation of barium sulphate in the 16" pipeline between Svend and Tyra. To prevent this, a scale inhibitor is added to the water produced from Lulita.

As another safeguard to prevent the 16” pipeline from becoming clogged in connection with the transportation of liquids from the three fields, a chemical is being added which reduces the friction of the liquid against the pipe wall, thus reducing the pressure drop in the pipeline.

Finally, it is necessary to clean the inside of the 16” pipeline at one- to three-week intervals with a special “cleaning pig” in order to avoid the depositing of wax in the pipeline.

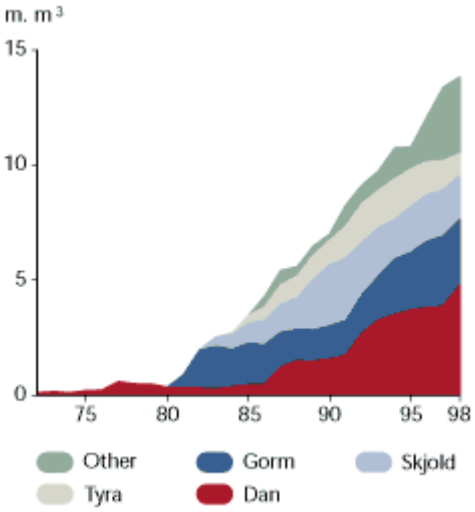
As appears from the above, the operator, Mærsk Olie og Gas AS, has introduced various measures to reduce the risk associated with producing oil from the Lulita Field. In fact, no major problems have been encountered in connection with processing or transporting the oil produced. Nor did a short-term shutdown of the pipeline in mid-October 1998 give rise to any problems upon the resumption of production. Launching the production of waxy oil must be deemed a technical success.

OIL PRODUCTION CONTINUES TO RISE

In 1998, Danish oil production yet again exceeded the production figures recorded in previous years, while gas production declined in relation to 1997. The increase in oil production can be attributed mainly to the new, highly productive oil wells drilled in the Dan and Gorm Fields in 1998.

Fig. 2.2 shows the development of Danish oil production in the period from 1972 to 1998, distributed by field.

Fig. 2.2 Distribution of Oil Production by Field



Total oil production in 1998 amounted to 13.83 million m^3 , equal to 11.81 million tonnes. This means that the 1998 oil production figure was 3% higher than the figure for 1997.

Gross gas production amounted to 10.28 billion Nm^3 in 1998, of which 2.93 billion Nm^3 was reinjected into the Gorm and Tyra Fields. Thus, net gas production amounted to 7.35 billion Nm^3 in 1998. More than 99% of the total amounts of injected gas was reinjected in the Tyra Field to enhance the recovery of liquid hydrocarbons from the Tyra Field. Net gas production in 1998 was 4% lower than the previous year.

Gas production from the Tyra, Roar and Harald Fields accounted for 0.73, 1.46 and 2.74 billion Nm^3 , respectively, of total net gas production, while the balance constituted associated gas produced with oil in the other fields.

Gas supplies to Dansk Naturgas A/S amounted to 6.63 billion Nm^3 . The difference between the net gas produced and the amount of gas sold (6.9% of the net gas) was either utilized or flared on the platforms. Three-fourths was used for energy supplies to the platforms, while the remainder was flared without being utilized. The gas is flared for safety and technical reasons exclusively.

Fig. 2.3 shows the development of Danish oil and gas production in the period from 1988 to 1998. Gas production comprises gas supplied to Dansk Naturgas A/S and gas used for energy supplies to the platforms.

Fig. 2.3 Production of Oil and Natural Gas

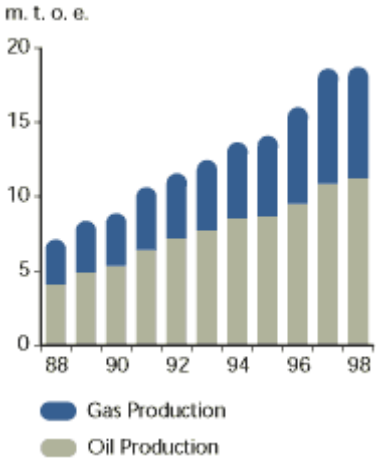
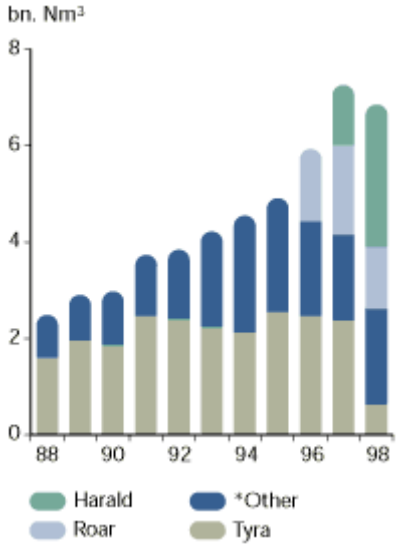


Fig. 2.4 shows the development in gas supplies to Dansk Naturgas A/S in the period 1988 to 1998, broken down into the Tyra Field, the Roar Field and the Harald Field, and a combined figure for associated gas produced from the other Danish fields.

