



RESOURCE ASSESSMENT AND PRODUCTION FORECASTS



30th of August 2018

RESOURCE ASSESSMENT AND PRODUCTION FORECASTS

The Danish Energy Agency (DEA) annually prepares an assessment of the Danish oil and gas resources alongside a long-term production forecast.

Compared to last year's forecast changes have been made, [link to latest production forecast](#).

The changes entail that Denmark is no longer expected to be net exporter of oil with the exception of one single year (2024) where oil production exceeds consumption due to the expected production start up of new developments. This is a change compared to forecasts, where Denmark was expected to remain a net exporter of oil for a number of years. However, in the previous forecast production only marginally exceeded consumption, and write-down in production expectations results in this change in the evaluation of Denmark as a net exporter of oil. The forecast for oil production is

reduced by 8 per cent compared to last year's forecast, which mainly is driven by a downward adjustment of the resources, delays and greater uncertainty regarding the development of several fields and discoveries.

The forecast for gas is reduced by 5 per cent compared the previous forecast, but Denmark is expected to remain a net exporter of gas until after 2035, excluding 2020 and 2021 due to the rebuilding of the facilities on the Tyra field. This corresponds fairly to last year's forecast.

The approval of the rebuilding of the facilities on the Tyra field implies that the uncertainty in this regard is less than before. However, great uncertainty remains with regard to the development of a number of projects hence contributing to the forecast being somewhat uncertain.

ASSESSMENT OF RESOURCES

The categories reserves and contingent resources in the resource assessment is overall adjusted downwards with 4 m. m³, while the gas resources has not been changed. As of 1st of January 2018 Reserves and contingent resources constituted in total 139 m. m³ oil and 72 bn. Nm³ sales gas, cf. table 1. As of 1st of January 2016 Reserves and contingent resources constituted in total 160 m. m³ oil and 80 bn. Nm³ sales gas. If the assessments are to be compared, the assessment at 1st of January 2016 must be corrected for the production in the intervening years 2016 and 2017. Including this correction the resources in the former assessment constitutes 143 m. m³ oil and 72 bn. Nm³ sales gas.

The revisions of the resource estimates are primarily due to the following reasons:

- The resources in the categories reserves and contingent resources for fields and discoveries have been re-evaluated because of new data and information, amongst other things based on production experience. This has resulted in both writing ups and writing downs and overall in a writing down of the oil resources of 4 m. m³ and an unchanged resource estimate for the gas.

- Based on the approval of 24th of October 2017 of a plan for the rebuilding of the facilities on the Tyra field potential from the category contingent resources has been transferred to reserves. The potential is production from the Tyra field and its satellites after the rebuilt of the facilities. As an example the gas reserves are assessed to 26 bn. Nm³, where the reserves in the former assessment is calculated to 8 bn. Nm³ corrected for the presumed recovery in 2016 and 2017. A substantial reason for the difference of 18 bn. Nm³ is transfer of resources between the categories.

Technological resources is an estimate of the volumes recoverable by means of new technology. The DEA has written down the contribution for gas by 2.5 bn. Nm³, because of a contribution for low pressure compression which was included earlier on and which is now included in the resources for the rebuilding of the Tyra facilities.

Prospective resources is an estimate of the volumes recoverable from future new discoveries made as a result of ongoing exploration activity and future licensing rounds. The DEA has – based on new information and maturing of projects – re-evaluated the prospective resources and written up the contribution for oil by 9 m. m³ and written down the contribution for gas by 4 bn. Nm³.

