



# RESOURCES AND FORECASTS

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## RESOURCES AND FORECASTS

Every other year, the DEA prepares an assessment of Danish oil and gas resources and a long-term production forecast. In the alternate years, the DEA prepares a short-term production forecast, the so-called five-year forecast. An assessment of Danish oil and gas resources and a long-term production forecast were prepared in 2016.

The DEA uses a classification system for hydrocarbons to assess Denmark's oil and gas resources. The aim of the classification system is to determine resources in a systematic way. A description of the classification system is available at the DEA's website, [www.ens.dk](http://www.ens.dk). Based on the assessment of resources, the DEA prepares short- and long-term oil and gas production forecasts.

## MAJOR CHANGES IN THE ASSESSMENTS

Compared to previous years, a number of changes have been made to the resource assessment and forecast. These changes are primarily attributable to the following factors:

- Drawing on an overall evaluation of the potential, etc., in the area, the DEA has based its resource assessment and forecast on the assumption that the Tyra Field installations will undergo a complete reconstruction. However, it is also assumed in the forecast that a temporary stop to production from the Tyra Field and associated fields will be put into effect as from 2019. For this reason, the gas forecast shows a decline for the period 2019-2021, after which production is expected to rise once again. The background for this is that Maersk Oil has announced that production will be discontinued from Tyra East and Tyra West as from 1 October 2018 if no financially viable solution for continued operation is found in the course of 2016. The field will be closed due to platform subsidence, which may pose a safety risk. For the first time, the production forecast provides for the temporary shutdown of the Tyra Field installations.
- The short-term oil production forecast has been written down. The reason for this writedown is a postponement in the commissioning of the Hejre Field because in spring 2016 the licensees, DONG Energy and Bayerngas, terminated a contract for the construction of processing facilities for the field. The commissioning of the Hejre Field has been postponed from 2017 to 2021 in the forecast.
- Generally, the forecast is more uncertain than usual this year, primarily due to the uncertainty surrounding the expected major development of the Tyra Field installations and the Hejre Field.
- Both oil and gas resources have generally been written up. As far as gas is concerned, this is attributable to the renovation of the Tyra Field, changed risk assessments and an expected increase in development activities. As concerns oil resources, the upward adjustment is made on the basis of further recovery from the Dan Field, an expected increase in development activities and changed risk assessments. At the same time, the resources for the Hejre Field have been written down. Generally, data is of higher quality and more detailed than before, which has provided a better basis for assessment. This has also contributed to the upward adjustment of oil and gas resources.
- The contribution from technological resources has been written down for oil in the longer term. The reason is that an increase in production due to the injection of CO<sub>2</sub> is no longer considered probable, as sufficient CO<sub>2</sub> is not expected to be available for injection in the fields; nor is such a project considered viable in light of the current low oil prices.

