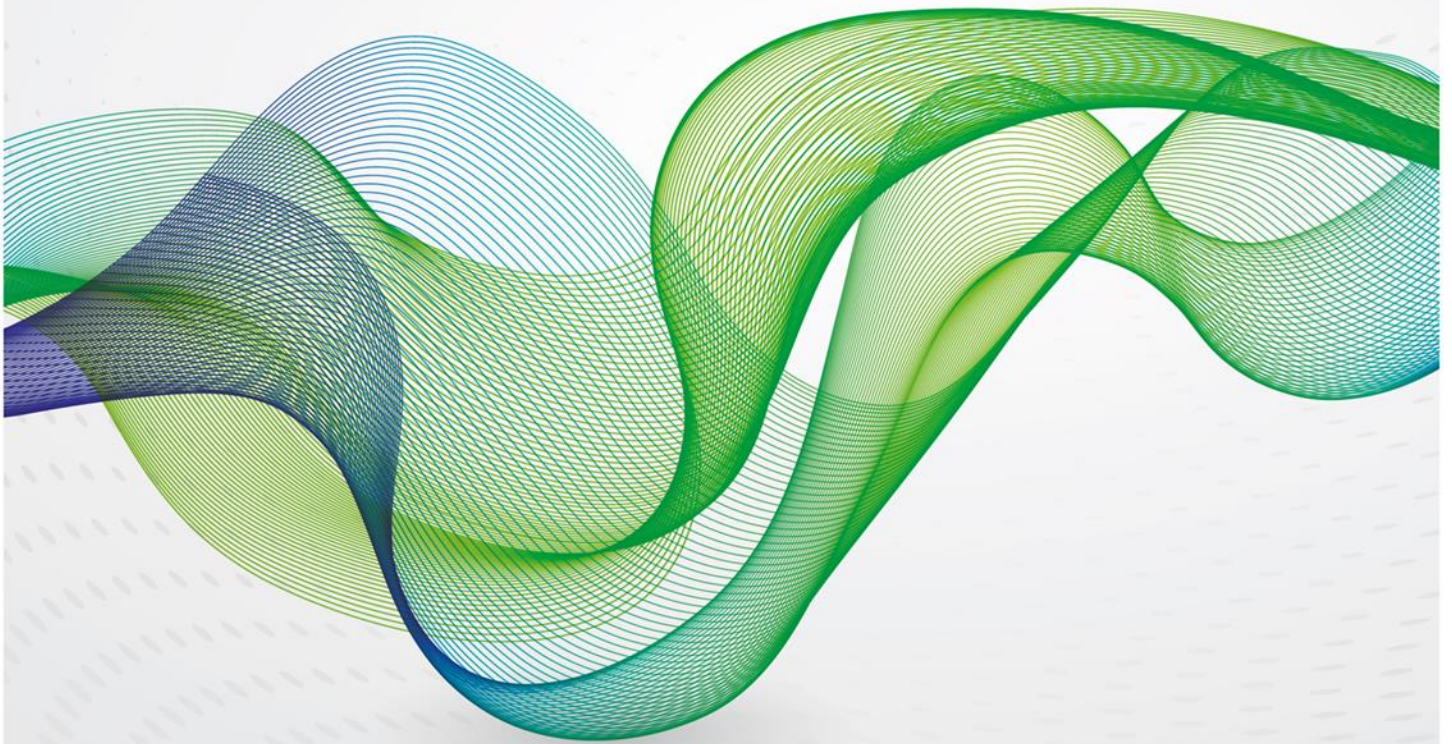


December 2020

Denmark's phase-out of upstream oil and gas:

Effective climate policy or symbolic gesture?



