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Perspective

Abandoning fossil fuel production: What can be learned from the Danish phase-out of oil and gas?

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ABSTRACT

In December 2020, the Danish parliament decided to terminate all oil and gas extraction by the end of 2050 'as an important step' to becoming climate neutral in the same year. The agreement also stated that the Danish example would have to inspire larger oil and gas-producing countries to follow suit. This perspective derives five lessons relevant to larger countries: (1) The necessity of undertaking an economic feasibility study of phasing out oil and gas. (2) Based on this work, the importance of choosing an end date, creating consensus around it and leaving sufficient time to enable a just transition and a well-managed re-orientation of public and private long-term investments. (3) Social acceptability could be achieved by developing industry-specific and regional compensation measures and systematic support for retraining and training the workforce for non-fossil fuel activities. (4) The need to develop a detailed roadmap for the phase-out, including just transition measures, but just as important, clear milestones to ensure synergy within and integration of the different parts of the energy system and elements of the transition. (5) Making the process as open and transparent as possible to make room for criticisms and improvements.

1. Introduction

'Denmark must take the lead in the green transition and inspire other countries for climate action' [1]

Globally, it is essential to avoid extreme global warming. This would undoubtedly imply the termination of oil and gas extraction as fast as possible, as also argued in the recent and growing literature discussing the merits of leaving oil and gas in the ground, e.g., van Asselt and Newell [2] and Newell et al. [3]. One way of doing this is to set a phase-out date, as also suggested by Billon and Kristoffersen [4]. Denmark is the first important oil and gas-producing country to announce a legally binding end date for the exploration and extraction of oil and gas by 2050. Other comparable but larger producers also strive for a green transition but have not yet settled on an end date or initiated a phase-out process (cf. Table 1).

The Danish decision and the subsequent process of how this might be achieved have been investigated as a part of the Oil & Gas Transitions project.¹ An offshore installation map is shown in Fig. A.2 to

get an overview of all three North Sea countries share of exploration and extraction of oil and gas. In this joint research project, each of the transition processes in the UK, Norway, and Denmark are analyzed and compared. Based on the three published reports covering the Danish oil and gas transition [5–7], this perspective combines the main lessons to be learned for other larger oil and gas-producing countries. Similarly, the Norwegian and UK teams have produced two reports on their respective national transition process [8–11].

Based on the Danish case, the following four key questions are posed, which every country striving to phase-out fossil production would have to develop its own answers to:

1. How could a phase-out become a political option?
2. What could a phase-out look like?
3. How could a phase-out be turned into a just and green transition?
4. What could be learned from this phase-out process?

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¹ <https://oilandgastransitions.org/resources/reports/denmark-without-oil-and-gas-opportunities-and-challenges/>

Table 1

Denmark, Norway, and UK's current total greenhouse gas (GHG) emissions status reduction since 1990 level, and their targets in 2030 and 2050.

	Current status [12]	2030 target	2050 target	Source
Denmark	42.5%	70%	net-zero emission	[13]
Norway	29.0%	55%	net-zero emission	[14]
UK	48.9%	68%	net-zero emission	[15]

The major part of this paper presents the Danish answers to each of these four questions. In the last section, it is discussed what the UK and Norway, and beyond, could learn from the Danish case. But first, a comparison of Denmark, the UK, and Norway is outlined.

2. Attitudes and fossil resources: Comparing the danish case with Norway and the UK

Accepting climate change as a fact has become conventional wisdom among most people worldwide during the last decades. A Danish survey did show that the proportion of people having climate as one of their main priorities did increase tremendously during the last decade. In 2015, 43% of Danish citizens regarded climate as a very or somewhat important subject when casting their votes.

During the election campaign May-June 2019, the climate was one of the three main priorities among voters. Six weeks prior to the election date, the climate started to get far more support than any other subject, and on the election date, around 57% of voters believed this to be the most important compared to around 30% before the election day was announced [31]. Finally, the above-mentioned 43% increased significantly to 66% in July 2022 after the invasion of Ukraine [32,33].

