

Lessons from Oil and Gas Transitions in the North Sea

SEI Report
August 2023

Felipe Sanchez¹

Björn Nykvist¹

Olle Olsson²

Linus Linde³

¹ Stockholm Environment Institute

² Energimyndigheten

³ Svenska Kraftnät





UNIVERSITY
OF OSLO



AALBORG UNIVERSITY
DENMARK



THE UNIVERSITY
of EDINBURGH

Stockholm Environment Institute

Linnégatan 87D 115 23 Stockholm, Sweden

Tel: +46 8 30 80 44 www.sei.org



FRIDTJOF NANSENS INSTITUTT
FRIDTJOF NANSEN INSTITUTE



Fafo

Author contact: Felipe Sanchez

felipe.sanchez@sei.org

Editor: Tom Gill

Layout: Olesia Polishchuk/Richard Clay

Graphics: Mia Shu

Cover photo: Oil platform at sea at the northern
lights background © Anton Petrus / Getty Images



KR
FOUNDATION

Laudes ———
— Foundation

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes, without special permission from the copyright holder(s) provided acknowledgement of the source is made. No use of this publication may be made for resale or other commercial purpose, without the written permission of the copyright holder(s).

Copyright © August 2023 by Stockholm Environment Institute

DOI: <https://doi.org/10.51414/sei2023.041>

Stockholm Environment Institute is an international non-profit research and policy organization that tackles environment and development challenges.

We connect science and decision-making to develop solutions for a sustainable future for all.

Our approach is highly collaborative: stakeholder involvement is at the heart of our efforts to build capacity, strengthen institutions, and equip partners for the long term.

Our work spans climate, water, air, and land-use issues, and integrates evidence and perspectives on governance, the economy, gender and human health.

Across our eight centres in Europe, Asia, Africa and the Americas, we engage with policy processes, development action and business practice throughout the world.

This synthesis report was written by the Stockholm Environment Institute as part of the Oil and Gas Transitions (OGT) programme, which is co-led by Climate Strategies (CS) and the Stockholm Environment Institute (SEI). OGT is an evidence-based programme which aims to generate evidence and co-produced pathways for policy action to accelerate oil and gas just transitions in the UK, Denmark and Norway. This report provides a synthesis of three country reports from university partners within the OGT consortium, as well as an assessment of the state of just transition policies in the North Sea using a novel scorecard analysis. The synthesis report forms the foundation for the OGT programme's ongoing work on co-producing just and feasible oil and gas transitions pathways/scenarios with stakeholders. The statements herein do not directly represent the views of CS, SEI, the funders of the programme or other members of the OGT consortium.

For more information visit: www.oilandgastransitions.org

Suggested citation: Sanchez, F., Nykvist, B., Olsson, O., & Linde, L. (2023). Lessons from Oil and Gas Transitions in the North Sea. SEI Report. Stockholm Environment Institute, Stockholm. DOI: <https://doi.org/10.51414/sei2023.041>

Acknowledgements

The production of this synthesis report is financed by the KR Foundation and Laudes Foundation. We are grateful for contributions to the report from Climate Strategies, the University of Aalborg, the University of Edinburgh, the University of Oslo, Fafo and the Fridtjof Nansen Institute. Thank you to the SEI editors and an anonymous peer reviewer for comments on an earlier version of this report.

Contents

1. Introduction	4
2. Oil and gas transition scenarios.....	5
2.1 Mixed success on identifying milestones and timing.....	6
2.2 Responsibility for transition sits primarily with government.....	9
2.3 Policies for oil and gas transition pathways	10
3. Lessons from the North Sea.....	11
3.1 One region yet three stages of transitions	11
3.2 Shift in state intervention away from “propping up”	13
3.3 Overcoming resistance: participatory processes and transformation narratives	13
3.4 Enabling conditions for just transitions in the North Sea	14
4. Beyond the North Sea	16
4.1 Choices of geographic delineation.....	16
4.2 Role of industry in stakeholder dialogues.....	16
4.3 Mapping implementation issues.....	17
4.4 Global supply reduction	17
5. Closing remarks.....	19
References	20
Annex	23

1. Introduction

While the Paris Agreement has galvanized efforts to limit global warming by reducing the use and consumption of fossil fuels, international efforts on a similar scale to reduce fossil fuel supply have not emerged. Countries are set to produce twice as much fossil fuels by 2030 than consistent with limiting global warming to 1.5C (SEI et al., 2021). The current logic of international climate policy – which is to address climate change mainly through demand-side efforts – is being questioned by academia (Asheim et al., 2019; Gaulin & Le Billon, 2020; Green & Denniss, 2018; Lazarus & van Asselt, 2018; Sanchez & Linde, 2023). In recent years several initiatives led by government and civil society have emerged that seek to push the issue of reducing fossil fuel supply higher up on the international climate agenda (Linde et al., 2022).

The Oil and Gas Transitions research project, co-led by Climate Strategies and the Stockholm Environment Institute (SEI), aims to improve understanding of how countries that produce oil and gas can move away from fossil fuel production towards pathways compatible with global climate goals and a just transition. The project adopts Atteridge and Strambo's (2020a) broad framing of a just transition, which goes beyond only supporting workers affected by transition to also consider local, national and international equity issues and broader negative consequences associated with structural change. While the questions analysed in the project are globally relevant, it focuses on three countries producing oil and gas from the North Sea basin: Denmark, Norway and the UK.

The North Sea as an oil and gas region has a shared geography, history of production, and operating conditions. The discovery of large resources in the North Sea in the late 1960s and early 1970s meant that North Sea oil output began to ramp up at a crucial juncture of new realities brought on by the oil crises of the 1970s. The strong increase in North Sea oil production in the 1980s contributed to a diversification of the global oil market, away from an earlier substantial dependence on OPEC producers (Yergin, 2009). The now mature production region is characterized by high capital investments, technologically complex projects and challenging offshore conditions for exploration and extraction (Adegbamigbe et al., 2022).

The case of the North Sea is pertinent for an equitable phase out of oil and gas, both globally and domestically. At the global level, it can be argued that North Sea producers ought to phase out soonest, since they are most capable of bearing the burden of the transition owing to the countries' wealth and provision of social safety nets (Kartha et al., 2018; Muttitt & Kartha, 2020). This also means that North Sea producers are well placed to take international leadership on reducing fossil fuel supply. At the domestic level, the history of socio-technical transitions demonstrates that without active management, the outcomes of a transition can be detrimental for local and marginalized communities (Atteridge & Strambo, 2020c). Given that the North Sea is a mature region of production where countries have ambitious carbon neutrality targets, these producers should already be putting in place transition strategies to ensure that no one is left behind.

This final synthesis report of the Oil and Gas Transitions project presents insights gained from co-production workshops on transition scenarios, held with stakeholders from government, industry and civil society in Denmark, Norway, and the UK. The report also brings together insights from all parts of the project, and sets out policy considerations and insights focusing on supply side interventions when pursuing just transitions from oil and gas in the North Sea. Finally, it highlights considerations that are relevant to producer countries in other regions of the world seeking to embark on similar transitions.

The report is structured as follows. Section 2 synthesizes the outputs of the scenario workshops. Section 3 discusses lessons learned from the North Sea case studies. Section 4 presents reflections on the implications of this project for oil and gas transitions in other regions of the world. Section 5 concludes the report.

BOX 1. A NOTE ON THE RUSSIAN INVASION OF UKRAINE

The Russian invasion of Ukraine in February 2022 put the oil and gas sector into another period of turbulence in the global energy markets, which tend to be dominated by the extraction and trade of fossil-based hydrocarbons. Millions of people around Europe – and more still globally – are struggling to pay their petrol, gas and electricity bills as the world passes through an energy crisis that is truly global in scope (Vaughan, 2022). The crisis exposes the costs and risks of the global dependence on oil and gas. It also means that European non-Russian oil and gas producers have found themselves in a new position. From having been under pressure in early 2022 to reduce their emissions – or preferably to having begun a process of phasing out their extraction operations – they suddenly found themselves in a situation where their product commands a substantial premium, simply by being non-Russian suppliers of fossil fuels.

The Oil and Gas Transitions project was conceived, designed and launched in late 2020, and had already begun to publish analysis and findings by the time of the Russian invasion (see annex for further details of outputs). The national co-production workshops in the project therefore could not be separated from the impact of the invasion as a key part of the global context. While it is logical that political priorities in this context pivot towards the need for short-term energy security and to mitigate the risk of acute energy poverty, climate change, which largely results from excessive use of fossil fuels, remains an overarching and growing global challenge.