The agreement

Presented as an agreement with broad multi-party support in the Folketing (Parliament), reached after discussion with key stakeholders, including the upstream industry, the announcement comprises a number of related elements:

- all domestic production of oil and gas will cease by 2050
- the current 8th licensing round, launched in 2018, is cancelled – no acreage will be awarded
- there will be no licensing rounds in future
- other existing licensing schemes (the so-called ‘mini-rounds’ and ‘neighbouring block’ licences) will remain available to operators
- ‘Open Door’ acreage west of Denmark but east of the North Sea licence area will be closed
- the potential for electrification of existing offshore operations and for development and demonstration of offshore CO₂ storage will be investigated, partly funded by the government
- steps will be taken to address the loss of jobs in the industry
- the government will lead a ‘global campaign on the role of fossil-fuel producing counties’

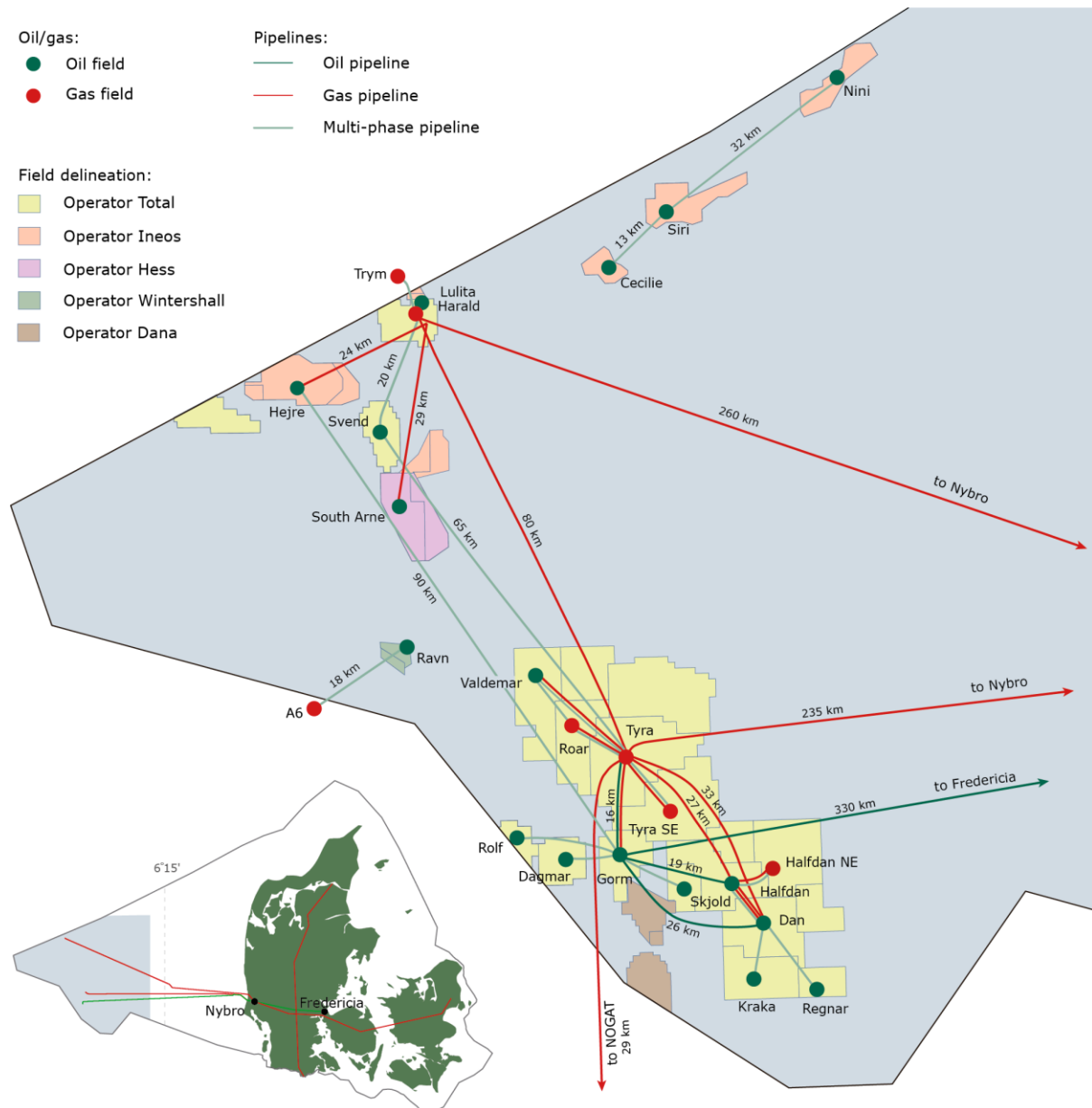
The statement did not include a full assessment of the expected impact on Danish oil and gas production, GHG emissions, government revenues or employment in the sector, either to 2030 or to 2050. It merely refers to an expected reduction in production of 9-15% from the latest projection by the Danish Energy Agency and an expected fall in annual government revenues of DKK 90m in the first five years. Nor was any further information provided as to how the ambitious 2030 emission reduction target of 70 per cent, adopted in the Climate Act 2019, is to be achieved, or how the financial costs will be borne.