The same tendency could be observed based on whether people recognize global climate change as a very or somewhat serious problem. In this respect, the Danish number did change from 67% in 2015 to 88% in 2022 [32,33]. A similar tendency could be observed in the UK: 28% of people in 2011 questioned the existence of climate change. This number declined to a modest size of 6% in 2018 [34]. The same tendency could also be observed in Norway, as climate change doubters dropped from 4.4% in 2018 to 2.4% in 2019 [35].

As Vanghaus et al. [36] also conclude in their work, as the willingness to act on climate change is growing, politicians and decision-makers get the opportunity to act with strong support from the population, even when it comes with a cost. This conclusion is supported by the Center for International Climate Research in Norway, where most people in Norway want something to be done to cut GHG emissions. Still, they are not entirely aware of how to proceed [35]. This indicates that politicians and decision-makers have a responsibility to take action to help society to establish a clear roadmap for reaching the GHG emission target.

The importance of the national oil and gas industry in achieving each country's future CO₂ targets is likely to correspond with its economic importance. Table 2 shows the size of Denmark, Norway, and the UK's oil and gas industry in numbers. Interestingly, Denmark and UK are similar on several accounts. For instance, the oil and gas rents (% of GDP) have decreased to a modest number, and the amount of barrels produced per capita is roughly identical for both countries.

Concerning Norway, more than 50% of their total export is still derived from the oil and gas industry. In comparison, Denmark and the UK's total export from the oil and gas industry only added up to 1.2% and 5.0% in 2021, respectively.

Another aspect to consider is countries' proven reserves, as this is a measure of how much oil and gas there is economically left to extract. These numbers are uncertain, as the extraction of additional reserves might become profitable in the future; the world's proven reserves have increased by 48.6% since 1996, based on BP's review

from 2017 [37]. However, the size of proven reserves still gives a good indication of the economic value each country must give up if they immediately stop extracting oil and gas. the results of abandoning oil and gas extraction will yield an 18.5-fold and 3.3-fold cede for Norway compared to Denmark and UK, respectively. Likewise, the results of the accumulated total production projections from 2023 to 2050 show that Norway is projected to produce 28.8-fold and 4.6-fold compared to Denmark and the UK.

On a global scale, abrupt changes in the fossil fuels energy market have occurred due to Russia's invasion of Ukraine, where oil and gas prices skyrocketed two weeks after Russia invaded Ukraine on the 24th of February 2022 due to the dependency on Russia's fossil fuels, particularly in Europe. The Russian-Ukraine war situation has prompted countries to reexamine their energy security and their respective energy mixes.

In the case of Denmark, it has, hence, been voiced that the North Sea agreement should be reopened and changed, but essentially, the chosen strategy has been to accelerate the phasing out of gas from the heating sector while at the same time strengthening the green transition.

Other countries like Norway have at first chosen more passive and fossil-based strategies:

'While the Russian-Ukraine war has undeniably accelerated the energy transition process in the EU, it has somewhat contributed to a delay in the phase-out of the petroleum sector in Norway' [38].

It might be unavoidable for a country like Norway in the short-run to stabilize the market, meanwhile helping other countries to break their dependency on Russian fossil fuels.

3. How did a phase-out become a political option in Denmark?

The phase-out of oil and gas in Denmark was agreed upon in December 2020, but as late as 2017, a 'North Sea Agreement' [39] was adopted by a large majority of Danish members of parliament. In contrast, the main purpose of this agreement was 'to stimulate investments in the extraction of oil'. So, how come the next Danish government, only three years later, decided to terminate all exploration and extraction of oil and gas by 2050?

The *economic rationale* of the decision to phase-out was the already steeply declining production of fossil fuels. This contributed to undermining one fundamental barrier to considering a phase-out, also reflected in the previous North Sea agreement of 2017: The deep-seated belief in the 'economic necessity' of producing oil and gas in Denmark. It has long been regarded as economically irresponsible to give up oil and gas production — especially for the decisive center-left party 'Radikale Venstre'. This party has been split between supporting a green transition while at the same time being highly economically responsible. Despite being a relatively small party, historically, it has time and again been 'threatening' to shift its support between left-wing and right-wing governments.