2. Oil and gas transition scenarios

As part of the Oil and Gas Transitions project three country research teams with local expertise in Denmark, Norway and the UK, followed a similar method to explore and define net-zero scenarios and more stringent complete phase-out scenarios in their respective countries. The research teams published the outputs of stakeholder workshops in the following reports: Denmark (Hansen et al., 2022); Norway (Jordhus-Lier et al., 2022); and the UK (Jenkins et al., 2022). It should be noted that these outputs are not necessarily endorsed by the workshop participants. Further details on the methodological approach of the co-production workshops and the full outputs of the project can be found in the annex of this report.

As shown in Table 1, the UK and Norway research teams explored one scenario with net-zero emissions in 2050 and another scenario in which oil and gas extraction is phased out by the same year. In the case of Norway the whole value chain is also considered. For both countries, the net-zero scenarios focus on the phase out of emissions from the oil and gas sector, rather than the phase out of oil and gas extraction. In other words, the net-zero scenario can be realized by focusing on internalizing the social cost of oil and gas, which may leave room for fossil-based business models, in contrast to the phase-out scenario, which requires a managed decline of oil and gas exploration and extraction. During stakeholder workshops, the Norway and UK research teams sought to gain insights on: a) the key milestones needed to meet the net-zero or phase-out vision; b) the key actors responsible for each milestone; and c) the main barriers and opportunities in both scenarios.

In contrast, the Denmark research team did not develop a net-zero scenario because it already has a phase-out target date of 2050. Instead, discussions focused on whether a phase out could happen sooner and how to operationalize such a phase out. Specifically, the objective of Danish stakeholder engagement was to develop and test the relevance, validity and robustness

of forecast models for state revenue under phase-out scenarios by 2034 and 2042. The year 2034 was chosen based on a global equity perspective, where Denmark's relative wealth and low dependency on oil and gas rents calls for them to accomplish a transition faster than currently planned. Whereas the year 2042 was chosen based on simulations showing that the state revenue from the oil and gas sector will diminish after that time period.

Table 1. Overview of scenarios adopted in stakeholder workshops and Scope 1, 2, and 3 emissions covered¹

	Net-zero scenario	Phase-out scenario
Norway	Net-zero emissions within the value chain of oil and gas (Scope 1,2 and 3) by 2050.	Phase out of oil and gas extraction by 2050.
UK	Net-zero emissions within Scope 1 and 2 (Scope 3 up for discussion) by 2050.	Phase out of oil and gas extraction by 2050.
Denmark	Not applicable for Denmark given existing 2050 phase-out target.	Phase-out of the oil and gas industry by 2034 or 2042.

The stakeholder workshop discussions in the three country case studies are summarized below, with a focus on milestones, responsibilities and policies recommendations.

2.1 Mixed success on identifying milestones and timing

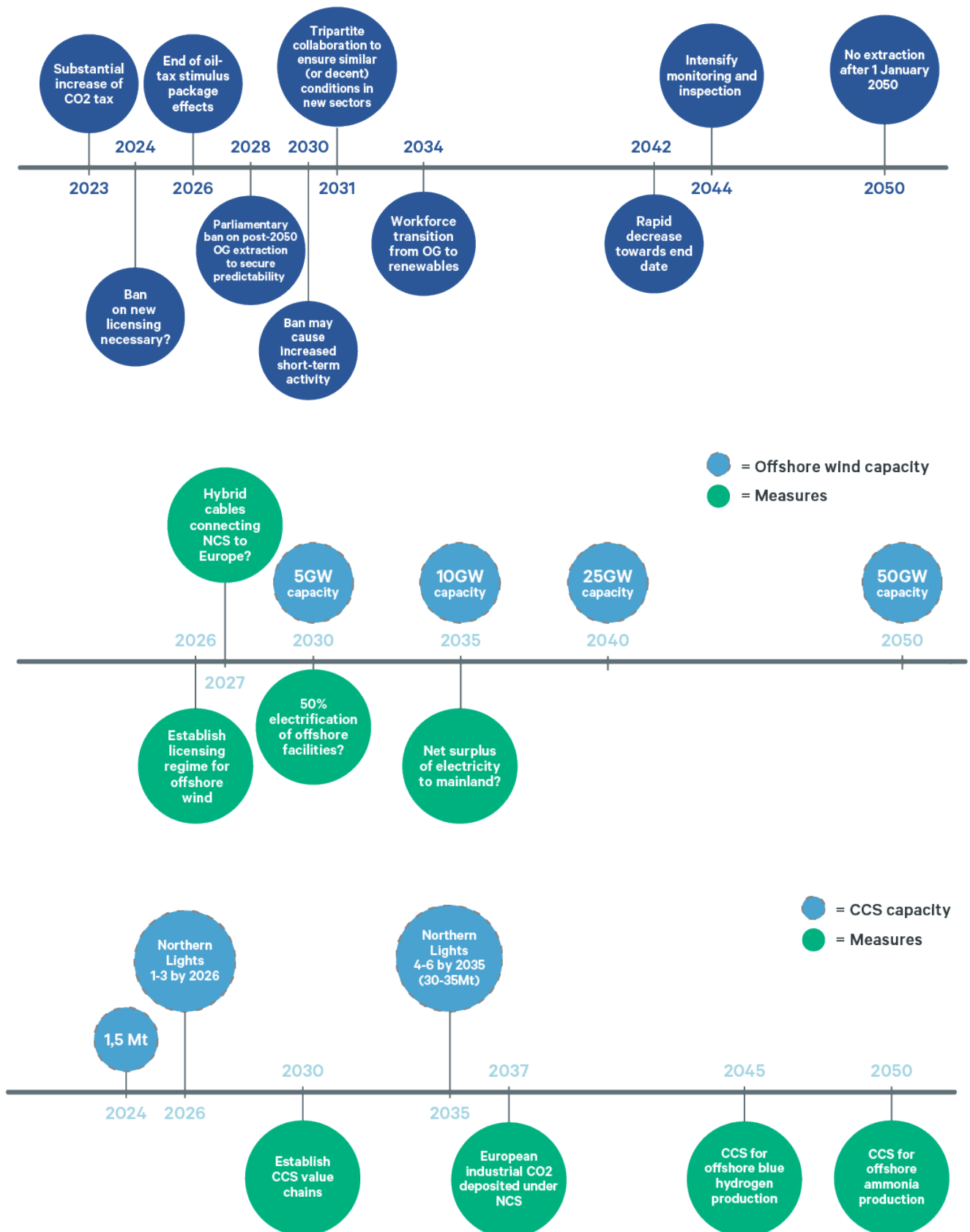
Clean energy and carbon removal technologies are essential elements of the transition away from oil and gas. The discussions in all three countries were dominated by technologies such as offshore wind power; carbon capture, utilization and storage (CCUS); and hydrogen, including different hydrogen derived carriers and electro-fuels such as ammonia. Ultimately, the development, scale-up and deployment of such technologies dictated the political and socio-economic enabling conditions necessary under both transition scenarios.

In Norway's case, achieving the net-zero scenario required taking two mutually dependent paths simultaneously: ramping up the capacities for both offshore wind power and carbon capture. As shown in Figure 1, the timeline for offshore wind is punctuated with capacity targets and short-term milestones, including establishing an offshore wind licensing regime, linking offshore wind to both Norwegian and European energy markets, and a potential requirement that electrification projects be based on offshore wind. Meanwhile, milestones for carbon capture and storage (CCS) under a net-zero scenario relied on further unquantified expansion of capacity and the development of CCS value chains for turning the Norwegian continental shelf into a functional storage for European CO₂, and spurring the production of natural gas-based hydrogen with carbon capture (so-called "blue hydrogen").

For the phase-out scenario, milestones focused on government action to curtail extraction, include a ban, an end to new licences, and a steep carbon tax. Importantly, participants believed that a ban on extraction by 2050 would lead to short-term increases in extraction and a sharper decline closer to 2050 as industry adapted strategies to optimize extraction. Discussions therefore focused on protecting communities and workers under these circumstances.

¹ Including all three scopes is in line with the recommendations from The Science Based Targets initiative (SBTi) (<https://sciencebasedtargets.org/>). The Greenhouse Gas Protocol (GHGP) divides emissions into three scopes: Scope 1 includes all direct greenhouse gas emissions owned or controlled by the company (including gas turbines for offshore oil operations), Scope 2 covers indirect emissions from consumption of purchased electricity, while Scope 3 covers other indirect emissions (also known as value chain emissions) and, crucially for the oil and gas industry, includes emissions from the end use of petroleum products.