TABLE 1 : RESERVES AND CONTINGENT RESOURCES AT 1 JANUARY 2018

	OIL, m. m ³		SALES GAS, bn. Nm ³
	Reserves		Reserves
Ongoing recovery and approved for development		Ongoing recovery and approved for development	
CECILIE	0	CECILIE	-
DAGMAR	0	DAGMAR	0
DAN	10	DAN	0
GORM	2	GORM	0
HALFDAN	20	HALFDAN	3
HARALD	0	HARALD	1
KRAKA	1	KRAKA	0
LULITA	0	LULITA	0
NINI	1	NINI	-
RAVN	2	RAVN	0
REGNAR	0	REGNAR	0
ROAR	0	ROAR	2
ROLF	0	ROLF	0
SIRI	1	SIRI	-
SKJOLD	3	SKJOLD	0
SOUTH ARNE	0	SOUTH ARNE	0
SVEND	14	SVEND	2
TYRA (incl. TYRA SE)	9	TYRA (incl. TYRA SE)	16
VALDEMAR	5	VALDEMAR	2
SUBTOTAL	68	SUBTOTAL	26
Justified for development	0	Justified for development	0
SUBTOTAL	68	SUBTOTAL	26
	Contingent resources*		Contingent resources*
Development pending	56	Development pending	29
Development unclarified	3	Development unclarified	7
Development not viable	12	Development not viable	10
SUBTOTAL	71	SUBTOTAL	46
TOTAL 2018	139	TOTAL 2018	72

*** 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 or on hold: *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.*

SYSTEMATIC ASSESSMENT OF RESOURCES

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 the resources in a systematic way. A description of the classification system is available at the DEA's website, www.ens.dk. The assessment

of resources is used as a basis for preparing oil and gas production forecasts in the short- and long-term to be used among other things by the Danish Ministry of Finance for its forecasts of state revenue.

Risk assessment

On the basis of the categories *Reserves* and *Contingent resources* a forecast for the expected production profile is prepared. In addition a forecast is prepared, which also includes the contributions from *Technological Resources* and *Prospective Resources*.

For all categories except *Reserves* a risk assessment is made in connection with preparing the forecast, because uncertainty is attached to these resources, see figure 1 and 2, where the sizes of production, resources and forecast are illustrated.