The announcement mentioned Denmark’s position as the EU’s largest oil producer (38 million barrels (mbl) in 2019) after the departure of the UK but it did not mention the significant domestic production of natural gas (3.4 billion cubic metres (bcm) or 21 million barrels of oil equivalent (mboe)). Nor did it draw attention to the heavy investment currently being made in redeveloping its largest gas field, Tyra, at a cost of \$3.4bn and in the new Baltic Pipe Project taking gas from Norway through Denmark to Poland.

Unsurprisingly, the announcement was greeted enthusiastically by environmental NGOs as a welcome step towards decarbonisation of the Danish economy and a good example of active ‘climate leadership’ as the Paris process gathers pace and COP26 approaches. The industry reaction was more cautious but still favourable. Oil Gas Denmark, the industry association, acknowledged that the agreement had wide political support and that it offers ‘clarity and stability’ for the future and the opportunity to use existing offshore infrastructure for CO₂ storage or other new uses in the energy transition.

The agreement proposes an early amendment to the underlying Danish Subsoil Act to fix the end-date of 2050 and to remove all possibility of future offshore licensing rounds.

Map of Danish Offshore Fields and Infrastructure



Source: Danish Energy Agency

Political background

The parliamentary elections in June 2019, held at the height of European climate change protests, delivered a decisive change of government and a much more urgent approach to climate change abatement. The Social Democrats formed a minority government with support from smaller left-wing and green parties and began work on new legislation and on building 'climate partnerships' with individual industries. The Climate Act, passed in December 2019, introduced binding targets for territorial emission reduction by 2030 of 70 per cent below 1990 levels and climate neutrality by 2050. This means that GHG emissions will have to fall from 54.8 mtCO₂e in 2018 to 23.1 mtCO₂e in 2030,

implying almost three times the rate of annual reduction previously envisaged¹. The Climate Act does not prescribe sectoral emission targets or how the national target should be achieved.

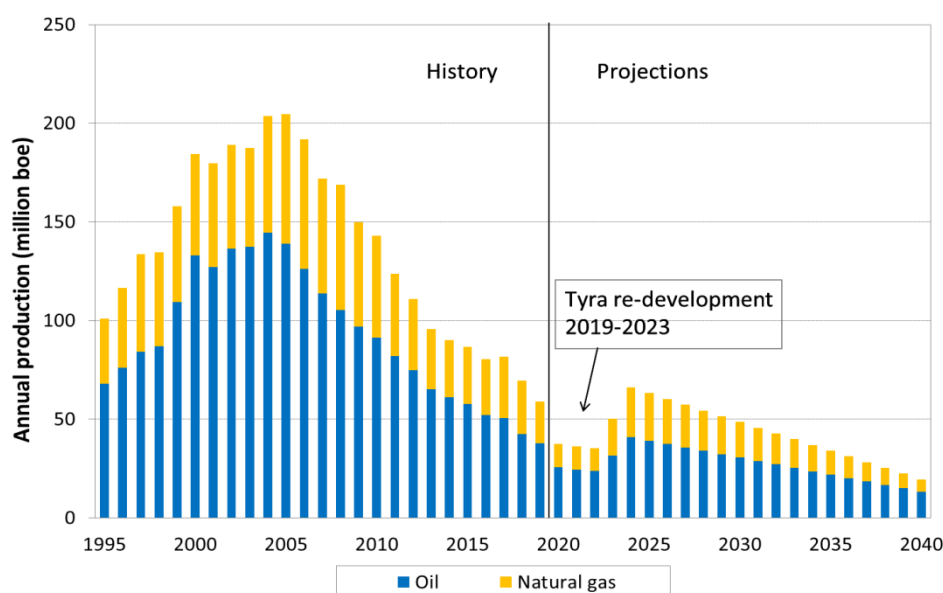
For the upstream oil and gas sector, like other energy-intensive sectors, this political change has led to a phase of intense examination of ways to reduce emissions in existing operations such as platform electrification and to use its infrastructure at the end of the production phase for carbon removal, principally CO₂ storage, or hydrogen production.