Two other types of economic arguments persuaded Radikale Venstre and other hesitant politicians to support a phase-out: A prognosis commissioned by the new social-democratic government suggested that phasing out by 31.12.2050 would only result in a loss of fewer than two billion euros in tax revenue [6] or around 2.5% of Danish tax in one year. Furthermore, the compensation to operators having a license to extract oil and gas beyond 2050 is regarded to be very limited or non-existent [6]. This was one of the advantages of having a rather long-term deadline.

Concerning *consensus-making*, Sperling et al. [5] highlight that after a change in government in 2019, the views of politicians, media, nongovernmental organizations (NGOs), employer/employee unions, interest organizations, and the population, in general, began to converge towards a more ambitious Danish climate effort as also indicated in Fig. 1.

Table 2

The economic importance of the oil and gas sector in Denmark, Norway, and the UK. Measured according to different indicators.

	Denmark	Norway	The UK	Year extrac.	Source
Oil Production (Thousand bbl/day)	64.8	1,704.3	744.9	2022	[16]
Natural gas Production (bcm) ^a	1.2	115	32	2022	[17]
Oil and gas rents (% of GDP) ^b	0.2	6.0	0.4	2020	[18]
Oil and gas export/total export (%) ^c	1.2	50.8	5.0	2021	[19–21]
Proven oil reserves (mil. bbl)	441	8,188	2,500	2022	[16]
Population (mil.)	5.88	5.46	67.65	2022	[22]
Direct employment	10,000	58,900	28,400	2021	[23–25]
Share of total labor force in %	0.33	1.68	0.08	2021	[26]
Accumulated oil equivalent production projections 2023–2050 (mil. boe) ^d	975.5	28,075.2	6,043.6	–	[27–29]
Oil production per capita (bbl/day/thousand capita)	11.03	312.26	11.01	2022	

^aPlease, note that the Danish share of natural gas is extraordinarily low because the main field, Tyra, has been closed from 2019–2023 as it is under reconstruction. In comparison, natural gas production was 4.8 bcm in 2017.

^bOil rents are the difference between the value of crude oil production at regional prices and total costs of production [30].

^cThe percentages are based on calculations from relevant national statistics offices. Please, note that the reconstruction of the Tyra field also affects the Danish export share of natural gas.

^dThe accumulated production projections are based on calculations from relevant national statistics offices. The data contains both oil and natural gases and is given in million of oil equivalent (mil. boe).

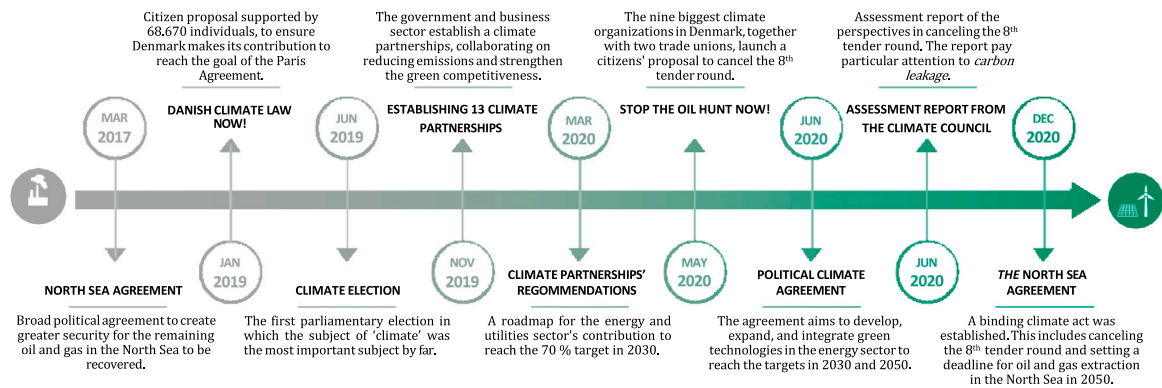


Fig. 1. Key events from 2017 emergence to The North Sea Agreement in December 2020.