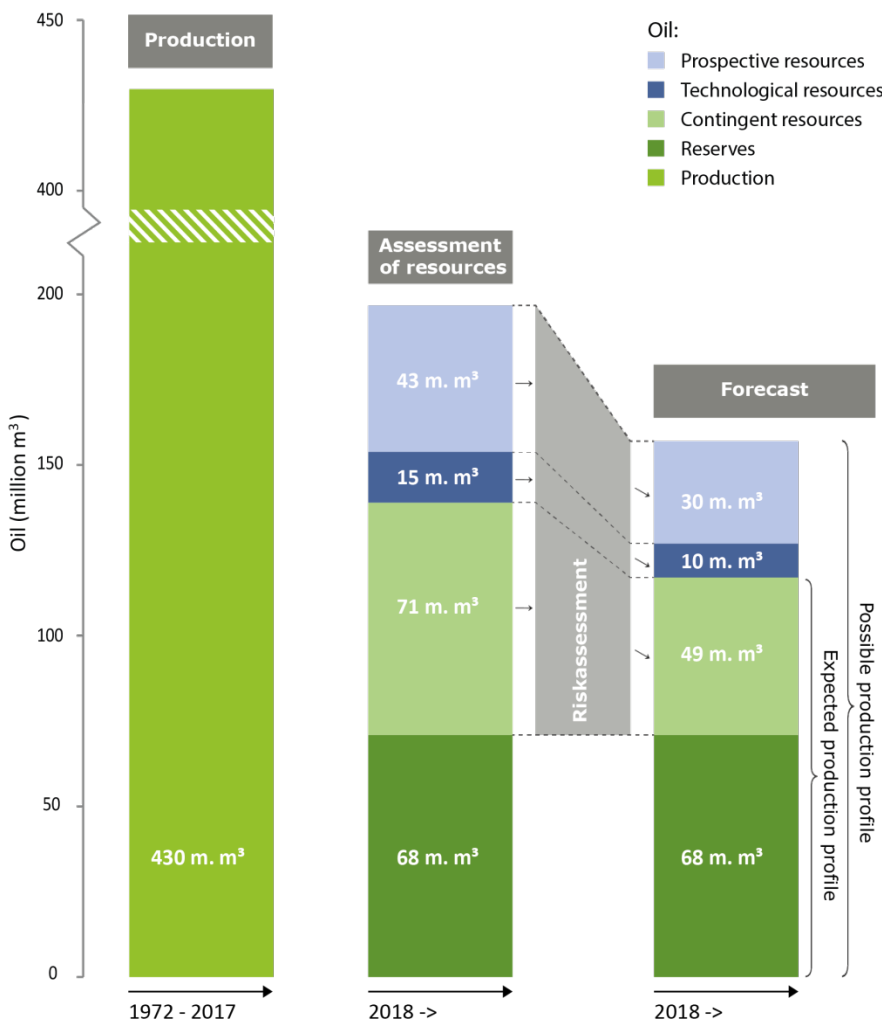


FIGURE 1: Resource assessment and forecasts distributed on categories for oil

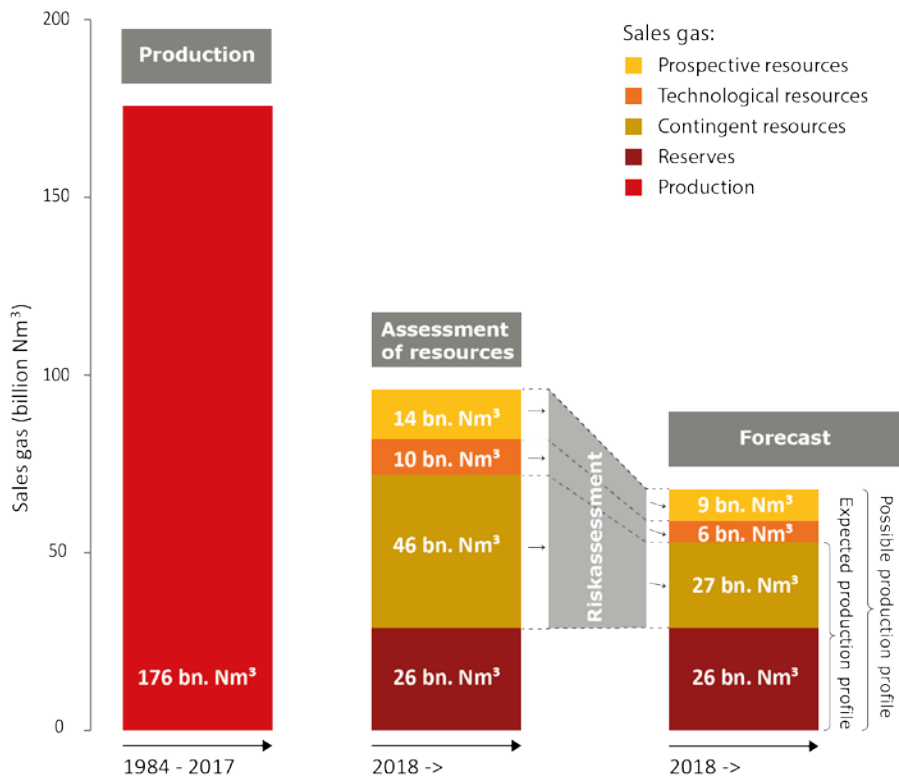


FIGURE 2: Resource assessment and forecasts distributed on categories for sales gas

PRODUCTION FORECASTS

SHORT-TERM FORECAST (FIVE-YEAR FORECAST)

The DEA prepares annual a five-year forecast of oil and gas production to be used among other things

by the Danish Ministry of Finance for its forecast of the state revenue.

TABLE 2: Expected production profile for production of oil and sales gas

	2018	2019	2020	2021	2022
OIL , m. m ³	7.4	6.5	5.2	4.9	5.9
SALES GAS , bn. Nm ³	3.6	2.4	0.9	0.7	2.2

Oil

For 2018 the DEA expects oil production to reach a total of 7.4 million m³, equal to about 128,000 barrels of oil per day, see table 2. Compared to last year's estimate for 2018, this constitutes a downward revision of 10 per cent, mainly attributable to a lower production expected by the DEA from some of the larger oil fields. The revision of the forecast is driven by new production experience.

