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Seas of change: An evolving imaginary of offshore energy capture on the United Kingdom's Continental Shelf

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ABSTRACT

The offshore waters surrounding the United Kingdom have been an important national space for energy capture for over six decades. Hosting oil and gas production, large-scale renewable electricity generation and potential sites for carbon storage, the United Kingdom's Continental Shelf is now a key site within national plans for energy transition and pathways to net zero. This paper critically examines an evolving national imaginary of energy capture on the United Kingdom Continental Shelf (UKCS) since the 1960s. It deploys the conceptual framework of sociotechnical imaginaries to explore offshore energy materials and infrastructures as key sites through which shared ideas about nationhood, modernisation and the exercise of geopolitical leadership are reproduced. Drawing on historical and contemporary energy policy documents, we argue that the potential for energy capture on the UKCS has served as a critical 'imaginative resource' over time for constructing national visions of social order. We identify and analyse four distinct phases in the evolution of this imaginary about the role of offshore energy capture in national life: economic recovery, market society, energy transition, and net-zero basin. The paper's novel focus on offshore energies expands understanding of the state's role in forging and sustaining a national imaginary around distributed energy materials and infrastructures. By exploring how a sociotechnical imaginary takes shape around certain material qualities offshore, and how these qualities are then a source of (generative) friction in the evolution and sustainability of the imaginary over time, we advance work at the intersection of materialities and sociotechnical imaginaries.

1. Introduction

For over six decades, the United Kingdom's Continental Shelf (UKCS)[1] has been an important space of energy capture [1–5], as the UK state has sought to harness fossil fuels and renewable energy resources in pursuit of various national objectives (see Fig. 1). Initially developed in the 1960s, the extraction of natural gas – and subsequently crude oil – transformed the UK into a major hydrocarbon producer [2,4]. Although oil and gas production continue to be part of the UK's energy strategy [6], since the 1990s two critical concerns have increasingly challenged the prominence of fossil fuel extraction on the UKCS: the inevitable decline of the large-scale, long-life oil and gas fields that have historically underpinned North Sea output; and the urgency to mitigate climate change, primarily driven by carbon dioxide emissions from fossil fuel combustion. Increasing recognition of the need to rapidly decarbonise the UK's power generation, alongside legislative measures such as the Climate Change Act of 2008 [7], has catalysed a shift towards the deployment of renewable, low-carbon energy technologies on the UKCS. Consequently, the UKCS has become the world's second-largest offshore wind market, trailing only China, with over 40 wind farms constituting around 20% of the global installed capacity [8]. Over time, then, the significance of the UKCS as a vital hub for energy capture has expanded, even as gas and oil production has waned, transforming the UK's offshore waters into an increasingly diversified energy landscape. For example, the UK government recently adopted a vision of the North Sea as a 'net zero basin' as a way of holding together different low-carbon technology trajectories in this space [9], including carbon capture and storage (CCS) and hydrogen production [10,11]. Essentially, the UK

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[1] The UKCS was established with the Continental Shelf Act in 1964 and refers to the region of water between the coastline of the United Kingdom and the boundary of the UK's Exclusive Economic Zone. It includes parts of the North Sea, the Atlantic Sea, the Irish Sea and the English Channel. The United Kingdom holds mineral and fishing rights on the UKCS.

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government seeks to "ensure a new lease of life for the North Sea in low-carbon technologies" (p.15) through "fully utilis[ing] our great North Sea reserve, us[ing] the empty caverns for CO_2 Storage, bring[ing] through hydrogen to use as an alternative to natural gas and us[ing] our offshore expertise to support our offshore wind sector" [12,p.14].

In this paper, we critically explore the evolving national imaginary of energy capture on the UKCS since the beginning of hydrocarbon development in the 1960s. More specifically, we draw out continuities and ruptures over time in the state's vision of the UKCS as a national energy space i.e., as a space containing energy resources that may be harnessed and put to work to achieve national objectives; and we consider how material qualities of the UKCS have shaped both the state's evolving imaginary of energy capture and its relation to this space. We employ the concept of a sociotechnical imaginary (STI), which draws attention to the "imaginative resources" employed by states to govern energy systems ([13], p.141; see also [14–16]). The concept of STI foregrounds how socio-cultural visions of the "good life" and the interests of the "national collective" are a central part of statecraft [13, p.141]. For example, Kuchler and Bridge [16,p.136] highlight how the Polish state fuses coal with the prospect of the country's economic development through an imaginary of a "Poland that stands on coal". Energy materials and infrastructures can be potent imaginative resources and often become sites for "cultural imaginar[ies] of shared *nationhood*", which can help sustain popular consent for the state's activities ([17], p.553, italics in original; [13,18]). Our focus on an evolving imaginary of energy capture on the UKCS and its role within national energy policies supplements existing historical accounts of the development of the UKCS for oil and gas by "invok(ing) not only the