Figure 1. Transition milestones for Norway under net-zero and phase-out scenarios (adapted from Jordhus-Lier et al., 2022).



In the case of the UK, agreement could not be reached on the most desirable futures, which in turn meant that the milestones and timelines to achieve the scenario goals were not fully completed. Nevertheless, workshop participants did discuss some points that could become milestones on the road to net-zero, which are presented in Table 2. In both scenarios the importance of technological progress is clear. Yet greater emphasis was placed on such progress in the phase-out scenario because it leaves no space for continued oil and gas extraction, and therefore shifted the logic from ways to decrease emissions to replacing oil and gas extraction entirely.

Despite the lack of a timeline for milestones, discussions did arrive at broad principles under which milestones could be developed in relation to the technologies that form the foundations of these scenarios. For the net-zero scenario, certainty is important for the creation of new markets, near-term targets, and transformational change. Meanwhile, the phase-out scenario added the need for accelerated implementation, confidence in business models and regulatory frameworks, and a people-focused transition. These principles appear to address some of the setbacks found in existing policy measures such as the North Sea Transition Deal (UK Government and OGUK, 2021).

Table 2. Issues discussed in the UK workshop for each scenario (adapted from Jenkins et al., 2022)

Net-zero scenario	Phase-out scenario
<ul style="list-style-type: none"> • Limits on oil and gas investment incentives • Tax relief for electrification of platforms and CCS • Electrification of new platforms • National emissions targets compatible with UK Climate Change Committee recommendations • Carbon takeback obligation • Creation of an independent body to coordinate oil and gas needs, decommissioning and skill transition • Workforce training • Quantitative targets for renewable energy generation • Scale-up of community-owned energy • Shorter deployment time for wind turbines • Energy efficiency measures 	<ul style="list-style-type: none"> • Simplified and accelerated permitting and construction processes for carbon capture and low-carbon energy • Climate compatibility checkpoints for oil and gas licensing that enforces best practice • Accelerated research, development and innovation • Clear decisions on the construction and use of carbon capture technologies (i.e. CCS, BECCS and DACCS) • Streamlined regulatory frameworks to ease transition of oil and gas companies towards other modes of operation • Labour force skilled in renewables and decommissioning

In the Denmark workshop, stakeholder discussions reflected those in Norway and the UK with regard to the importance of rolling out carbon capture and clean energy technologies to achieve a faster phase-out. Although the Danish case study did not seek to provide a timeline for milestones, it does provide insight into second-order issues that are likely to emerge after a phase-out date has been set. These include striking a balance between an earlier phase out and limiting compensation losses; providing transparency around the timescales for decommissioning oil and gas infrastructure; and questioning the merits of electrification if it were to prolong the use of oil and gas infrastructure. Moreover, the Danish case study highlights the risk posed by uncertainties surrounding the mutual dependence of phasing-out oil and gas while simultaneously phasing-in low-carbon technologies.

2.2 Responsibility for transition sits primarily with government

Across the three countries and all the scenarios, government was seen as the actor with the greatest responsibility for a just transition. This view was even more pronounced in the phase-out scenarios. From a technology perspective, it is within government's gift to provide incentives for clean industries, business models and infrastructure while disincentivizing fossil-based production. From a social perspective, the oil and gas workforce across the North Sea is expected to decline, which calls for social measures to mitigate the negative consequences for workers, communities, and regions (Linde et al., 2022). Examples of such measures are unemployment benefits, regeneration schemes and reskilling.

In the case of Norway, government responsibilities under the net-zero scenario centred on curbing fossil fuel emissions, incentivizing low-carbon technology, and helping workers develop the skills required by new industries such as CCS. Participants proposed that the implementation of those responsibilities should be overseen by a dedicated transition commission with a focus on the most affected regions. For the phase-out scenario, on the other hand, participants called for stronger and faster government intervention, including banning new exploration in oil and gas fields within a few years. The radical pace of the phase-out scenario, compared with a net-zero scenario, would depend on political will and a large parliamentary majority to adopt more short-term political measures, and therefore would require more widespread support from society.

In the UK workshops, consensus also formed around the government being the main actor in both scenarios. However, the function of government was contested. Some argued for a more limited role for government, focused on creating regulations and incentivizing incumbents to shift from fossil fuels to renewables. While others argued for a greater intervention, including state ownership of energy assets. It was acknowledged that the transition requires a whole-of-government approach, with contributions from departments for education, transport, industry, energy, environment, and finance. There was also recognition that the current situation, in which major decisions such as licensing are taken solely by the Westminster government², is unsustainable. However, the impact of the invasion of Ukraine on domestic energy prices was deemed to have shifted the focus of government towards energy security and increased extraction, while putting to question the resilience and affordability of the transition.

In both Norway and the UK, stakeholder discussions emphasized that the responsibility for transferring education and skills, as part of a just transition for workers, is shared between government and industry: government would mostly provide oversight and facilitation, while industry actors can provide knowledge on the skills gaps in green technologies, as well as relevant training. Although this view applied to both scenarios, it featured more prominently in phase-out scenarios because they represent a greater threat to oil and gas workers' livelihoods. While concerns about reskilling were most pronounced in a phase-out scenario, concerns also remained under a net-zero scenario, given the inevitable depletion of oil and gas it would entail.

The Danish stakeholders also placed the bulk of responsibility for transition on government, because an earlier phase-out date calls for more state intervention on issues such as compensation and decommissioning. This could be largely because the Danish study focused on developing a statistical model to assess the impact of an earlier phase out, which is partly based on government revenues. Nevertheless, in terms of Danish workers, their versatility in pivoting between the labour demands of fossil fuels and renewables industries was noted. In addition, the Danish North Sea Agreement (KEFM, 2020) calls for a just transition for exposed workers. However, stakeholder discussions acknowledged that the lack of detailed plans to support the transition of existing oil and gas workforce may lead to labour shortages and act as a barrier to transition.

² Under the UK's devolved constitutional settlement, there are separate legislatures and executives in Scotland, Wales and Northern Ireland, with varying degrees of power. The UK Parliament and UK Government in Westminster retains some powers across the whole of the UK. For more information see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770709/DevolutionFactsheet.pdf

In terms of the role of industry, Norwegian participants noted responsibilities for companies within the net-zero scenario beyond reducing emissions per se, including facilitating training and education for new and existing workers for CCS and offshore wind; offering early retirement for oil and gas workers unable to obtain the required skills; developing significant amounts of offshore wind, hydrogen and CCS capacity; and promoting research and development within these fields. Meanwhile, some UK participants foresaw an important role for the European oil majors to implement new technologies and capabilities at a large-scale and ensure that the existing workforce is redirected towards other sectors. However, not all oil and gas companies may be as successful in adopting new business strategies in the transition and such companies may risk further workforce lock-in in the inevitable phase out of oil and gas. Under the phase-out scenario, it was emphasized in the Norway and UK workshops that government would play a key role due to major impacts on society and the large investment required to achieve a rapid phase-out. The responsibilities of government and industry highlight that even if a supply side strategy relies on bans or restrictions on extraction, a successful transition rests on broad stakeholder participation across society.

2.3 Policies for oil and gas transition pathways

At the conclusion of each country case study, the research teams were asked to develop overarching policy recommendations that could guide governments in developing effective transition pathways for the oil and gas industry (regardless of the particular decarbonization scenario). These policy recommendations, in contrast to the milestones, technologies and responsibilities discussed in this section, are not entirely an output of the scenario co-production process: they were derived from the scenario discussions by the research teams that facilitated the workshops.

One overarching policy challenge alluded to across the three country case studies is the importance of aligning short- and long-term goals, regardless of which scenario is pursued. The need to agree on a timeline and milestones, in addition to developing a shared vision, is put forward in each case study as a concrete solution, with the onus once again being placed on government. Steps in the right direction towards a shared vision can be found in the Norwegian case study's acknowledgement that market mechanisms alone would not deliver an oil and gas phase-out but would instead require regulation and state investment in the short-term to deliver on long-term goals. The British case study also highlights the need for a timeline for regulations and standards and proposes quantitative and binding targets for oil and gas phase-out alongside an unambiguous end goal. And the Danish case study proposes that an expert North Sea transition committee should be established and tasked with identifying key decisions and setting out details for implementing them, as well as developing a timeline for the transition to inform political decision-making.