For the period from 2018 to 2022 the production estimate has been revised downwards by an average of 14 per cent for the same reason as the estimate for 2018.

Sales gas

The DEA expects the production of sales gas to reach a total of 3.6 billion Nm³ in 2018, equal to about 65,000 barrels of oil equivalent per day; see table 2. Compared to last year's forecast, the estimates for sales gas for 2018 and 2019 almost remain unchanged, while the estimates for 2020 and 2021 have been downward adjusted as a consequence of the reduced oil production. Furthermore the estimate for 2022 has been written down because of revised assumptions for the rebuilding of the facilities on the Tyra field.

LONG-TERM FORECAST AND CONSUMPTION FORECAST

In the first part of 2018 The DEA has prepared a long-term production forecast for oil and sales gas.

The long-term forecast is divided into three contributions: *The expected production profile*, *Technological resources* and *Prospective resources*. The forecast is based on the so-called technical resources. This means, that the timing of the cease of production is not influenced by criteria concerning operating economics.

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

The DEA has written down the forecast for oil and sales gas with 8 per cent and 5 per cent respectively compared to last year's forecast which is mainly driven by revision of fields and discoveries together with risking of a number of development projects.

Technological resources is an estimate of the volumes recoverable by means of new technology.

The DEA has re-evaluated the technological resources and written down the contributions compared to the former forecast. A revised risk assessment of part of the technological resources for oil has been carried out, and the DEA has written down the contribution for gas with 2.5 bn. Nm³, because of a contribution for low pressure compression was earlier included on and which now is included in the expected course of production.

Prospective resources is an estimate of the volumes recoverable from future new discoveries made as a result of on-going 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 additional prospects expected to be demonstrated later in the forecast period. Based on new information the DEA has re-evaluated the prospective resources upwards for oil and downwards for gas compared to last year's forecast.

The consumption forecast is based on the consumption of oil and gas estimated in "The DEA's baseline scenario, 2018". The consumption according to the 2018 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 2030 based on a number of assumptions regarding technological developments, prices, economic trends, etc., assuming that no new initiatives or measures are taken. It should be noted, that the baseline scenario does not include the measures included in "the energy agreement" of 29th of June 2018.

The DEA uses the oil and gas production forecasts together with its consumption forecast to determine whether Denmark is a net importer or net 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.

The long-term forecast for oil and sales gas is shown together with the mentioned consumption forecast on figure 3 and 4.

To illustrate if Denmark is a net exporter or importer, consumption for the period from 2031 to 2035 is assumed equal to the consumption in 2030.

PRODUCTION AND FORECAST FOR OIL

Denmark is no longer expected to be a net exporter of oil based on the expected production profile with the exception of a single year (2024), where the production exceeds the consumption because of production start of new projects. Earlier it was expected, that Denmark would be a net exporter of oil for a number of years. However, in the former forecast the difference between production and consumption was small, and a write-down of the expectations to the production has thus resulted in this change in the evaluation of Denmark as a net exporter.

As in last year's forecast a decrease in oil production is expected until 2022, especially in 2020 and 2021 due to the rebuilding of the facilities on the Tyra field. According to the forecast the production decreases in general from 2024, which was the case in last year's forecast already

from 2023. This change is driven by postponement of the production start for several developments.

Until 2030 the expected production profile is in general smaller than last year's forecast due to:

- Resources for fields and discoveries have been re-evaluated because of new data and information, amongst other things based on production experience. This has resulted in both writing ups and writing downs and overall in a writing down of the oil resources.
- The forecast for a number of development projects has been written down, because new information concerning lacking progress has resulted in a revision of the risking of the projects.
- The production start for several developments is postponed, which influences the timing of the production.

After 2030 the expected production profile is nearly identical to last year's forecast. This may seem as a paradox, because the forecast in general is written down. However, postponement of production start for a number of fields compared to the former forecast will result in, partly lesser production in the period, where the postponement takes place, partly

a larger production in the period, where the recovery takes place.