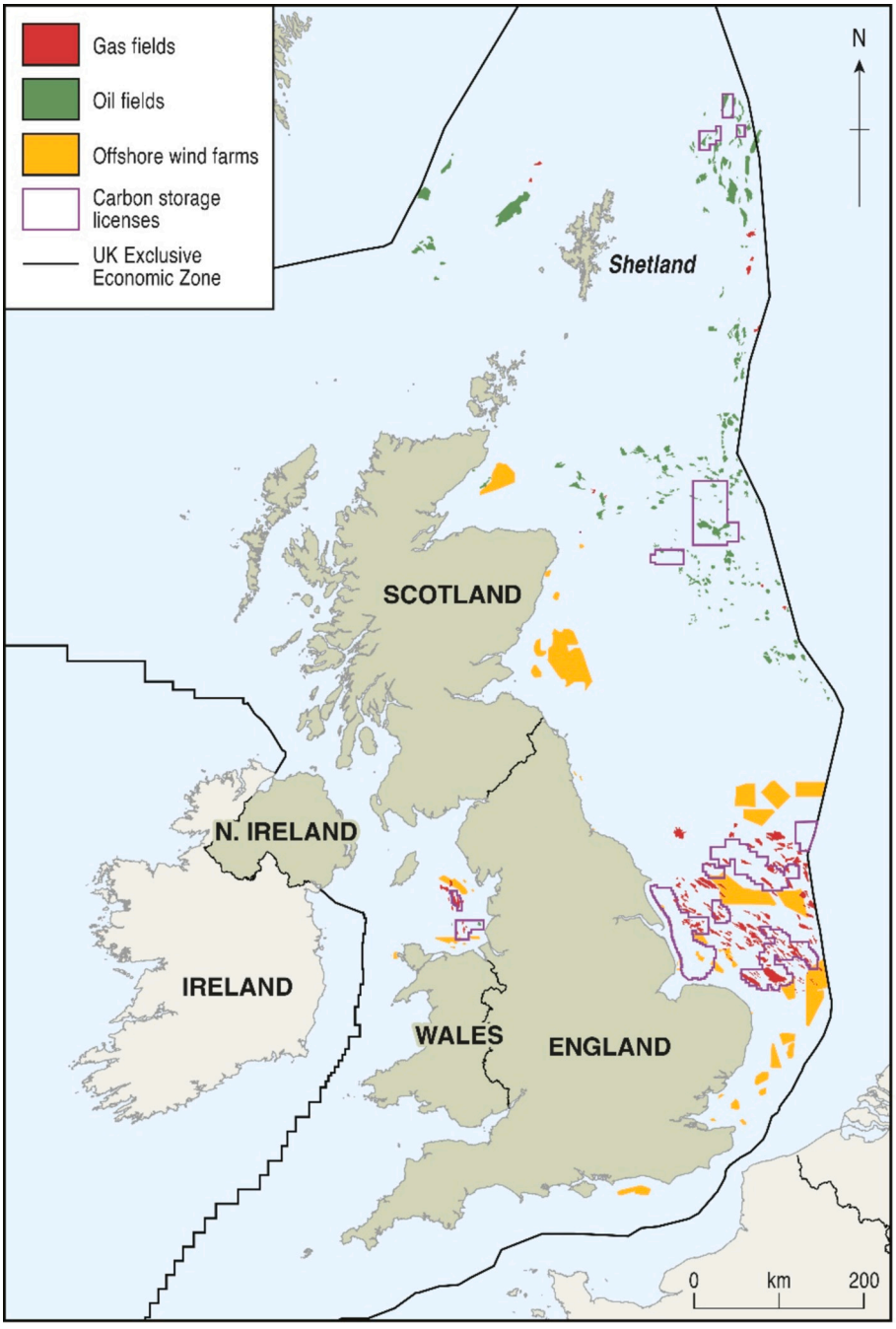

Fig. 1. Gas fields, oil fields, offshore wind farms and carbon storage licences on the United Kingdom Continental Shelf (The data for carbon storage licences are current as of January 2024.).

Table 1
Selected archival materials (not all documents in this table are cited in this paper; we have included reference numbers [in square brackets] for those that are cited).