Common themes of policy action did emerge among stakeholders in the UK, despite the lack of consensus on the most desirable future. These themes include the need for a step-change in coordinated government leadership and to overcome tensions in the UK's devolved constitutional settlement. In addition, some consensus emerged on the need for fiscal and regulatory reform and investment in education and skills. Building on these themes, the British research team put forward solutions to support a just transition for workers and maximize the benefits of transferring skilled workers towards clean industries. These solutions include the creation of a national training fund; shifting the costs of retraining and reskilling to companies rather than individuals; standardizing labour qualifications and promoting "skills passports"; and, more broadly, informing these measures through the principles outlined in section 2.1 (i.e. certainty, transformational change, accelerated implementation, confidence in business models and regulatory frameworks, and a people-focused transition).

The Norwegian research team suggests that the public-private climate partnerships proposed by the governing parties (see Arbeiderpartiet & Senterpartiet, 2021) should be based on a just transition framework. The team suggests that the scope of these partnerships ought to include

regulation and targets to cut carbon emissions from oil and gas production; skills planning for the workforce; and a roadmap to consider issues around renewable energy and clean technology (e.g. avoiding conflicts with energy-intensive land-based industries, and long-term investments).

While the Danish proposal to establish an expert committee might seem restrained when compared with the UK and Norway's proposals, it aims to support long-term planning. The thematic remit of the committee, which would include CCS, compensation, carbon taxation, and energy, hints at the integrated policy direction that is lacking in the near- to medium-term.

In summary, political and socio-economic measures are essential in the short- and medium-term to create the enabling conditions to develop and deploy the clean energy and carbon removal technologies that are fundamental for a just transition away from oil and gas.

The three case studies identified government as the actor with the greatest responsibility for implementing such measures, guided by the need for a just transition for workers and communities. To deliver on this, and to achieve alignment of short- and long-term goals as well as gain widespread support for the transition in society, new modes of governance are required that meet the deficit in existing political institutions and promote dialogue with all affected stakeholders.

3. Lessons from the North Sea

This section discusses the key lessons learned on North Sea oil and gas transitions, drawn from the co-production of transition scenarios and the range of research outputs of the broader Oil and Gas Transitions project (see annex for list of outputs). Specifically, it reflects on the differences in national contexts in the North Sea region, the role of state intervention, and the need for participatory processes and transformation narratives. Finally, these lessons are conceptualized as the enabling conditions for a just transition in the North Sea, with a view to providing insights useful for future work in similar oil and gas dependent regions.

3.1 One region yet three stages of transitions

North Sea oil and gas production has entailed very different courses for Denmark, Norway, and the UK despite the shared characteristics of geography, mature production and operating conditions. In Norway, the oil and gas sector has been the most significant sector in the country's economy by generating substantial state revenues, funding welfare state provision, and creating many jobs. In contrast, Denmark has historically pursued a more diversified approach, including investments in renewables, energy efficiency, and district heating (Eikeland & Inderberg, 2016; Sperling et al., 2021), with oil and gas production playing a smaller role in its overall economic development. Similarly, despite significant British oil and gas resources, their importance remained limited due to the relative to the size of other sectors of the economy and because oil rents were not diverted towards social benefits.

These divergent paths have led to distinct circumstances for each country, which are reflected in the recommendations of the country research teams involved in the Oil and Gas Transitions project. Denmark is a first mover in phasing out fossil fuels and a leader in offshore wind; Norway is a major global exporter of natural gas with a growing portfolio of renewables; and the UK is struggling to reconcile its pro-extraction regulatory incentives with its climate action commitments. Hence, domestic economic contexts remain important despite shared characteristics. It is therefore key not to overplay the similarities of countries within a region or treat regions as isolated from the global context.

Figure 2. Oil and natural gas production in Denmark, 1970–2021.

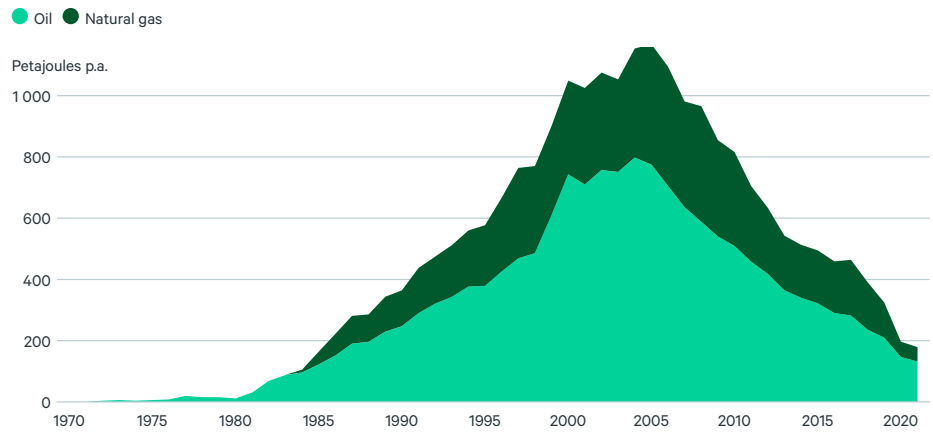


Figure 3. Oil and natural gas production in Norway, 1970–2021.

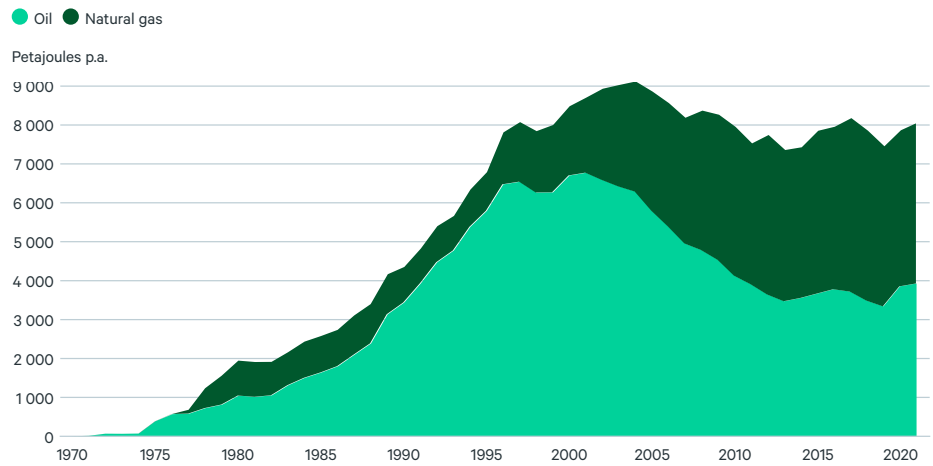
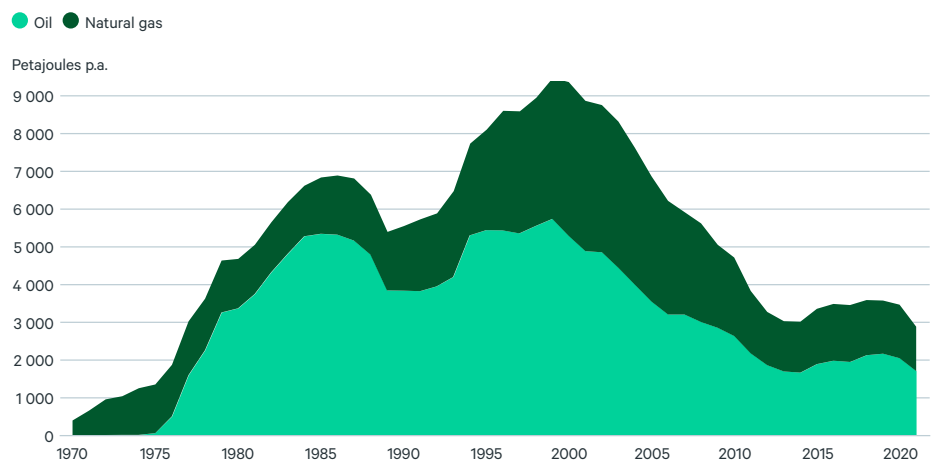


Figure 4. Oil and natural gas production in the UK, 1970–2021.