Part of this shift was also reflected in the formulation of a common understanding (in Danish: forståelsespapiret) by the government and the three parties supporting the new government. A key feature of this paper was a promise to become the greenest parliament in the world. Hereby, the way was paved for the change of a North Sea Agreement, 2017 into the North Sea Agreement, 2020, which is described in Section 4. This decision was explicitly linked to the goal of becoming climate neutral in 2050. Further, phasing out fossils was depicted as a necessary precondition to achieve this goal.

The Danish case, therefore, indicates the importance of economic feasibility studies concerning oil and gas production and taxes, demonstrating the potential possibility of a phase-out while at the same time finding ways to create the necessary degree of consensus among decision-makers and, to some extent, also in the electing population.

4. What does the Danish phase-out entail?

Understanding the successful implementation of the Danish phase-out requires an introduction to how it was designed and regulated politically. One and a half years after the election, a crucial component of the promised green transition, *The North Sea Agreement* (cf. Box 1) on phasing out oil and gas production by 2050, was adopted politically. This agreement was based on widespread support from the social-democratic government and five other parties, including three right-wing parties and a party to the left of the government (the Socialist People's Party, SF).

The agreement consists of 11 provisions (cf. Box 1) which could be grouped into four themes: Provisions 1–4 are related to the different

aspects of the phase-out process. Provisions 5–8 concern different aspects of a 'just transition',² while provision 9 focuses on the Danish leadership in phasing out oil and gas globally. These three themes will be discussed in the following subsections. The more formal provisions 10 and 11 are not of relevance to the paper.

4.1. The phase-out elements of the agreement

An essential part of the agreement was to declare a phase-out deadline without any exemptions. Hereby, the agreement violated some contracts reaching beyond the phase-out deadline of 2050. Therefore, the government initiated voluntary agreements with relevant operators. In addition, the 8th tender round for oil and gas exploration from February 2019 was canceled, including all future tendering rounds. This decision was, however, already anticipated by the market as only one operator had shown an interest in making a bid [41].

The agreement allows new exploration and extraction licenses until 2050 due to so-called 'mini-rounds' and neighboring blocks adjacent

² This concept is central to the Oil & Gas Transition project. According to Atteridge and Strambo [40] it is an umbrella concept for the following actions needed to counter-act the negative consequences of a transition away from fossil fuels: actively encourage decarbonization; avoid the creation of carbon lock-in and more 'losers' in these sectors; support affected regions; support workers, their families and the wider community affected by closures or downscaling; clean up environmental damage, and ensure that related costs are not transferred from the private to the public sector; address existing economic and social inequalities; ensure an inclusive and transparent planning process.

to existing fields [42]. This possibility has already come into play, as Ineos Oil & Gas Denmark was granted permission to exploit the Solsort field in late 2022, with Syd Arne Nord as the recipient platform [43].

Box 1: The Danish North Sea Agreement [1]

1. An end date for all extraction of oil and gas in the North Sea by the end of 2050
2. Voluntary agreement with operators negatively affected by end date
3. Cancellation of the scheduled 8th tender round
4. Closure of the 'Open Door'-area (reducing the area that could potentially be investigated)
5. CCS development in the North Sea
6. Stable opportunities and conditions for the operators in the North Sea until 2050
7. Cooperation between the state and the oil and gas sector on electrification
8. Promoting growth and development in the main oil and gas region around Esbjerg
9. Taking global leadership in terms of phasing out oil and gas
10. Administrative provisions regulating details in the further political process
11. Agreement on the financing of the yearly cost of the agreement

4.2. The (just) transition elements of the agreement

Internationally, phasing out oil and gas could raise severe just transition issues. In Denmark these are, however, mostly limited to the town of Esbjerg and its vicinity, where the majority of the oil and gas infrastructure is situated. For this reason, the North Sea Agreement supports Esbjerg during the transition process away from oil and gas in various ways.

A tangible, yet limited, support of €12 million is allocated in 2025 for developing the harbor of Esbjerg, allowing it to become better suited for shipping offshore wind turbines by deepening the harbor's fairway [1,5].