Authors, year and title	Document type	Phase of imaginary
Continental Shelf Act, 1964 [101].	UK Act of Parliament	Phase 1: Economic recovery (1964–1979)
Department of Energy, 1974 [103]. United Kingdom Offshore Oil and Gas Policy.	Policy document	
Labour Party, 1974 [102]. October 1974 Labour Party Manifesto. Britain Will Win with Labour.	Political manifesto	
Department of Energy, 1977 [88]. Green Paper on Energy Policy.	Policy document	
Department of Energy, 1978. The Challenge of the North Sea.	Policy document	
Conservative Party, 1979. Conservative Manifesto.	Political manifesto	Phase 2: Market society (1979–1997)
Lawson, 1982 [107]. Energy Policy: Text of a speech given in June 1982.	Political speech	
Conservative Party, 1983. Conservative Party General Election Manifesto. The Challenge of Our Times.	Political manifesto	
Conservative Party, 1987. Conservative Party General Election Manifesto. The Next Moves Forward.	Political manifesto	
Conservative Party, 1992. Conservative Party General Election Manifesto. The Best Future for Britain.	Political manifesto	
Department of Trade and Industry, 2002 [111]. Future Offshore: A Strategic Framework for the Offshore Wind Industry	Policy document	Phase 3: Energy transition (1997–2020)
Department of Trade and Industry, 2003 [11]. Our Energy Future. Creating a low carbon economy.	Policy document	
Department of Trade and Industry, 2007 [114]. Meeting the Energy Challenge.	Policy document	
HM Government, 2009. The UK Low Carbon Transition Plan - National strategy for climate and energy.	Policy document	
Department of Energy & Climate Change, 2009 [119]. Draft Overarching National Policy Statement for Energy (EN-1).	Policy document	
Conservative Party, 2010. Invitation to join the Government of Britain.	Political manifesto	
Department of Energy and Climate Change, 2012 [121]. Energy Security Strategy.	Policy document	
Conservative Party, 2015 [116]. Strong Leadership, A clear economic plan, A brighter, more secure future.	Political manifesto	
Conservative and Unionist Party, 2017 [117]. Forward, Together - Our Plan for a Stronger Britain and a Prosperous Future.	Political manifesto	
Conservative and Unionist Party, 2019 [122]. Get Brexit Done - Unleash Britain's Potential.	Political manifesto	
Wood, 2014 [127]. UKCS Maximising Recovery Review: Final Report.	Report	Phase 4: Net zero basin (2020−)
Department for Business, Energy and Industrial Strategy, 2020 [10]. Powering our Net Zero Future.	Policy document	
HM Government, 2020 [126]. The Ten Point Plan for a Green Industrial Revolution.	Policy document	
Department for Business, Energy and Industrial Strategy and Oil and Gas UK, 2021 [124]. North Sea Transition Deal.	Policy document	
HM Government, 2021 [125]. UK Hydrogen Strategy.	Policy document	
HM Government, 2022 [12]. British Energy Security Strategy. Secure, clean and affordable British energy for the long term.	Policy document	
Department for Business, Energy and Industrial Strategy and Oil and Gas UK, 2022. North Sea Transition Deal - One Year On.	Policy document	

material and organisational resources that states deploy but also the imaginative resources with which they relate such policies to the public good" ([13], p.141; see also [2,3,5,6,19,20]).

We have chosen to adopt an STI framework because of its capacity to address how materials and technologies are integrated into broader collective visions of the future. At the same time, we acknowledge the significant contributions other fields – such as geography, sociology, political economy, and political ecology – have made to understanding the interplay between material and social dimensions of energy systems. This diverse body of research offers valuable insights into how infrastructure projects, geopolitical dynamics, everyday practices, and socio-environmental struggles are deeply intertwined with the material aspects of modern energy systems, encompassing both fossil fuels and renewables. It has shown, for example, how the material qualities of large energy infrastructures – like oil pipelines – are frequently objects of public knowledge production, turning such infrastructures into sites of political contestation (e.g., [21,22]). Other research highlights the role of fossil fuels in shaping regional politics and economic aspirations, and how they become a potential symbol of national independence (e.g., [23,24]); the embeddedness of materials in everyday social practices related to energy demand and consumption (e.g., [25,26]); and how resource materialities are central to the exercise of power and the reproduction of socio-environmental inequalities (e.g. [27,28]). Our paper shares with this diverse literature an interest in understanding the intersection of materialities and sociopolitical dynamics. However, we have adopted the STI framework because it focuses on the particular problem of how – and with what consequences – (energy) materials and infrastructures are integrated into broader collective visions of the future. As Jasanoff [29,p.22] observes, the STI lens helps us capture "the ways in which people's hopes and desires for the future (…) get bound up with the hard stuff of past achievements, whether the material (…) or normative infrastructures." In sum, while STI shares with other scholarly traditions an interest in the way socio-material interactions shape energy systems, it provides a more specific focus on the visionary dimensions that drive societal change.