3.2 Shift in state intervention away from “propping up”

In both Norway and the UK, periods of declining exploration and extraction in the North Sea have prompted successive governments to adjust fiscal and regulatory conditions in favour of the industry (Linde et al., 2022). Recent downturns brought on by events such as the Covid-19 pandemic and the Russian invasion of Ukraine have been cited as further reasons for continuing support for the industry. For example, Norway extended temporary tax relief measures for the industry (Norwegian Government, 2022), and the UK has scaled-back climate compatibility tests for new licences and paused the moratorium on fracking (BEIS, 2022a; Keane, 2022).

This established pattern of state intervention, which props-up production during crises, locks-in emissions for decades to come due to the long lead times between licensing and production and large capital investments. The net-zero scenario represents a departure from this status quo as it calls for state intervention through demand-side policies that internalize the social cost of exploration and extraction (e.g. carbon pricing). It also emphasises the development of clean transition technologies such as CCS, though this leaves room for continued production resting of the hope of commercially viable capture and storage. On the other hand, the phase-out scenario represents a starker departure from the status quo by targeting supply reduction through the removal of subsidies and favourable terms of taxation and bans and moratoriums on exploration. Taking such measures in the short-term is challenging for any government, especially during a time of geopolitical and market pressures such as the hunt for non-Russian sources of oil and gas and high prices. However, the consequences of recent oil and gas price volatility highlight the global dependency on fossil fuels and provide a glimpse at cost of inaction in the long-term.

Nevertheless, popular support and political willingness are crucial prerequisites for shifting state interventions towards either scenario. For instance, in the Norwegian case study, there is a pressing need to overhaul regulatory processes to accelerate the development of renewable energy. Similarly, even in Denmark, which is already pursuing a phase out, political action is needed to address loopholes that allow for new exploration and extraction licences to be awarded before 2050. This is important because loopholes such as these are already being exploited by appealing to the need for European energy independence (INEOS, 2022). Furthermore, it remains to be seen whether a greater emphasis on global justice in domestic discussions would shift popular support and political willingness and, in turn, the pace or magnitude of state intervention. Although the need to connect national and international contexts was acknowledged by participants across the case studies.

3.3 Overcoming resistance: participatory processes and transformation narratives

In this project we use Atteridge and Strambo's (2020a) just transition framing. They highlight the importance of distributive justice, such as support for affected workers, for a truly just transition. However, the procedural aspects of a transition are equally important. The case studies show that both the net-zero and phase-out scenarios and the types of interventions they necessitate are heavily contested. The UK and Norway case studies reveal the challenge of introducing radical change in the short-term while maintaining public support for the transition, and the need to make changes in the present rather than relying solely on long-term visions.

Resistance to transformation is evident in the UK and Norway case studies, where institutional arrangements and prevailing narratives are used by vested interests to sway public opinion, in line with the literature on socio-technical regime change (see Geels, 2014). There was limited participatory input in transition planning processes in the UK's North Sea Transition Deal (UK Government and OGUK, 2021). The Transition Deal was developed by the UK Government in collaboration with industry, but excluded input from devolved governments and the public. In Norway, despite a political debate on phasing out oil and gas, there is a lack of political will to do so. Even Denmark's North Sea Agreement, achieved through political consensus, lacked input

from stakeholders outside of government and political parties (Sperling et al., 2021).

In terms of narratives, it is clear from each of the case studies that a goal of net-zero with a distant time-horizon for implementation is less challenging to the status quo than phasing out oil and gas extraction. As a result, adherence to net-zero is seen as part of the oil and gas industry's social license to operate in Norway and hinders an earlier phase out in Denmark. Meanwhile in the UK, the emphasis placed on achieving global net-zero in a policy consultation on licensing has been used to dismiss the idea that a unilateral phase out would contribute to net-zero (contrary to empirical evidence - see Caldara et al., 2019; Fæhn et al., 2017; Hamilton, 2009), and therefore deemed unnecessary (BEIS, 2022b).

To overcome resistance to transformation, the North Sea case studies collectively put forward novel institutional arrangements and narratives. Dialogue and collaboration between government, industry, and civil society are emphasized as essential to a just transition. In the UK, fostering democratic participatory processes and decentralization of initiatives aim to fill gaps in participation and cross-governmental cooperation. Recommendations in Norway include a formalized multi-stakeholder dialogue process established by commission that broadens its reach to include environmental organizations and local communities. This would ensure the potential for discussions that are aligned with targets under the Paris Agreement, as well as inclusivity in line with the principles of just transition. The approach builds on the Norwegian model of collaboration between labour organizations and government on industrial matters, and lessons learned from the development of onshore wind power (see Vasstrøm & Lysgård, 2021). Around the North Sea, participatory processes are key to upholding the legitimacy of the transition and ensuring it is not imposed forcibly.

The development of a credible alternative narrative for transformation is critical for transitioning away from national oil and gas narratives, as exemplified by Denmark's "black to green" narrative (Danish Energy Agency & State of Green, 2021). However, the framing and prioritization of problems within a narrative can also be used to suppress the transition, as seen in the resurgence of coal and nuclear power in British energy debates (Geels, 2014). A successful transformation narrative must have practical meaning and be linked to participatory processes to ensure equity and diversity as part of political contention. Attempts to depoliticize debate through technocratic approaches stifles the political encounters that are necessary to inject equity and diversity into the transition. This can be a deliberate strategy by incumbent actors to maintain the status quo (Swyngedouw, 2011). Government-established commissions, like those proposed or discussed in all three case studies, must strike a balance between providing expertise and impartiality and not exacerbating democratic participatory deficits.

3.4 Enabling conditions for just transitions in the North Sea

Bringing together some of the topics discussed in this section, and building on Denmark's journey towards announcing a phase-out date, it is possible put forward a few conditions that may enable a just transition, at least for producers in similar circumstances to those of the North Sea. These are:

- the point on the production curve
- alternative opportunities for workforce in oil and gas and connected industries
- a weak oil and gas "culture", and
- a participatory governance tradition.

These enabling conditions are not intended to be mutually exclusive or exhaustive, but simply reflections that could inform future research or strategies for reducing oil and gas supply.

BOX 2. ENABLING CONDITIONS FOR JUST TRANSITIONS IN THE NORTH SEA**Point on the production curve**

A key element in Denmark's decision to phase out oil and gas was the dwindling resources in the Danish North Sea, coupled with a less attractive business case for continued exploration beyond 2050 (Sperling et al., 2021). The low economic and fiscal dependence on the oil and gas sector in terms of GDP and tax revenues further paved the way for political action towards a phase out date. However, it cannot be assumed that dwindling resources alone will lead to similar outcomes in other countries without a shift in the role of state intervention. Countries at the opposite end of the production curve, with limited available resources for immediate energy use or export, may be better positioned to re-imagine energy futures and alternative development pathways.

Alternative opportunities for workforce

The availability of existing or potential alternative opportunities for workers in industries exposed to the oil and gas sector is a crucial factor in determining the impact of a transition on workers' lives, families, and local communities; , as well as the support that those affected require (Atteridge & Strambo, 2020a). However, the reskilling and industrialization required to create new opportunities for the workforce may be prohibitively expensive for some producer countries.

Weak oil and gas “culture”

The sociocultural significance of oil and gas, and its embeddedness in the national identity, can act as a hindrance to the transition in some countries. For example, the Norwegian “oil fairy tale” (oljeeventyre) is a source of national pride and a pillar of the welfare state, making it challenging to act against the interests of the oil and gas industry in mainstream politics (Jordhus-Lier et al., 2022; Szuleck et al., 2021). In contrast, Denmark lacks a strong oil and gas culture, and the business opportunities provided by its long-term strategic interests in offshore wind development drive optimism for the transition (Sperling et al., 2021). It could be argued that a limited, or at least challenged, oil and gas culture makes it easier to discuss the phase out oil and gas.

Participatory governance tradition

Participatory governance traditions, with inclusive and transparent social dialogue and planning processes, are crucial for a just transition (Atteridge & Strambo, 2020a). Denmark's phase out announcement was built on citizens' demands for a climate law and a consensual approach to developing the North Sea Agreement among political parties (Sperling et al., 2021). Countries with existing participatory governance institutions may be better equipped to establish the necessary processes for inclusive planning and decision-making, although fostering trust among social actors may still be challenging in other regions of the world.

At first glance the enabling conditions presented in Box 2 may appear daunting for producer countries, but they can be incorporated into just transition strategies by governments or civil society. For example, countries that are close to fulfilling these conditions could start planning for a just transition, alongside global equity considerations such as historical responsibility and accrued benefits. Alternatively, by identifying remaining gaps or leveraging strengths of already met conditions, efforts can be targeted strategically, for instance, by taking advantage of workforce opportunities or existing national participatory governance to overcome other barriers to transition. It is important to note that while these conditions are based on the experience of North Sea countries, producers in other regions can also assess their relevance and make necessary adjustments to suit their unique circumstances.