On a more political level, the state has also promised to support Esbjerg by:

'developing recommendations concerning how to invest in local industrial competencies and uncovering potentials for a green transition of the whole region of Southern Denmark' [1].

Specifically, the planned Energy Island in the North Sea is expected to benefit Esbjerg (cf. [5]). In the same publication, it is also highlighted that stakeholders attach great significance to the potential of Carbon Capture and Storage (CCS) in the North Sea. In that context, it is also likely that former oil and gas reservoirs would be used for storing CO₂.

The North Sea Agreement (Provision 5) already allocates €24 million to developing and demonstrating CO₂ storing facilities in the North Sea. Experiences and competencies within the oil and gas industry could also become part of the transition to CCS in conjunction with many companies servicing the oil and gas industry in the North Sea [44].

4.3. Having an impact on the phase-out process in other oil and gas producing countries

Concerning the question of a wider impact, the belief is that the decision to phase-out oil and gas in Denmark makes it possible to inspire and put moral pressure on other oil and gas-producing countries. Implicitly, the establishment of the Beyond Oil and Gas Alliance (BOGA) was announced in the agreement:

'The agreement represents an obvious opportunity to put pressure on and engage in dialogue with other countries to prepare plans for the phasing out of fossil fuel production, and that Denmark should, thus, take global action leadership in the preparation of an initiative where such work can be formalized, and the greatest possible climate effect is hereby achieved' [1].

If successful, the BOGA initiative, in principle, could partly counter the stark projections of the annual Production Gap report [45], where the production of oil by 2030 is expected to be 45% higher compared to the recommended low carbon pathways of 2 °C proposed by the UN's Intergovernmental Panel on Climate Change (IPCC) [45].

What could be learned from the Danish example here is that a phase-out process needs to be planned in as much detail as possible and that just-transition issues must be dealt with proactively as part of this planning. Furthermore, other countries would have to make their own conclusions about the fact that the agreement was supported by a large majority in the Danish parliament. This makes the agreement resilient to a shift in government and hence relatively future-proof.

5. How does the Danish state try to turn the phase-out into a just transition?

One of the main reasons why the biggest oil and gas-producing countries hesitate to phase-out oil and gas are concerns around just transition issues and related challenges. Some of the key transition questions are: how does a country compensate for the losses in production, exports, and employment? How does a country develop an alternative productive activity that would create new workplaces to replace those directly or indirectly linked to the oil and gas industry?

The Danish transition process has so far been surprisingly frictionless [5]. This could, in part, be attributed to the peculiarities of the Danish case, including the fact that it is a rather small oil and gas producer compared to countries like Norway and the UK and that the economy, in general, and the renewable energy sector, in particular, have been booming for a couple of years.

However, some general features can supplement this explanation, and that might also – to some extent – apply to other countries. These are that:

- Large parts of the workforce within oil and gas have (engineering and mechanical) competencies that have proven to fit well with the (offshore) renewable energy sector. As such, the two sectors could be regarded as complementary rather than substitutes. Furthermore, the wind turbine industry offers a two-week course in Denmark, giving immediate access to employment in this sector.
- Second, the North Sea Agreement promises a comfortably late deadline of 2050 combined with a promise of stable business conditions during the phase-out period. According to both observers and stakeholders, this is very important — especially for long-term investments [5].
- Third, it was signaled politically and economically that the town of Esbjerg would be supported specifically during the transition. This has further contributed to a development that was already on its way: Decision-makers in Esbjerg are putting a strong focus on developing the renewable energy sector [5].
- A fourth feature, which Norway especially has in common with Denmark, is a fine-grained safety net offering compensation and re-qualification of the affected workforce. This has limited the resistance from prospective losers and arguably increases the social acceptability of the transition.
- A fifth and final feature is the establishment of 13 national industrial climate partnerships.

'The purpose [of these] is to strengthen the dialogue between the government, business, and trade unions about opportunities and barriers to the green transition' [46].