Even if the technological resources and the prospective resources are included, Denmark is not estimated to be a net exporter of oil in the forecast period except for 2024.

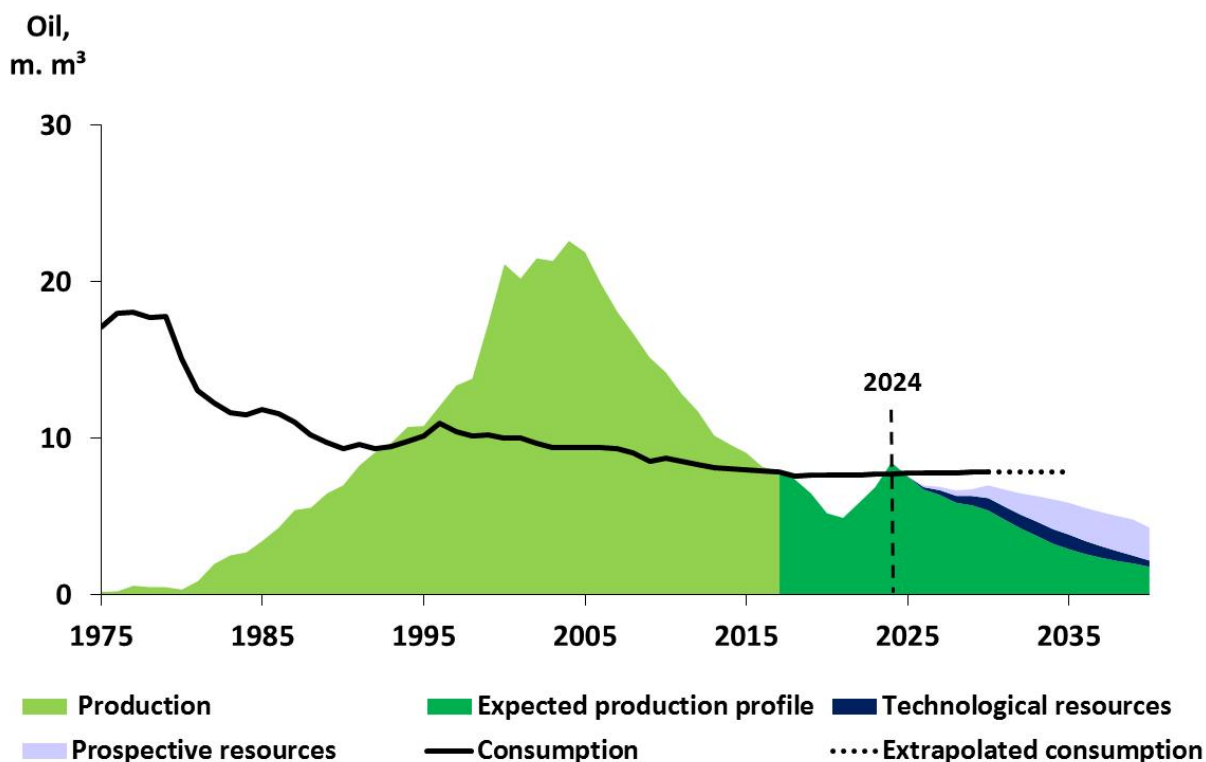


FIGURE 3: Production and long-term oil forecast

PRODUCTION AND FORECAST FOR SALES GAS

For sales gas Denmark is expected to be a net exporter in 2018 and 2019 based on the expected production profile.

In the years 2020 and 2021 a pronounced decrease in the production of sales gas is expected because of the rebuilding of the facilities on the Tyra field. Therefore, in these years the consumption is expected to exceed the production, while the forecast for the expected production profile again exceeds the consumption in the period from 2022 up to and including 2035, where Denmark will be a

net exporter of gas. Therefore, based on the expected production profile, Denmark is estimated to be a net exporter up to and including 2035, except for the years 2020 and 2021. This corresponds approximately to last year's forecast.