RESOURCE ASSESSMENT BY CATEGORY

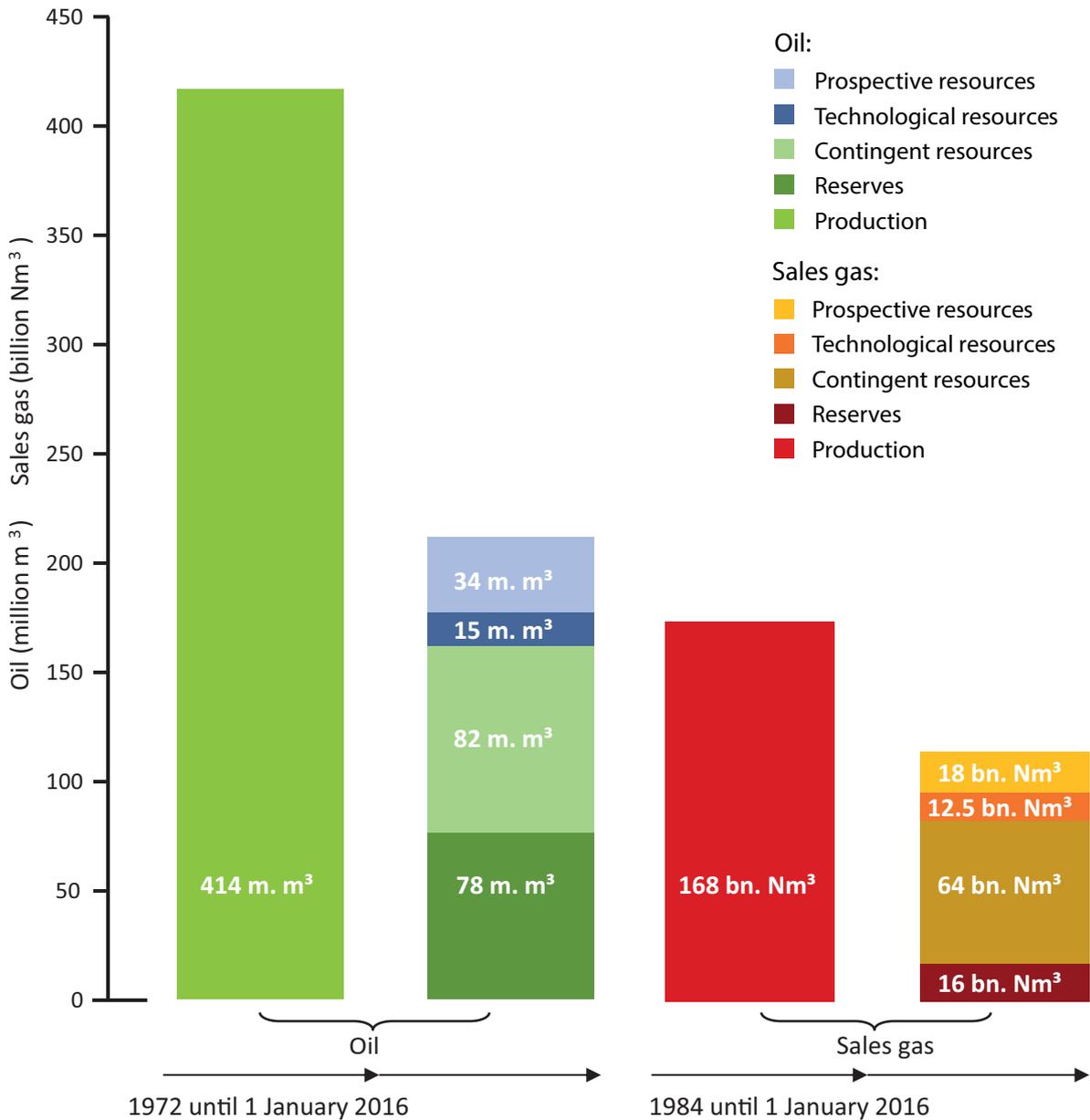


Figure 1. Resource assessment by category

**Risk weighting**

The expected production profile is drawn up based on the categories *Reserves* and *Contingent resources*. In addition, a forecast including contributions from *Prospective resources* and *Technological resources* is prepared.

The category *Contingent resources* is subjected to risk weighting because uncertainty attaches to these resources. The resources in this category are therefore risk-weighted in the forecast.

TABLE 1. RESERVES AND CONTINGENT RESOURCES AT 1 JANUARY 2016

	OIL, m. m <sup>3</sup>		SALES GAS, bn. Nm <sup>3</sup>
	Reserves		Reserves
Ongoing recovery and approved for development		Ongoing recovery and approved for development	
CECILIE	0.1	CECILIE	-
DAGMAR	0,0	DAGMAR	0
DAN	16.8	DAN	1
GORM	2.5	GORM	0
HALFDAN	29.4	HALFDAN	5
HARALD	0.1	HARALD	1
KRAKA	0.7	KRAKA	0
LULITA	0.1	LULITA	0
NINI	0.7	NINI	-
RAVN	0.4	RAVN	0
REGNAR	0,0	REGNAR	0
ROAR	0.1	ROAR	1
ROLF	0.6	ROLF	0
SIRI	1,0	SIRI	-
SKJOLD	4.2	SKJOLD	0
SOUTH ARNE	9.4	SYD ARNE	1
SVEND	0.0	SVEND	0
TYRA (incl. TYRA SE)	3.4	TYRA (incl.TYRA SE)	6
VALDEMAR	2.2	VALDEMAR	1
<b>SUBTOTAL</b>	<b>72,0</b>	<b>SUBTOTAL</b>	<b>16</b>
Justified for development	6	Justified for development	0
<b>SUBTOTAL</b>	<b>78</b>	<b>SUBTOTAL</b>	<b>16</b>
	<b>Contingent resources*</b>		<b>Contingent resources*</b>
Development pending	69	Development pending	51
Development unclarified	2	Development unclarified	2
Development not viable	11	Development not viable	10
<b>SUBTOTAL</b>	<b>82</b>	<b>SUBTOTAL</b>	<b>64</b>
<b>TOTAL 2016</b>	<b>160</b>	<b>TOTAL 2016</b>	<b>80</b>