Upstream industry background

Denmark is a highly mature oil and gas-producing province with a long record of good operating practices and environmental standards. After changes of asset ownership, today the industry lies between the state-dominated Norwegian model and the entirely privately-owned UK model. The state-owned, non-operating company Nordsofonden holds a 20% stake in most licences and accounts for about 15% of Danish oil and gas production. State-owned Energinet owns, or has a stake in, all offshore gas pipelines. In 2019, the upstream contributed DKK 5.9 bn in revenue to the government, less than 1% of total tax revenue.

The first oil came ashore in 1972 and the first gas in 1984. Combined production reached a peak of 205 mboe (560 thousand barrels of oil equivalent per day (kboe/d) in 2005. As resources were depleted, production fell progressively to 59 mboe (160 kboe/d) in 2019. Denmark became a net

Danish Oil and Gas Production 1995-2040



Source: Danish Energy Agency, author's projections adapted from DEA projections

importer of oil in 2016 but was still a small net exporter of gas in 2019. At the end of 2019, remaining oil reserves (excluding contingent resources) were estimated by the Danish Energy Agency (DEA) at 430 mb and gas reserves at 190 mboe. In September 2019, operations temporarily halted at the largest gas field, Tyra, which processes 90% of the gas produced offshore, to replace two platforms with one new processing platform as part of a major field redevelopment project led by operator Total. Production is now expected to resume in 2023 after a coronavirus-related delay in 2020.

The chart above shows the history of production, the new expected Tyra re-development schedule and the projections of output *from existing developed reserves* to 2040 based on the DEA's most recent

¹ Denmark's Energy and Climate Outlook, Danish Energy Agency, 2020

forecasts published in September 2020². Volumes previously expected by the DEA from ‘technical resources’ and ‘prospective (undiscovered) resources’ have been excluded. The indicative ‘base case’ figure for production in 2040 is about 20 mboe or 55 kboe/d, little changed from the previous projections released in 2018. No figure for output in 2050 has been published by the DEA. However, by extrapolation, the level of production in 2050 expected by the DEA would have been minimal under most oil price scenarios, despite the good record of Danish operators in improving recovery rates, in managing late-life fields and in deferring decommissioning.

In 2018, total upstream GHG emissions (CO₂, methane and other GHGs) were reported in the National Inventory Report submitted to the UNFCCC as 1.63 million tonnes (mt) CO₂e. This amounted to 3 per cent of total territorial GHG emissions of 54.8 mt CO₂e. Average upstream emission intensity in Denmark in 2018 was 23 kg CO₂e/boe produced, higher than in Norway (10 kg CO₂e/boe) but lower than in the equally mature UK (28 kg CO₂e/boe). The Danish average intensity figure is close to the average which emerges from international industry surveys³. Total upstream emissions have fallen since 1999 but more slowly than production. In consequence, emission intensity has risen gradually in recent years but the commissioning of the new, more energy-efficient Tyra platform in 2023 is expected to lead to fall in emissions and emission intensity in 2024-2025.