As was the case for oil, the forecast for the expected gas production profile has been revised due to:

- Resources for fields and discoveries have been re-evaluated because of new data and information,

amongst other things based on production experience, which overall results in an unchanged resource estimate for the sales gas.

- The forecast for a number of development projects has been written down, because new information concerning lacking progress has resulted in a revision of the risking of the projects.
- The production start for several developments is postponed, which influences the timing of the production as mentioned earlier.

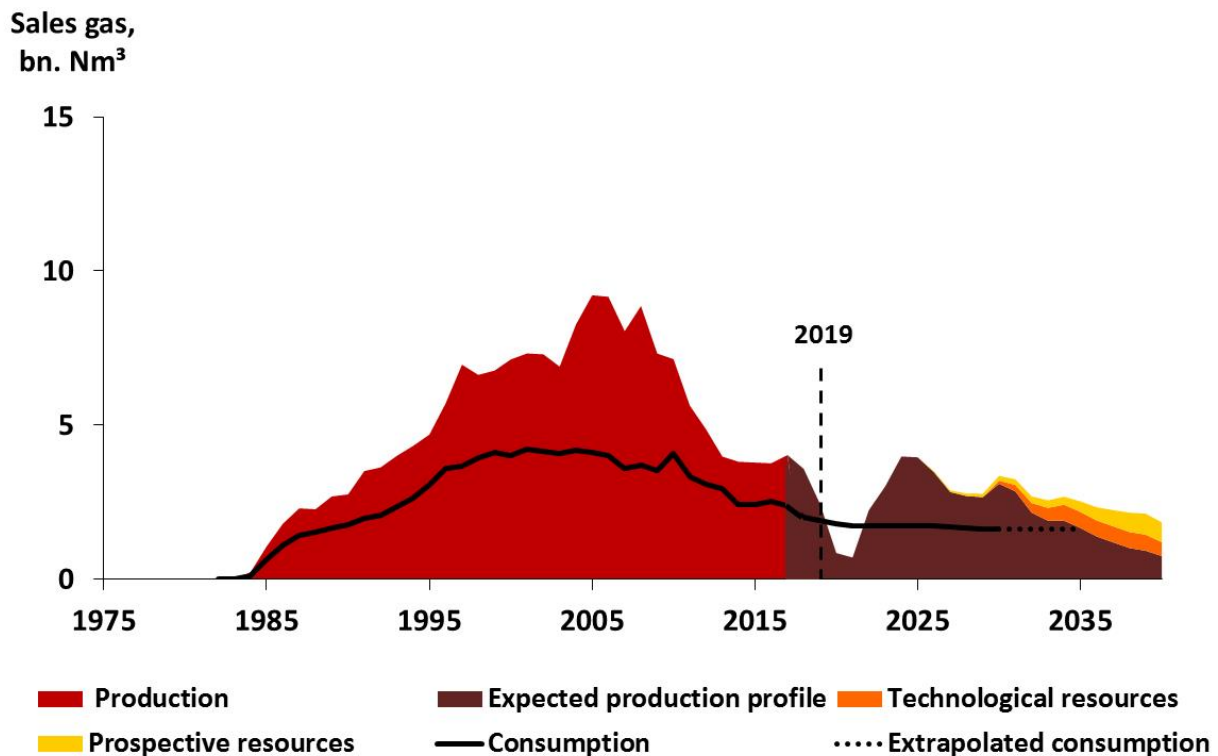
In the period from 2018 to 2021 the expected production profile is not that different from the former forecast. In 2022 the forecasts are as mentioned relatively different, because the estimate for 2022 has been written down due to revised assumptions for the rebuilding of the facilities on the Tyra field. Postponement of the production start

for a gas field causes from 2033, that the expected production profile exceeds the former forecast.

If the technological and prospective resources are included, Denmark is estimated to be a net exporter until after 2035, excluding the years 2020 and 2021. That corresponds to last year's forecast.

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 will be technically feasible to recover. However, the actual production depends on the sales based on existing and future gas sales contracts.



FIGUR 4: Production and long-term sales gas forecast