Fig. 2.4 Natural Gas Supplies Broken down by Field



Appendix D contains an overview of Danish oil and gas production in the period from 1972 to 1998. It also includes an outline of the development in natural gas sales from the startup of the gas project in 1984 until 1998, broken down by field. Finally, this appendix sets out the monthly production figures for oil and condensate for the individual fields in 1998.

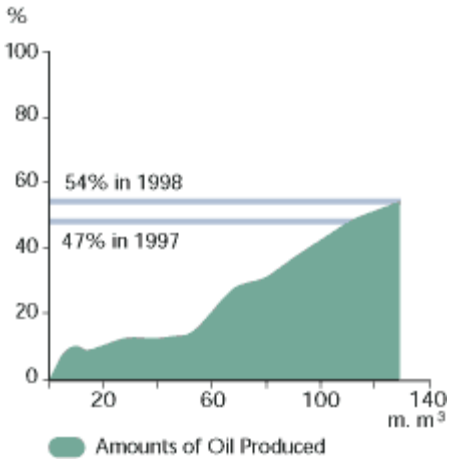
AMOUNTS OF WATER PRODUCED AND INJECTED

In 1998, Danish fields produced 14.16 million m^3 of water together with the oil produced, a 17% increase compared to 1997.

The share of water production relative to the total production of liquids continues to climb moderately for most Danish oil fields. For the Dan, Gorm and Skjold Fields, water accounted for 38%, 53% and 67%, respectively, of all liquids produced in 1998.

Fig. 2.5 shows the development in the ratio of water produced to total liquids produced, relative to cumulative oil production from producing chalk fields. The figures calculated at 1 January 1999 show that, after the production of almost 130 million m^3 of oil, the share of water produced has gone up to 54%. This means that every cubic metre of oil extracted from the reservoirs is now accompanied by a slightly larger amount of water.

Fig. 2.5 Development in Water Production



Water is still injected into the Dan, Gorm and Skjold Fields in order to improve oil recovery. In total, 26.23 million m^3 of water was injected into these three fields in 1998. This represents an 11% increase compared to 1997. In order to lessen the impact on the marine environment, an increasing amount of the water produced from the Gorm, Skjold and Dan Fields is reinjected into the reservoirs.

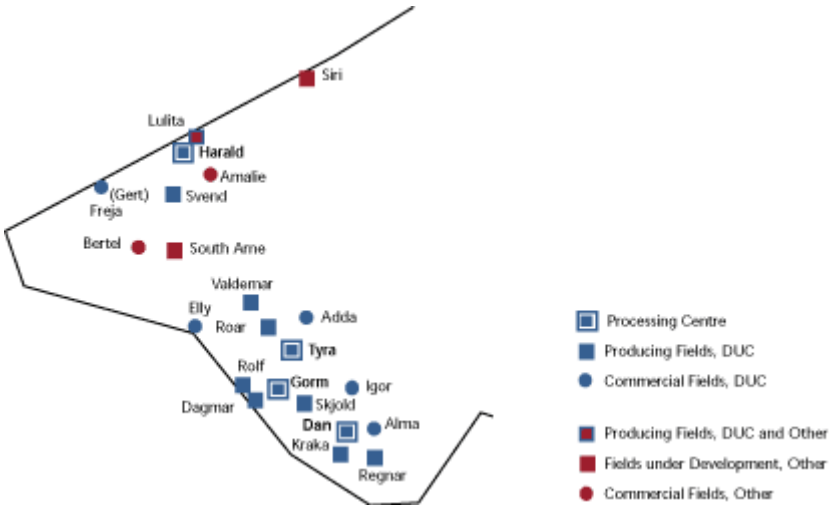
Appendix D shows figures for the amounts of water produced, as well as the amounts of gas and water injected into the reservoirs.

PRODUCING FIELDS

The producing Danish oil and gas fields are grouped round four processing centres: the Dan, Gorm, Tyra and Harald Centres. The following description of Danish oil and gas fields is based on this grouping of fields and focuses mainly on developments in 1998. More details are also given about the Siri and South Arne Fields.

Fig. 2.6 contains an outline map showing the locations of the four centres, and existing and planned production facilities appear from Fig. 2.9.

Fig. 2.6 Danish Oil and Gas Fields



Appendix E provides an outline - with supplementary data - of producing fields, including the most important key figures. Appendix C contains various information about new field developments, i.e. the Siri and South Arne Fields, as well as the fields for which development plans have been approved.

The Dan Centre

This centre comprises the Dan Field and the Kraka and Regnar satellite fields. The Igor and Alma Fields, as yet undeveloped, are also to be hooked up to Dan as satellites.

After processing at the Dan F complex, oil and gas are transported to shore through the Gorm and Tyra Centres, respectively. Total oil production from the Dan Centre amounted to 5.12 million m^3 in 1998. Fig. 2.8 illustrates the development in oil production from the fields at the Dan Centre.