4. Beyond the North Sea

4.1 Choices of geographic delineation

The three country case studies in the North Sea have shown that results and discussions have been very different across the countries. Even with a shared understanding of the urgency challenge of climate change, a shared geography and thus types of oil and gas resources, and close similarities in terms of all three countries being advanced democracies with high national wealth and technological capabilities, and not least the interconnected development of large amounts of shore wind power in the North Sea, the differences between the three in terms of supply side mitigation are large. This primarily stems from differences in production volumes and resource development, which translate to different levels of dependency on the economic benefits of the oil and gas. Our conclusion is that for similar future studies of oil and gas producing regions across the world, the corresponding differences in conditions will be equally large, and will strongly determine how other oil and gas producing countries envision phase out or net-zero scenarios.

A regional approach brings differences and similarities to the forefront which enables the identification of common themes, such as the broadly recognized need for new modes of governance supporting transition scenarios away from oil and gas in the North Sea. However, there is merit in future projects focusing instead on comparing producing countries from different regions but with similar production curve characteristics and similar dependency on oil and gas revenues. This could facilitate sharing insights from co-production methods and scenarios developed between country contexts with more similar conditions. It could also ease the adoption of new ideas and methods across cases, increasing the odds of identifying levers and arguments for economic diversification or earlier production retirement as good examples emerge. The comparison of countries with similar production (e.g. emerging producers), economic conditions (e.g. export-dependent) or other characteristics (e.g. shale oil producers) may lead to spillover effects and lessons for these countries that could lead to opportunities for action. The downside with this approach may be limited opportunity for opportunities to usher in meaningful change in a region, and lower participation of regional actors or multilateral regional collaboration on the issues.

4.2 Role of industry in stakeholder dialogues

From the outset, the Oil and Gas Transitions project has argued that industry actors must play a role in the transition towards a low-carbon future and has endeavoured to bring industry representatives to the table. The three North Sea case studies have all highlighted the importance of inclusive, procedural processes for determining the low-carbon pathways, as demonstrated by identifying common recommendations on public-private partnerships, commissions, and stakeholder dialogues. In this respect, the co-production scenario workshops have provided one momentary opportunity to challenge preconceived notions of the transition by tackling tricky questions directly with the input of multiple perspectives. Even so, it is too early to qualify the significance of these deliberations. In addition, the focus on recommendations on procedural improvements and proposals for improved governance of the transition could be a product of the co-production process itself.

In any case, it is clear that the shift in policies, corporate strategies and investments required to align with climate goals is in many cases still lacking. For example, clean energy investments only accounted for 5% of capital expenditure of the worldwide oil and gas sector in 2019 (IEA, 2022). Hence, while participatory processes are critical, researchers and policymakers need to remain vigilant of the risks of involving the oil and gas industry representatives promoting corporate strategies designed to delay action. Future projects also need to be cognisant of implicitly acquiescing greenwashing as the cost of bringing industry stakeholders to dialogues.

More broadly, we expect that placing an emphasis on plurality of views and inclusivity in countries with similar circumstances to the North Sea producers would also be beneficial. However, we also acknowledge that adopting such an approach outside of the North Sea may be challenging. Even setting aside differences in national contexts and the current position of each potential case on the resources production curve, sensitive consideration is warranted of the merits and risks of involving oil and gas representatives (e.g. from multinational oil and gas majors) given the North-South dimensions of oil and gas value chains, remnants of colonial exploitation in extractive industries and historic environmental injustices, as well as the safety of civil society participants.

4.3 Mapping implementation issues

The conceptual difference between a stringent phase-out date and a net-zero goal is clear, with the latter providing more mitigation curve flexibility and more visible opportunities for the oil and gas sector to contribute to developing net-zero solutions such as carbon storage. It is much more demanding to go beyond the adoption of measures that incrementally reduce the consumption of oil and gas and grapple with much more tangible refocusing of investment and alignment of new business strategies. As the Danish case study also shows, determining the steps required to reach a phase-out target while ensuring a just transition is delivered remains a critical challenge. Lessons from first movers on phase out will therefore be essential and there is a growing list of countries putting in place phase-out dates and beginning to consider key issues around how to operationalize such targets (Linde et al., 2022). These first movers provide lessons and experiences that can chart the way forward and lighten the burden for producers that follow.

Although lessons from the North Sea will be helpful for many producers, emerging producers would benefit from broadening the knowledge base by learning from research and co-production of phase out and net-zero scenarios beyond the North Sea. Emerging producers are often located in Global South, and now face even more pressure to develop fossil resources in the wake of the current energy crisis, such as liquified natural gas for export. We recommend that a follow-up project on supply side governance of the oil and gas sector includes oil and gas economies from the Global South. It is important that new research on supply side reduction develops scenarios that both recognize the short-term economic gains in this new energy landscape alongside rapidly growing climate risks in the coming decades, and thus the need for economic diversification at the onset.

4.4 Global supply reduction

Stakeholders engaged with the project have highlighted that the transition away from oil and gas at the national level cannot be treated in isolation from the international context. First and foremost the impact of the UNFCCC process and the Paris Agreement cannot be overlooked. Yet prior experiences strongly suggest that it will be challenging to integrate a discussion of fossil fuels reduction into the UNFCCC process. Despite the Paris Agreement's importance, until recently countries had not reached agreement on language regarding the reduction of fossil fuel supply (Piggot et al., 2018). The Glasgow Climate Pact at COP26 included the necessity of tackling unabated coal and gradually eliminating inefficient fossil fuel subsidies (UNFCCC, 2022). This provided a basis for negotiations at COP27, where India unsuccessfully led efforts to add oil and gas to the text explicitly (Hodgson, 2022).

A focus on the governance of supply-side reduction within the existing climate regime will likely face resistance from vested interests, which have stalled climate action in the past (van Asselt & Newell, 2022). This approach may therefore carry the risk of expending political capital and negotiation efforts that do not result in substantial progress on fossil fuel supply, or even worse, detract from the progress on climate mitigation through demand reduction.

Yet, outside of the UNFCCC, some progress is being made by government- and civil society-led initiatives focusing on multiple aspects of fossil fuel supply reduction, for instance, on subsidies. These initiatives include Fossil Fuel Subsidy Reform (WTO, n.d.); “leaving it in the ground” – Beyond Oil & Gas Alliance (BOGA, n.d.) and Fossil Fuel Non-Proliferation Treaty (Fossil Fuel Treaty, n.d.); government-to-government learning (New Producers Group, n.d.); and tackling legal barriers through the reform of the Energy Charter Treaty (Japari, 2023). This also illustrates that the work of the Oil and Gas Transitions project has not occurred in a vacuum but among a constellation of initiatives and actors working in this space.

The Oil and Gas Transition project was conceived during a very limited international policy regime on fossil fuel supply. However, momentum has been building on climate change mitigation with rapidly expanding renewable energy and growing political leadership on climate change from the US, EU, and China. These circumstances strengthen the prospects of alternative development pathways already being proposed for the North Sea (e.g. electro-fuels, energy islands, etc.), that can be deployed, with assistance, by established and emerging producers alike to diversify their economies and energy systems and kick-start their transitions. The momentum building on climate mitigation may have seemed unimaginable before the Paris Agreement. Although unexpected progress on fossil fuel supply reduction should not be assumed, it should not be ruled out either. This would change the conditions under which the phase out of oil and gas is contemplated in other countries. For instance, a phase out could be directly influenced through the spread of new global norms on fossil fuels, such as non-proliferation, which are gaining traction in the European Parliament (Fossil Fuel Treaty, 2022). Alternatively, a phase out could be indirectly influenced by progress on a loss and damage mechanism as part of the UNFCCC process, given that future extraction could mean future liabilities for loss and damage.

5. Closing remarks

Oil and gas are finite resources and thus a transition away from these resources is inevitable. However, unjust outcomes of a transition are avoidable if action is taken in anticipation. The Oil and Gas Transitions project was established to address the ambition gap between climate policies and oil and gas industrial strategies by generating evidence and co-produced pathways to accelerate policy action towards just oil and gas transitions in the North Sea. As a first step, the project shone a light on the challenges of ushering in just transitions due to the complex web of stakeholders and political, technological, and social issues within North Sea producer countries. The stakeholder co-production workshops have begun to test assumptions and uncertainties surrounding the seemingly unassailable transition challenges by encouraging participants to imagine the milestones, responsibilities, opportunities, and barriers under net-zero and phase out transition scenarios.