One of these partnerships involved the private energy sector as well as private and public utilities. Organizations for employers and employees are also represented, and CEOs from private firms like Vestas and the public firm Ørsted. The partnership has produced specific recommendations for reaching Denmark's climate targets, including actions in the oil and gas sector [47].

It is noteworthy that the representatives from the renewable energy sector have prepared these recommendations in close collaboration with participants from the oil and gas sector – for the first time – at this scale. This has created a degree of commitment and acceptance in the oil and gas industry, which might help explain the subsequent and immediate change in private and public investments away from oil and gas. For instance, measures like the electrification of offshore platforms and converting platforms to carbon storage facilities are mentioned in the partnership's recommendations. Bearing this in mind, the general support towards the 2050 phase-out within the oil and gas industry is understandable.

The Danish example suggests that states with weaker social safety nets that undergo a transition away from fossil production would have to allocate a significant amount of resources for compensatory measures. This drain on resources might, however, be compensated by directing some of these resources towards active restructuring into new activities, preferably within renewables. The stimulation of such a development can be approached differently, and the creation of climate partnerships might be one of the possibilities.

6. What could be learned from the Danish phase-out process?

6.1. Recommendations for the ongoing phase-out process in Denmark

As Denmark has been a first mover, this has also resulted in some educational mistakes and omissions. A key point in this context is that the phase-out has mostly been opaque, declared rather than planned, and has taken place without engaging all relevant actors. Transparency does not only follow from democratic ideals but also the lesson that 'locally driven and coordinated transitions have tended to fare better than those coordinated by national governments' [40]. Opacity could potentially lead to sub-optimal investments in, e.g., CCS infrastructure or unnecessarily long lifetime extensions of some oil and gas fields.

To avoid this, Hansen et al. [6] suggest establishing an independent expert committee to develop detailed scenarios and recommendations for the phase-out. The committee should cover different and complementary competencies concerning future electrification infrastructure, power-to-x plants, energy islands, offshore wind turbines, oil and gas, CCS, energy sector legislation, economics, and environmental and political issues. The ambitions of this committee should be to:

- Identify the major decisions to be taken en route to a complete phase-out of oil and gas and at least the basic details of their implementation.
- Develop a timetable to help politicians make adequate decisions in due time to exploit synergies, secure the close integration of individual elements, minimize risks, avoid unnecessary costs, and understand overlapping and conflicting activities.

In its work, the committee should be requested to answer the following questions:

- What would it require to phase-out the production of oil and gas in Denmark before 2050, e.g., by 2034 or 2042? (The analysis in Hansen et al. [6] suggests these two years as plausible alternative options).

- How many and which platforms should or could be used for CCS? Should it only be these platforms which become electrified beforehand?
- What is the expected size of the compensation claims from the operators' side in case of an earlier phase-out than 2050? What could be done to reduce these potential claims, perhaps in collaboration with the operators?
- How could a(n increased) national CO₂-taxation contribute to the transition? And how high would it have to be to support an earlier deadline than 2050?
- How could national and international efforts within offshore wind energy and energy islands be strengthened by local, regional, and state action while simultaneously supporting the development of power-to-x?

The controversial aspect of choosing an end date often relates to one of the most important principles of a just transition: Carbon-intensive countries would have to take the lead in cutting CO₂ emissions, even if this might have a significant negative impact on their economy. This issue is also addressed by Calverley and Anderson [48]:

'For our central scenario (50% chance of 1.5 °C), the final redistribution that balanced equity with delivery sees oil and gas production in the wealthiest... nations reduce by 50% in just six years and cease by 2034... If the chance is to be increased to 67%, the requirement is 2031.'

As Hansen et al. [6] indicates, the loss of tax revenues due to an earlier phase-out in, e.g., 2042, would only be marginally higher than in 2050. A phase-out by 2034 would lead to a much larger loss but not be prohibitive. Phasing out earlier than 2050 does, hence, seem to be a realistic possibility, but that has only been considered by left-wing parties. The then social-democratic government ignored the requests from NGOs and the political opposition for calculations on the consequences of an earlier deadline. The official argument was, at the time, that an earlier phase-out would become 'enormously expensive' and legally complex [49]. This lack of transparency and openness illustrates that the Danish example is not without problems.