\* **Contingent resources**

This class comprises projects for the development of discoveries and new fields or the further development of existing fields for which the technical or commercial basis has not been sufficiently clarified to make a final development decision. These projects are subdivided into three categories:

**Development pending:** This category comprises projects with potential for commercial development.

**Development unclarified:** This category comprises projects that are believed to have potential for commercial development or projects that are not commercially viable in the current financial situation, but could become viable in the near future.

**Development not viable:** This category comprises development projects not considered commercially viable under the existing conditions.



## SHORT-TERM FORECAST, FIVE-YEAR FORECAST

The DEA prepares annual five-year forecasts of oil and gas production to be used by the Danish Ministry of Finance for its forecasts of state revenue.

	2016	2017	2018	2019	2020
<b>OIL, m. m<sup>3</sup></b>	8.7	8.4	8.2	7.5	6.6
<b>SALES GAS, bn. Nm<sup>3</sup></b>	3.9	3.9	3.5	2.5	1.1

**Table 2.** Expected production profile for oil and sales gas

### Oil

For 2016 the DEA expects oil production to total 8.7 million m<sup>3</sup>, equal to about 150,000 barrels of oil per day; see table 2. Compared to last year's estimate for 2016, this constitutes a writedown of 8 per cent, mainly attributable to the fact that the DEA expects a lower production figure for South Arne because the production startup from new wells has not progressed as expected.

Oil production is expected to be lower in 2019 and 2020 compared to last year's estimate, due to the postponement of the commissioning of the Hejre Field and the renovation of Tyra.

### Sales gas

The DEA expects the production of sales gas to total 3.9 billion Nm<sup>3</sup> in 2016, equal to about 71,000 barrels of oil equivalent per day; see table 2. Compared to the estimate for 2016 made by the DEA last year, this is an upward revision of about 8 per cent based mainly on the DEA's expectation of higher gas production in the Tyra Field.

Sales gas production is expected to be lower in 2019 and 2020 compared to last year's estimate, due to the renovation of Tyra and because the commissioning of the Hejre Field has been postponed; see above. The production estimate for 2019 and 2020 has been written down by about 37 per cent and about 69 per cent, respectively, compared to last year's estimate.

## METHOD USED TO PREPARE LONG-TERM FORECAST

The long-term forecast is divided into three contributions: the expected production profile, technological resources and prospective resources.

**The expected production** profile is a forecast of production from existing fields and discoveries based on existing technology.

**Technological resources** are an estimate of the volumes recoverable by means of new technology. As mentioned above, the DEA has reassessed the technological resources for oil and written down the contribution from 100 million m<sup>3</sup> to 15 million m<sup>3</sup> because enhanced oil recovery based on CO<sub>2</sub> injection is no longer included in the estimate. The reason is that such a project is not viable based on the current low oil prices; nor is there sufficient CO<sub>2</sub> available for injection.

**Prospective resources** are an estimate of the volumes recoverable from future new discoveries made as a result of ongoing exploration activity and future licensing rounds. The estimate is based on the exploration prospects known today in which exploration drilling is expected to take place. Moreover, the estimate includes assessments of the addi-

tional prospects expected to be demonstrated later in the forecast period.

**The consumption forecast** is based on the consumption of oil and gas estimated in "The DEA's baseline scenario, 2015". The consumption according to the 2015 baseline scenario is an estimate based on the assumption that no measures will be taken other than those already decided with a parliamentary majority. Therefore, the baseline scenario is not a forecast of future energy consumption, but a description of the development that could be expected during the period until 2025 based on a number of assumptions regarding technological developments, prices, economic trends, etc., assuming that no new initiatives or measures are taken.