This is not the first occasion on which exploration has been restricted in the Danish offshore. In February 2018, under the previous centre-right government, it was decided to end all exploration licensing and drilling onshore in inland waters, leaving only the North Sea area west of the Danish mainland open for oil and gas drilling.

The decision announced in December 2020 to restrict exploration further follows a period of low exploration activity by existing operators and diminished interest in future exploration. Since the end of 2015, according to DEA data, only one exploration well has been drilled. Total withdrew its interest in the 8th licensing round in October, leaving only one applicant remaining. The industry appetite for exploration is currently very depressed as it seeks to restore its finances after the oil and gas price collapse in 2Q 2020. Unlike Norway, there is no particular fiscal incentive in Denmark for exploration drilling or for new market entrants.

Impact on oil and gas exploration and production

There will still be a route to drill an exploration well in future if a highly prospective opportunity emerges, but exploration activity is likely to remain very low in all future years. Appraisal wells will still be permitted but such drilling will remain an occasional activity unless oil prices recover strongly.

The agreement does not require any producing field to cease operation. However, it may deter some late-life investment at some of the larger fields currently expected to cease production in the 2030s or 2040s, thereby indirectly bringing forward the cessation of production. In our view, the setting of an ‘end date’ in 2050 for all future oil and gas production is unlikely to lead to a material loss of value for existing licenses and taxable revenues, or to a downgrading of reserves, since the end date is beyond the expiry of all existing offshore production licences. At present, the existing licences at the 20 producing fields expire between 2022 and 2050. Existing licenses will be respected under the agreement⁴. The agreement does not explicitly exclude the possibility of extending an existing license if an operator makes such a request in the future, provided the cut-off date of 2050 is respected, but it

² Resource Assessment and Production Forecasts, Danish Energy Agency, September 2020.

³ A study by Stanford University in 2019 claimed that Danish oil production had the lowest emission intensity of any country in the world, lower even than Norway and Saudi Arabia. The estimates were derived in part from engineering-based modelling and applied only to oil fields. We prefer to view emission intensity for oil and gas production together where there is significant co-production and shared facilities

⁴ The agreement mentions one licence awarded in the 7th round in 2016 where they may be a reasonable expectation of a possible extension beyond 2050 if discoveries are made in future. It is proposed that this and any similar cases would be addressed fairly in amendments to the Danish Subsoil Act.

may be politically more difficult to agree in future. License holders will have 'booked' only those reserves which can be produced before the end of the current license.

At fields with the largest remaining resources, (the Dan, Halfdan and South Arne oil fields and the Tyra gas field), the agreement may deny the license holders the opportunity to realise the expected value of 'technical resources' as well any exploration-based tie-ins which have extended the life of fields in the past. However, appraisal drilling will continue to be permitted within the existing approval process. Operators at these fields will review and revise their investment and reservoir management plans over the remaining life of the respective fields to ensure the recovery of all economic resources at least cost. It would not be a surprise to see an end to offshore production in the early 2040s, well ahead of the expiry of all existing licences and the 2050 'end-date'.

The agreement includes a claim that future production of oil and gas will be reduced by 9-15% but the origin and basis of the estimates is not disclosed. It may simply reflect the exclusion of 'prospective resources' from all future production projections. Based on the published DEA projections to 2040 released before the agreement, and the extrapolation of the trend to 2050, we estimate that Denmark is still expected to produce >900 mboe of oil and gas between 2020 and 2050 from its proven reserves alone but that most of estimated undiscovered 'prospective resources' of about 150 mboe will be left in the ground.

Offshore CO₂ storage

Among the options to use existing offshore oil and gas infrastructure as part of the Danish energy transition are platform electrification, CO₂ storage and 'power-to-X', the conversion of surplus renewable electricity to hydrogen generation and storage. Ambitious plans for new offshore 'energy islands' to serve the transition are still under discussion but the most promising practical application for existing facilities is CO₂ storage. Electrification of platforms, either from shore or from offshore wind, is economically hampered by the maturity and small scale of most remaining resources.