The project has demonstrated that the vision and pathways for a just transition are deeply contested among stakeholders. The solution to this contestation is not to depoliticize the transition but to provide the institutional and governance arrangements to incorporate diverse perspectives into planning for it, particularly the perspectives of exposed and marginalized communities. Failure to do so will result in public resistance which will scupper the chances of achieving a truly just transition. It is also evident that although a just transition is not possible without the right policies and state interventions, fostering a just transition is not the preserve of government alone. Bringing stakeholders together and creating a space for dialogue will be valuable for supporting a just transition in the three case study countries.

Furthermore, based on the experiences from the three case studies, the Oil & Gas Transitions project has presented valuable lessons and key conditions to enable just transitions of North Sea producers and others in similar circumstances. However, further attention should be given to developing lessons tailored for the just transition of emerging producers and developing countries. Moreover, the global nature of oil and gas means that countries and regions should not be treated in isolation. The importance of the global context and international efforts on climate mitigation cannot be overlooked. In sum, planning for a just transition at the local, national, regional, and international level is imperative.

References

- Adegbamigbe, T., Biswas, A., Blaney, J., & Jagtap, A. (2022). *The North Sea—A Long and Proud History*. TWA. <https://jpt.spe.org/twa/the-north-sea-a-long-and-proud-history>
- Arvanitopoulos, T., & Agnolucci, P. (2020). The long-term effect of renewable electricity on employment in the United Kingdom. *Renewable and Sustainable Energy Reviews*, 134, 110322. <https://doi.org/10.1016/j.rser.2020.110322>
- Asheim, G. B., Fæhn, T., Nyborg, K., Greaker, M., Hagem, C., Harstad, B., Hoel, M. O., Lund, D., & Rosendahl, K. E. (2019). The case for a supply-side climate treaty. *Science*, 365(6451), 325–327. <https://doi.org/10.1126/science.aax5011>
- Atteridge, A., & Strambo, C. (2020a). *Seven principles to realize a just transition to a low-carbon economy*. <https://cdn.sei.org/wp-content/uploads/2020/06/seven-principles-for-a-just-transition.pdf>
- Atteridge, A., & Strambo, C. (2020b). *Seven principles to realize a just transition to a low-carbon economy*.
- Atteridge, A., & Strambo, C. (2020c). *Insights from historical cases of transition: Background paper for the EBRD just transition initiative*. <https://www.sei.org/publications/insights-historical-transition-ebrd-just-transition-initiative/>
- BEIS. (2022a). *Climate Compatibility Checkpoint Design*. Department for Business, Energy & Industrial Strategy. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1105667/climate-change-checkpoint-design.pdf
- BEIS. (2022b). *Designing a Climate Compatibility Checkpoint for Future Oil and Gas Licensing in the UK Continental Shelf: Government Response to the consultation*. Department for Business, Energy & Industrial Strategy. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1105669/checkpoint-government-response.pdf
- BOGA. (n.d.). *Beyond Oil & Gas Alliance*. Beyond Oil & Gas Alliance. <https://beyondoilandgasalliance.com/>
- BP. (2022). *BP Statistical Review of World Energy*. <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf>
- Caldara, D., Cavallo, M., & Iacoviello, M. (2019). Oil price elasticities and oil price fluctuations. *Journal of Monetary Economics*, 103, 1–20. <https://doi.org/10.1016/j.jmoneco.2018.08.004>
- Calverley, D., & Anderson, K. (2022). *Phaseout Pathways for Fossil Fuel Production Within Paris-compliant Carbon Budgets*. Tyndall Centre, University of Manchester. https://www.research.manchester.ac.uk/portal/files/213256008/Tyndall_Production_Phaseout_Report_final_text_3_.pdf
- Eikeland, P. O., & Inderberg, T. H. J. (2016). Energy system transformation and long-term interest constellations in Denmark: Can agency beat structure? *Energy Research & Social Science*, 11, 164–173. <https://doi.org/10.1016/j.erss.2015.09.008>
- Fæhn, T., Hagem, C., Lindholt, L., Mæland, S., & Rosendahl, K. E. (2017). Climate policies in a fossil fuel producing country—demand versus supply side policies. *The Energy Journal*, 38(1).
- Fossil Fuel Treaty. (n.d.). *The Fossil Fuel Non-Proliferation Treaty*. <https://fossilfueltreaty.org>
- Fossil Fuel Treaty. (2022, October 20). *The European Parliament calls on nation-states to develop a Fossil Fuel Non-Proliferation Treaty*. The Fossil Fuel Non-Proliferation Treaty Initiative. <https://fossilfueltreaty.org/european-parliament>
- Gaulin, N., & Le Billon, P. (2020). Climate change and fossil fuel production cuts: Assessing global supply-side constraints and policy implications. *Climate Policy*, 20(8), 888–901. <https://doi.org/10.1080/14693062.2020.1725409>
- Geels, F. W. (2014). Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective. *Theory, Culture & Society*, 31(5), 21–40. <https://doi.org/10.1177/0263276414531627>
- Ghaleigh, N. S., Stuart Haszeldine, Kirsten Jenkins, Charlotte Bucke, Kirsty Fairhurst, Andi Sihota, & Andrew Sweeney. (2021). *The Future is Built on the Past: Just Industrial and Energy Transitions in the UK and Scotland*. <https://oilandgastransitions.org/resources/reports/the-future-is-built-on-the-past-just-industrial-and-energy-transitions-in-the-uk-and-scotland/>
- Green, F., & Denniss, R. (2018). Cutting with both arms of the scissors: The economic and political case for restrictive supply-side climate policies. *Climatic Change*, 150(1–2), 73–87. <https://doi.org/10.1007/s10584-018-2162-x>
- Hamilton, J. D. (2009). Understanding Crude Oil Prices. *The Energy Journal*, 30(2), 179–206.
- Hansen, D. S., Madsen, P. T., Sperling, K., & Mathiesen, B. V. (2022). *Why wait until 2050? Exploring possible scenarios for phasing out oil and gas production faster than planned in the Danish North Sea*. Aalborg University.