The DEA uses the oil and gas production forecasts together with its consumption forecast to determine whether Denmark is a net importer or exporter of oil and gas. Denmark is a net exporter of energy when energy production exceeds energy consumption, calculated on the basis of energy statistics.

## LONG-TERM FORECAST AND CONSUMPTION FORECAST

In 2016 the DEA prepared a long-term production forecast for oil and sales gas.

Long-term oil and sales gas forecasts are shown together with the above-mentioned consumption forecast; see figures 2 and 3. To illustrate whether Denmark will be a net importer or exporter after 2025, consumption for the period from 2026 to 2035 is assumed to be on a par with consumption in 2025.

### PRODUCTION AND FORECAST FOR OIL

Denmark is anticipated to be a net exporter of oil for three years up to and including 2018, based on the expected production profile. Consumption is expected to exceed production for the years 2019 and 2020, while the expected production profile is once again forecast to exceed consumption during the period from 2021 through 2026. According to the most recently published forecast from 2015, Denmark was expected to be a net exporter of oil up to and including 2021.

A reduction in oil production is expected until 2021 compared to last year's forecast, due mainly to a postponement of the commissioning of Hejre and the renovation of the Tyra Field installations. The forecast shows that production will generally decline from 2023, which is later than projected in last year's forecast.

The expected production profile is forecast to climb after 2022, particularly as a result of further recovery expected from the Dan Field, an expected increase in development

activities and changed risk assessments. Parts of the forecast have also been prepared on the basis of data that is more detailed and of higher quality than before.

The contribution from technological resources has been reduced compared to the most recent estimate, from 100 million m<sup>3</sup> of oil to 15 million m<sup>3</sup> of oil. Moreover, the contribution from prospective resources has been revised downwards from 55 million m<sup>3</sup> to 34 million m<sup>3</sup> of oil. The downward revision is due in part to exploration drilling during the past period, which has resulted in the removal of this contribution from the prospective resources assessment; in part to a revised estimate of the exploration potential in the 7th Licensing Round, among other factors; and, finally, due to a writedown of the long-term forecast for prospective resources.

If the technological and prospective resources are included, Denmark is expected to remain a net exporter until 2032, except in the years 2019 and 2020.

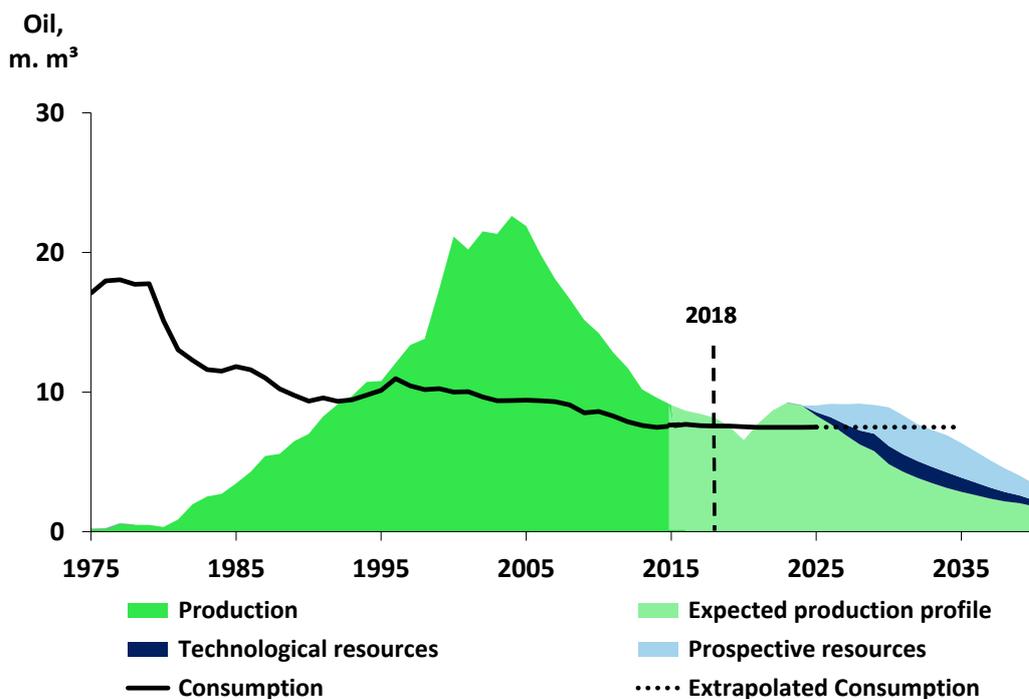


Figure 2. Production and long-term forecast for oil

## PRODUCTION AND FORECAST FOR SALES GAS

Denmark is anticipated to be a net exporter of sales gas for four years up to and including 2019, based on the expected production profile. According to the most recently published forecast from 2015, Denmark was expected to be a net exporter of gas up to and including 2023.