The Danish Council on Climate Change, which advises the government, has identified the potential for offshore CO₂ storage to provide a domestic carbon sink for onshore industrial emissions from 2025 and there is broad popular support for CCS in Denmark. However, the regulatory and commercial framework and is not yet as advanced as in Norway or the UK. Project Greensand, which involves Ineos, operator of the Nini West oil field, Wintershall and Maersk Drilling, has received certification of the field as suitable for storage of 0.45 mt CO₂ per annum⁵ and it may be among the first projects to proceed if a commercial model, involving some public funding, can be agreed.

Conclusions

The growing maturity of the European upstream oil and gas industry at a time of relatively low oil prices and more demanding decarbonisation targets has eroded political support for indigenous oil and gas production. The industry is now generating lower tax revenues and providing fewer jobs, making it more vulnerable to hostile political sentiment. Gradual resource depletion is reducing upstream GHG emissions but not fast enough for some climate-conscious political parties. Even where activity is largely offshore, it has become, for many, an unwelcome symbol of the urgent need to shift away from fossil fuels.

The Danish government agreement on 4 December to halt exploration and phase out production by 2050 is much less draconian than it at first appears but it will shape future upstream investment and resource recovery. It aims to strike a balance between meeting political concerns over climate change and protecting fiscal revenues to help finance the transition to low-carbon energy. The expected costs and benefits of the agreement are not easy to assess because they will critically depend on the

⁵ 'Subsea CO₂ storage plan offshore Denmark clears first regulatory hurdle', World Oil, 25 November 2020

fluctuating course of oil and gas prices in the coming decades and their impact on upstream investment and tax revenues. The agreement is expected to be followed by revising legislation, supplemented by further measures which may entail changes to taxation, carbon pricing and trading and the funding of new technology such as CCS to meet the 2050 carbon neutrality target.

The Danish government's announcement will have been expected by the upstream industry given the change of government in 2019 and the adoption of a more stringent 70% national emission reduction target in 2030. The constraints under which existing developed fields will be operated are now at least clear, even if they are not welcomed by the industry. Operators will have an opportunity to mitigate the impact within their existing licences.

The halt to licensing rounds will restrict offshore exploration and appraisal (E&A) drilling but it does not itself mean an end to all such drilling. However, the maturity and low prospectivity of the Danish offshore already mean that there is little investor appetite to drill new E&A wells. Similarly, the cut-off of all production in 2050 is not expected to significantly change the remaining reserves produced because operators will revise their investment and reservoir management plans to reflect the new constraint. Production and upstream emissions to 2030 are not expected to be significantly different from previous expectations but the 'tail' of production in the 2030s and 2040s may be shorter than previously expected.

There appears to be little risk that the Danish production phase-out will lead to greater imports of higher-emission oil or gas, or unintended 'carbon leakage'. The commissioning of the Baltic Pipe Project in 2022, taking gas from Norway via Denmark to Poland, will provide a new potential source of gas and ensures a lower-emission source of imported supply is available when domestic gas production once again resumes its decline in the mid-2020s.

France and Ireland have already anticipated the Danish announcement with pledges to halt exploration and production but could one of the larger European producer countries follow Denmark? Norway is already an exceptionally low-emission producer and is set on further platform electrification to allow it to continue to develop its offshore resources. The UK is equally unlikely to curb upstream activity, maintaining consistently that maximising economic recovery of offshore resources is compatible with progressive decarbonisation, provided the industry accelerates the expected natural decline in sector emissions and contributes to the energy transition. The Netherlands is a more intriguing case, given the parallels between the Dutch and Danish offshore industries. Having acted decisively in 2019 to phase out Groningen production by 2022 for local environmental reasons, the willingness to 'leave hydrocarbons in the ground' is already established. Small field operators are already facing difficulties over profitability and nitrogen regulations in permits. Despite the recognition in policy circles of the role that upstream infrastructure can play in the energy transition, support for dwindling oil and gas production cannot be taken for granted. In this context, the impending parliamentary elections in March 2021 and the composition of the coalition government which follows may be decisive.