Total net gas production from the fields at the Dan Centre amounted to 1.45 billion Nm^3 in 1998, of which 1.26 billion Nm^3 was transported to shore via the Tyra Centre. The rest of the gas was used as fuel or flared without being utilized.

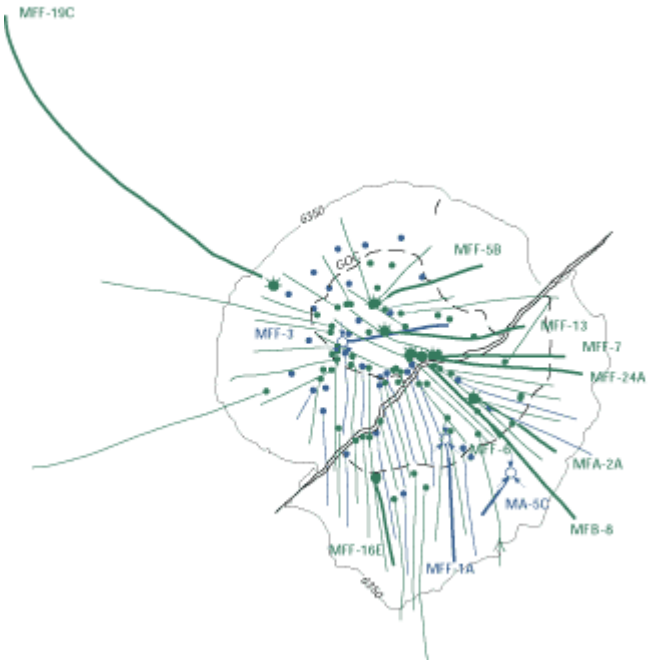
The Dan Field

Dan is an oil field with a gas cap, and is the largest accumulation of oil demonstrated to date in the Danish subsoil. The field was brought on stream already in 1972, and was thus the first Danish producing field. Water injection was introduced in 1989.

The most recent development plan from 1995 provides for a major expansion of the production facilities, including the Dan FF wellhead and processing platform, which was installed in 1997 and put into full operation in 1998.

In 1998, an additional 12 horizontal wells were drilled in the field, so the 1995 development plan is close to being implemented. The only work outstanding is the completion of two production wells in the southern part of the B-block. The wells drilled appear from Fig. 2.7.

Fig. 2.7 Wells Drilled in the Dan Field in 1998



For three of the wells drilled in 1998, well slots from older, deviated wells were reused. The older wells were abandoned because, with only one producing zone in the reservoir, they were no longer economically viable compared to the new horizontal wells, which extract oil from up to 15 to 20 producing zones.

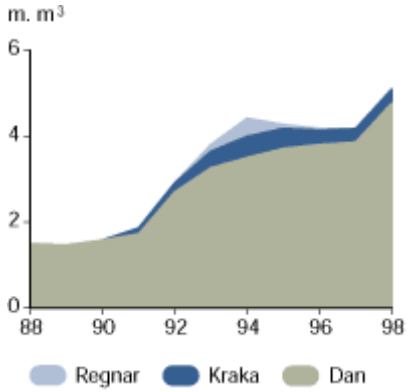
The length of an existing horizontal well from 1988 was doubled, being extended by about 1,200 metres, which illustrates the technological advances made in drilling and completion technology in merely ten years.

Of the 12 wells, three are directly designed for water injection, having from three to five injection points. Due to the injection pressure, the water induces a controlled fracture in the chalk, so that the water is distributed over a much larger area than that penetrated by the well.

Production has been initiated from the remaining nine wells. Large sections of two of these wells were drilled for appraisal purposes.

The MFF-16E well drilled in Danian layers in the southern part of the B-block is to investigate whether the induced producing fractures and the water injected from the wells in the Maastrichtian chalk contribute to draining and stabilizing pressure, respectively, in the overlying Danian chalk.

Fig. 2.8 Oil Production from the Fields at the Dan Centre



The MFF-19C well has been drilled in a northwesterly direction beyond existing well control in the A-block. Where the MFF-4B well drilled in 1997 set a new North Sea record for horizontal wells, Mærsk Olie og Gas AS has now succeeded in setting a world record with a horizontal well of 6,117 m, measured from the point where the deviation of the well from the perpendicular exceeds 86 degrees. By means of LWD (logging while drilling) and biostratigraphic analyses, the well was targeted at the high-porous zones in the upper section of the Maastrichtian chalk.

Satisfactory oil saturations have been ascertained along the entire horizontal section of the well. At the beginning of 1999, production from the MFF-19C well set a record for the Dan Field, bringing total production from the Dan Field up to more than 100,000 barrels a day.

In 1998, production from the Dan Field exceeded the 1997 production figure by 24%, due mainly to the drilling and hooking up of new production wells. The amounts injected in 1998 exceeded the previous year's figures by about one-third as a result of the new injection wells drilled and the increase in injection capacity following the commissioning of the Dan FF platform.

Tests are currently being carried out in the field to assess the consequences for the reservoir of reinjecting the water produced.