During the period 2019-2021, the production of sales gas is expected to decline compared to last year's estimate due to the renovation of the Tyra Field installations. To this should be added that the commissioning of Hejre has been postponed from 2017 until 2021. Consumption is expected to exceed the expected production profile in 2020 and 2021.

After 2022 sales gas production is anticipated to increase compared to last year's forecast. This is primarily attributable to the renovation of the Tyra Field, an expected increase in development activities and changed risk assessments. Parts of the forecast have also been prepared on the basis of data that is more detailed and of higher quality than before.

The contribution from technological resources has been reduced compared to the most recent estimate, from 15

billion Nm<sup>3</sup> to 12.5 billion Nm<sup>3</sup> of sales gas. Moreover, the contribution from prospective resources has been revised downwards from 30 billion Nm<sup>3</sup> to 18 billion Nm<sup>3</sup> of sales gas.

If the technological and prospective resources are included, Denmark is expected to remain a net exporter until after 2035, except in the years 2020 and 2021.

The production of sales gas is subject to the condition that sales contracts have been concluded. Such contracts may either be long-term contracts or spot contracts for very short-term delivery of gas. As opposed to this, oil is most frequently sold as individual tanker loads from the North Sea at the prevailing market price.

The sales gas forecast indicates the quantities that the DEA expects it will be technically feasible to recover. However, the actual production depends on the sales based on existing and future gas sales contracts.

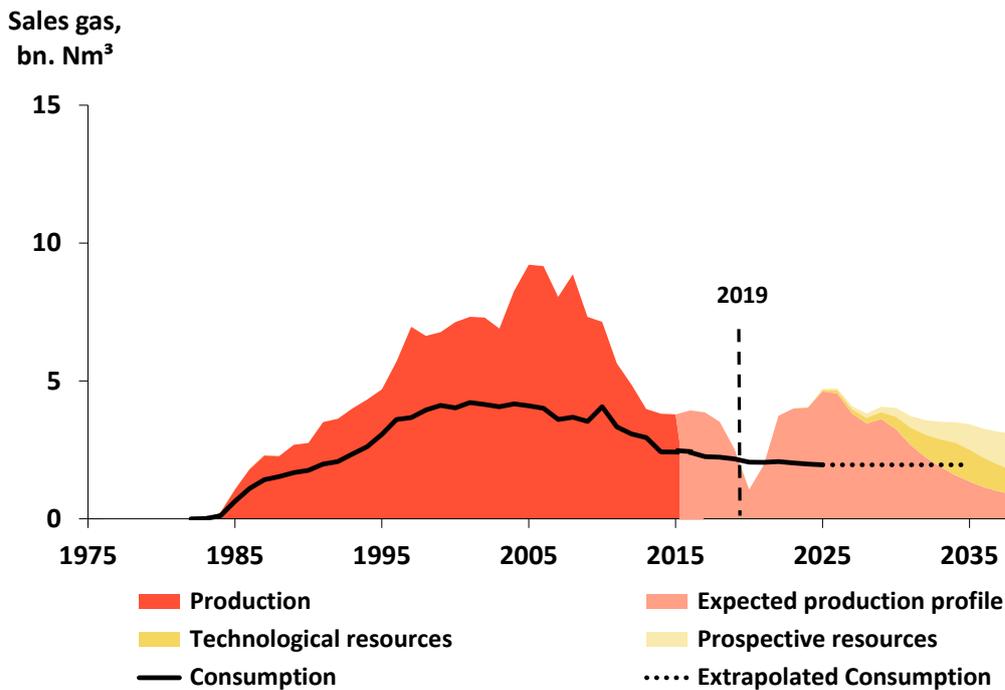


Figure 3. Production and long-term sales gas forecast