- Hansen, D. S., Yang, Z., & Pedersen, S. (2022). *North Sea Oil and Gas: Potential Technological Transformation Towards Net-Zero Emissions*. Aalborg University. https://oilandgastransitions.org/wp-content/uploads/2022/03/Denmark-NS-Oil-and-Gas-Tech-Report_Final.pdf
- Hodgson, C. (2022, November 15). COP27: India draws support for wider climate target than coal alone. *Financial Times*. <https://www.ft.com/content/eedc63fd-8f69-49f8-9a22-2dfe77d6a24a>
- IEA. (2022, June 22). *Record clean energy spending is set to help global energy investment grow by 8% in 2022—News*. IEA. <https://www.iea.org/news/record-clean-energy-spending-is-set-to-help-global-energy-investment-grow-by-8-in-2022>
- Japari, B. (2023, January 15). The Energy Charter Treaty: Reform or Retreat? *Columbia Journal of Transnational Law*. <https://www.jtl.columbia.edu/bulletin-blog/the-energy-charter-treaty-reform-or-retreat>
- Jenkins, K., Ghaleigh, N. S., Haszeldine, S., & Sihota, A. (2022). *Living in the present, making the future: UK scenarios for the phase-out of oil and gas*. University of Edinburgh.
- Jordhus-Lier, D., Houeland, C., Holmås, H. E., Szuleck, K., & Østring, P. R. (2022). *Petroleum Transition Pathways in Norway: How do Norwegian stakeholders envision pathways to net-zero and phase-out for the country's oil and gas sector?* University of Oslo, Fafo.
- Kartha, S., Caney, S., Dubash, N. K., & Muttitt, G. (2018). Whose carbon is burnable? Equity considerations in the allocation of a “right to extract.” *Climatic Change*, 150(1–2), 117–129. <https://doi.org/10.1007/s10584-018-2209-z>
- Keane, K. (2022, September 22). Oil and gas climate test branded a sham by environmentalists. *BBC News*. <https://www.bbc.com/news/uk-scotland-scotland-business-62993161>
- KEFM. (2020, December 4). *Bred aftale om Nordsøens fremtid*. <https://kefm.dk/aktuelt/nyheder/2020/dec/bred-aftale-om-nordsoeens-fremtid>
- Lazarus, M., & van Asselt, H. (2018). Fossil fuel supply and climate policy: Exploring the road less taken. *Climatic Change*, 150(1–2), 1–13. <https://doi.org/10.1007/s10584-018-2266-3>
- Linde, L., Sanchez, F., Mete, G., & Lindberg, A. (2022). *Oil and Gas Transition Synthesis in the North Sea*. <https://www.sei.org/wp-content/uploads/2022/05/sei2022-012-oil-gas-north-sea-transition.pdf>
- Muttitt, G., & Kartha, S. (2020). Equity, climate justice and fossil fuel extraction: Principles for a managed phase out. *Climate Policy*, 20(8), 1024–1042. <https://doi.org/10.1080/14693062.2020.1763900>
- Norwegian Government. (2022, October 6). *Adjusting the tax rules for the petroleum sector* [Pressemelding]. Government.No; regjeringen.no. <https://www.regjeringen.no/en/aktuelt/tightening-of-the-tax-rules-for-the-petroleum-sector/id2930396/>
- Piggot, G., Erickson, P., van Asselt, H., & Lazarus, M. (2018). Swimming upstream: Addressing fossil fuel supply under the UNFCCC. *Climate Policy*, 18(9), 1189–1202. <https://doi.org/10.1080/14693062.2018.1494535>
- Ram, M., Aghahosseini, A., & Breyer, C. (2020). Job creation during the global energy transition towards 100% renewable power system by 2050. *Technological Forecasting and Social Change*, 151, 119682. <https://doi.org/10.1016/j.techfore.2019.06.008>
- Sanchez, F., & Linde, L. (2023). Turning out the light: Criteria for determining the sequencing of countries phasing out oil extraction and the just transition implications. *Climate Policy*, 0(0), 1–15. <https://doi.org/10.1080/14693062.2023.2197854>
- SEI, IISD, ODI, E3G, & UNEP. (2021). *The Production Gap Report 2021*. <http://productiongap.org/2021report>
- Sperling, K., Madsen, P. T., Gorroño-Albizu, L., & Vad Mathiesen, B. (2021). *Denmark without Oil and Gas Production: Opportunities and Challenges*. <https://oilandgastransitions.org/resources/reports/denmark-without-oil-and-gas-opportunities-and-challenges/>
- Swyngedouw, E. (2011). Depoliticized Environments: The End of Nature, Climate Change and the Post-Political Condition. *Royal Institute of Philosophy Supplements*, 69, 253–274. <https://doi.org/10.1017/S1358246111000300>
- Szuleck, K., Chitra, A., Harald Claes, D., Houeland, C., & Jordhus Lier, D. (2021). *Norwegian Oil and Gas Transition: Building bridges towards a carbon neutral future*.
- UK Government and OGUK. (2021). *North Sea Transition Deal*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/972520/north-sea-transition-deal_A_FINAL.pdf
- UNFCCC. (2022). *Report of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on its third session, held in Glasgow from 31 October to 13 November 2021*. https://unfccc.int/sites/default/files/resource/cma2021_10a01E.pdf
- van Asselt, H., & Newell, P. (2022). Pathways to an International Agreement to Leave Fossil Fuels in the Ground. *Global Environmental Politics*, 22(4), 28–47. https://doi.org/10.1162/glep_a_00674

Vasstrøm, M., & Lysgård, H. K. (2021). What shapes Norwegian wind power policy? Analysing the constructing forces of policymaking and emerging questions of energy justice. *Energy Research & Social Science*, 77, 102089. <https://doi.org/10.1016/j.erss.2021.102089>

Vaughan, A. (2022). The first global energy crisis. *New Scientist*, 253(3379), 18–21. [https://doi.org/10.1016/S0262-4079\(22\)00513-9](https://doi.org/10.1016/S0262-4079(22)00513-9)

WTO. (n.d.). *Fossil Fuel Subsidy Reform*. Retrieved March 21, 2023, from <https://www.wto.org>

Yergin, D. (2009). *The prize: The epic quest for oil, money, & power*. Free Press.

Annex

Project outputs

The Oil and Gas Transitions project was established by Climate Strategies and Stockholm Environment Institute (SEI) with the objective of generating evidence and co-produced pathways for policy action to accelerate just oil and gas transitions in Denmark, Norway, and the UK, supported by local research partners in each country. The project consisted of three phases: 1) generating evidence of the role of oil and gas in the political economy in the North Sea; 2) co-producing just and feasible oil and gas transition pathways to 2050; and 3) drawing lessons from the North Sea for raising ambition in other producing and non-producing countries facing similar oil and gas transition challenges. The following research outputs were produced at each phase of project.

1. Generating evidence of the role of oil and gas in the political economy
 - a. Denmark
 - b. Norway (Szuleck et al., 2021)
 - c. United Kingdom (Ghaleigh et al., 2021)
 - d. North Sea technology (Hansen, Yang, et al., 2022)
 - e. Synthesis report (Linde et al., 2022)
2. Co-producing just and feasible oil and gas transition pathways
 - a. Denmark (Hansen, Madsen, et al., 2022)
 - b. Norway (Jordhus-Lier et al., 2022)
 - c. United Kingdom (Jenkins et al., 2022)
3. Lessons learnt from the North Sea
 - a. **Synthesis report – this publication. Note that this report includes a synthesis of reports 2(a), 2(b) and 2(c).**

Co-production methods

With regards to the methodological approach to the co-production activities across the three case studies, similar instructions were given to each research team to align research objectives and ensure comparability of the activities undertaken across the case studies.

The stakeholder co-production workshops were devised as hypothetical and normative scenario-building exercises where participants started from two end-point goals (e.g. net-zero oil and gas or phase out by 2050) and traced a set of milestones backwards through time to the present. This method is also known as ‘backcasting’. Specifically, local research teams were advised to use the stakeholder co-production workshops to (a) identify milestones; (b) identify actors and responsibilities, and (c) highlight potential barriers and opportunities. The teams were advised to use Atteridge & Strambo’s (2020a) principles of just transition to frame the workshop discussions and subsequent policy recommendations.

The research teams were encouraged to recruit participants from four different stakeholder groups: i) government; ii) industry representatives; iii) civil society (including trade unions); and iv) academia. The workshops were held in-person in Norway and online in the UK.

As Denmark already has a phase out target date of 2050, discussions focused instead on whether a phase out could happen sooner and how to operationalise such a phase out. As a result the structure of the case study was adjusted to include technical expert co-production for scenarios and societal stakeholder consultations. Nevertheless, stakeholder co-production, backcasting and just transition principles remained central to the study.

For full details and reflections from the local research teams, please see the individual country reports which can be found on oilandgastransitions.org.

Visit us

SEI Headquarters

Linnégatan 87D
Box 24218
104 51 Stockholm Sweden
Tel: +46 8 30 80 44
info@sei.org

Måns Nilsson
Executive Director

SEI Africa

World Agroforestry Centre
United Nations Avenue Gigiri
P.O. Box 30677 Nairobi 00100 Kenya
Tel: +254 20 722 4886
info-Africa@sei.org

Philip Osano
Centre Director

SEI Asia

Chulalongkorn University
Henri Dunant Road Pathumwan
Bangkok 10330 Thailand
Tel: +66 2 251 4415
info-Asia@sei.org

Niall O'Connor
Centre Director

SEI Latin America

Calle 71 # 11-10
Oficina 801
Bogotá Colombia
Tel: +57 1 6355319
info-LatinAmerica@sei.org

David Purkey
Centre Director

SEI Oxford

Oxford Eco Centre
Roger House Osney Mead
Oxford OX2 0ES UK
Tel: +44 1865 42 6316
info-Oxford@sei.org

Ruth Butterfield
Centre Director

SEI Tallinn

Arsenal Centre
Erika 14
10416 Tallinn Estonia
Tel: +372 6276 100
info-Tallinn@sei.org

Lauri Tammiste
Centre Director

SEI York

University of York
Heslington
York YO10 5NG UK
Tel: +44 1904 32 2897
info-York@sei.org

Sarah West
Centre Director

SEI US Main Office

11 Curtis Avenue
Somerville MA 02144-1224 USA
Tel: +1 617 627 3786
info-US@sei.org

Michael Lazarus
Centre Director

SEI US Davis Office

501 Second Street
Davis CA 95616 USA
Tel: +1 530 753 3035

SEI US Seattle Office

1402 Third Avenue Suite 925
Seattle WA 98101 USA
Tel: +1 206 547 4000