6.2. Five key lessons for other oil and gas producing countries — illustrated by the case of the UK and Norway

- Firstly, other countries beyond Denmark are strongly encouraged to make long-term prognoses for the production and (state) revenues stemming directly and indirectly from the oil and gas industry and to re-evaluate these estimates regularly, particularly where they are influenced by geopolitical upheaval. The choice of end date should be partly based on such a feasibility study to create the necessary degree of consensus.
- The next step would be to create a consensus on a phase-out deadline. Ideally, this phase-out should be collaboratively determined and legally binding. When setting an end date, oil and gas-related companies would need time to readjust and re-evaluate their strategic responses and their opportunity to invest in new domains while retaining a profitable business [5]. The setting of an end date in 2020 for oil and gas production by 2050 did render stakeholders 30 years to adapt. Even so, long-term investments in oil and gas have already been reduced significantly after the announcement of the expiry date in 2050, where previously expected projects to be launched have been reviewed [6,27,49]. As a result, exploration activities on respectively oil and gas have been reduced by 55% and 77% [27].

A counterargument to setting a phase-out deadline could be that such a measure is unnecessary if a country has already set ambitious overall targets for decarbonization. However, not much indicates that the oil and gas industry will phase-out based on

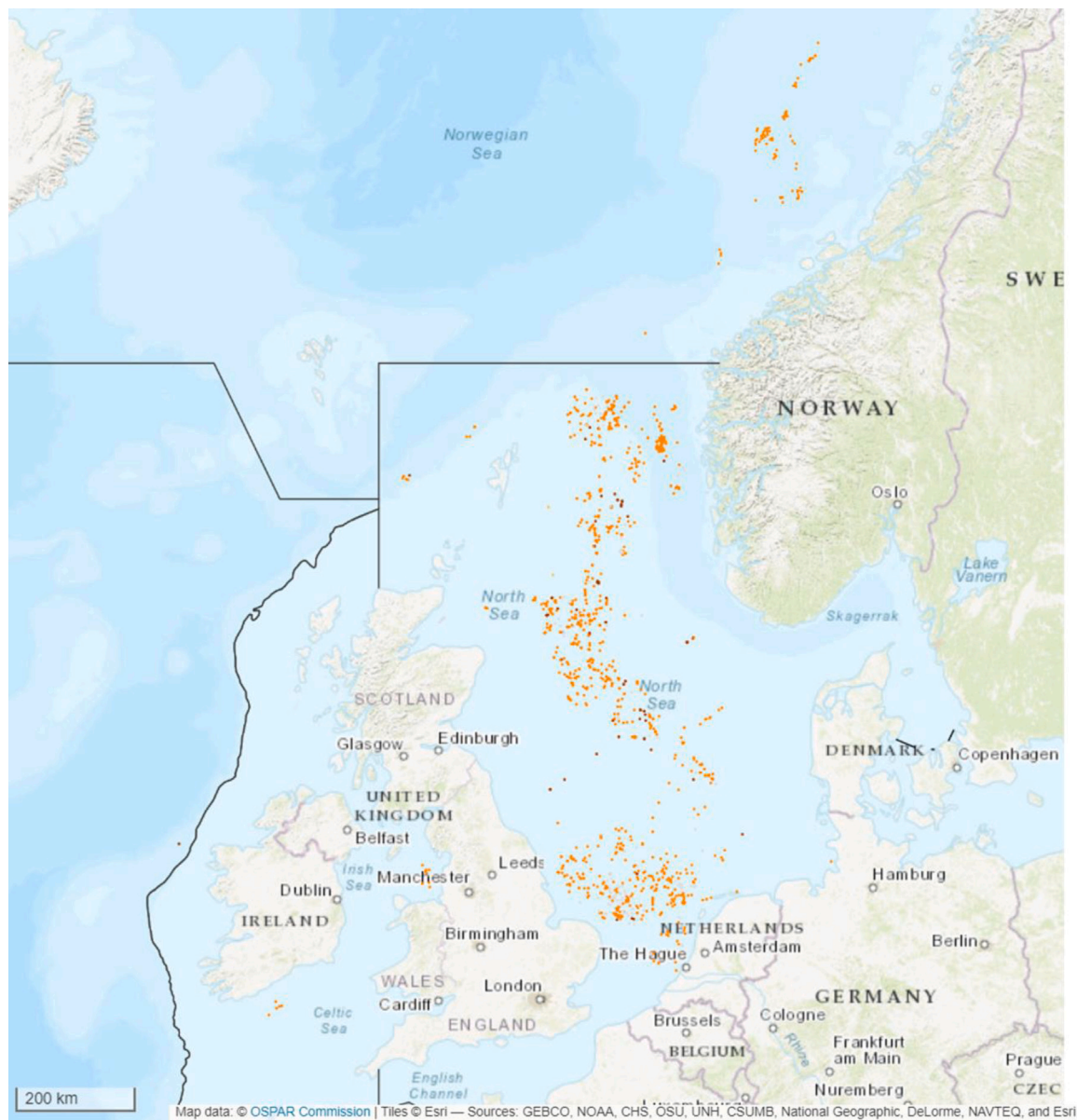


Fig. A.2. Map of offshore installations in the North Sea registered by OSPAR. All orange markers are operational installations, and red markers indicate those that are being decommissioned [50].

national climate commitments alone, as highlighted in the above-mentioned production gap report [45]. More than other national energy industry actors, the oil and gas industry follows global trends and prices and has, thus, no strong links to national climate and energy policies. This highlights the need for oil and gas-producing countries to actively govern a production phase-out, for instance, by building a consensus around a phase-out date.

- Thirdly, countries like the UK and especially Norway would have to face the reality that they would be destined to encounter much larger just transition issues and challenges than Denmark. In the case of Norway, as many as 200,000 individuals are directly or indirectly employed in the Norwegian petroleum sector [24]. One would expect more resistance to a phase-out in Norway for several other reasons also: oil and gas production is still very profitable, it constitutes a significant part of exports, and production is not expected to decline before 2025. Furthermore, oil and gas have been so fundamental to the development of the Norwegian welfare state, which makes it difficult even to raise the discussion of a phase-out.

A phase-out of oil and gas production is sometimes perceived as synonymous with destroying a whole industry. Contrary to this, the Danish case indicates that most oil and gas workers would be adaptable and could enter the offshore wind sector. There will also remain significant job opportunities in decommissioning former oil and gas infrastructure. Yet, there would be a much larger need for counteracting higher local and regional unemployment in Norway, and possibly also in the UK, than in Denmark. In the UK, there is a particular need to develop just transition policies across all regions to move from rhetoric to action. Scotland, for instance, has recently launched a draft Energy Strategy and Just Transition plan along with various support mechanisms for affected regions, whereas the Westminster government has yet to engage substantively with just transition concerns or opportunities.

- Fourthly, in the two countries, it is more imperative than in the Danish case to have a clear timetable and roadmap for the phase-out, given the transition process away from oil and gas is set to be more challenging and wide-ranging.

- Finally, part of the Danish phase-out process has been rather opaque. This conflicts with one of the seven principles of a just transition: transparency. Based on experience gathered through the comparative research project, the UK and Norwegian states seem to show more open and transparent administrative procedures — at least in relation to the oil and gas sector. The needed acceleration of the phase-out process in the two countries can hopefully be built on this higher degree of transparency.

7. Conclusion

The main question that this paper has aimed to answer is whether and how larger oil and gas-producing countries could be inspired by the Danish phase-out process to ensure a relatively frictionless and not too long-term transition away from extracting oil and gas. The analysis leads to five lessons presented in Section 6.2. The keywords for other important oil and gas-producing economies are feasibility studies, a phase-out deadline, social acceptability of change, and transparency.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Poul Thoeis Madsen reports financial support was provided by Laudes Foundation. Poul Thoeis Madsen reports financial support was provided by R Foundation.

Data availability

Data will be made available on request.

Appendix. Map of offshore installations in the North Sea

See Fig. A.2.

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