The process of capturing energy from the UKCS has involved a variety of resources, infrastructures, and technologies. These material qualities of energy capture have shaped the state's relation to the UKCS in distinctive ways and have influenced the imaginative resources the state has deployed to relate energy capture on the UKCS to the public good. For this reason, we pay particular attention to the material qualities attributed to the UKCS and how these qualities sustain or disrupt a national imaginary of offshore energy capture. Here we aim, like other recent research, to capitalise on the value of STI as a 'voyaging concept' able to forge connections with other social science traditions including those in energy geographies and on the materialities of energy infrastructures [16,30–32]. We show not only the range of materialities attributed to the UKCS, but also how the qualities of this space, its potential for energy capture, and the relation of the UKCS through energy capture to the rest of the UK, have been understood in quite different ways. In this sense our effort to read materialities and sociotechnical imaginaries *together* sits squarely within the interpretivist tradition of social science that "begs for illustration rather than proof" [33,p.6]. Our goal is to elucidate how these two conceptual strands can be deployed simultaneously to understand a specific phenomenon in a time and place – rather than try to universalise their interaction – in the hope of sensitising researchers to their interactions and the analytical possibilities for future work [34].

Like other researchers whose work charts the longitudinal imaginaries of states in relation to energy technologies and infrastructures,

our methodological focus is on state energy policies and associated official documents [14,16]. We assembled an ad-hoc archive of historical and contemporary energy policies and relevant legislative documents produced by the British state, supplemented with key influential reports (e.g. the 2014 Wood Review) and the political manifestos of winning governments (see Table 1). Political manifestos and energy policies for this archive were sourced either from the National Archives (pre-2000) or online (after 2000). We uploaded documents to the qualitative analysis software Nvivo and coded them. Our coding framework was developed abductively so that, by the end of the process, our reading of documents in the archive focused on three main features: (i) their characterisation of resource, spatial and infrastructural materialities (e.g., spatial qualities of the UKCS, such as the distribution, concentration and distance of hydrocarbons from shore; resource quantities, such as abundance, field size, or trajectories of change; and resource qualities, such as the type or grade of oil or the class of wind resource); (ii) how they sought to connect energy capture on the UKCS to ideas about nationhood and desired forms of social order (e.g., a source of fuels to modernise onshore energy services, a key site through which to forge a market-based society, a means of decarbonising the national economy); and (iii) their characterisation of the state's role (and desirable modes of state action) in relation to the offshore (e.g. sovereign power, anticipatory planner, resource regulator, financial speculator etc.). In addition to this assembled archive, we bolster and contextualise our analysis of the imaginary by drawing on a broad range of secondary literature on the history of the North Sea and British energy politics. A primary objective of the paper is to chart the evolution of an imaginary of offshore energy capture spanning several decades, and evolving across multiple different Governments with diverse political economic priorities. To achieve this within the structural limits of a paper, our focus has been on identifying substantial continuities and shifts in the imaginary rather than exhaustively cataloguing debates and disagreements. We have distilled our detailed reading of the empirical material into four broad phases: each phase represents a period of continuity in the energy capture imaginary, while the passage from one phase to another marks a distinctive evolution of the imaginary in relation to the offshore. In some instances, our identification of periods of continuity in the imaginary cross-cut or blur the more familiar periodicity of shifts in government (between Labour and the Conservatives) which is how histories of the North Sea are conventionally structured.

Overall, we chart the evolution of an imaginary of energy capture on the UKCS in four successive phases: (i) initial attachment of energy capture to the UKCS in the 1960s and 1970s, centred on locating, evaluating and extracting contained stocks of hydrocarbons, in which the UKCS became understood primarily as a national resource for arresting British economic decline; (ii) an evolution of this imaginary in the 1980s and 1990s, still anchored around hydrocarbon extraction, in which the UKCS becomes a space through which to expand the play of the market and re-work the national socio-political order; (iii) re-imagination of the UKCS for low-carbon electricity generation in the 2000s, based on installing capacity to capture ambient flow resources (primarily offshore wind) and decarbonising UK power generation; and (iv), more recently, redeploying the materialities and infrastructures of the UKCS as part of a net zero basin, a multi-energy space in which imagined synergies between oil and gas production, renewables and carbon capture and storage deliver energy transition.

2. Sociotechnical imaginaries and the materialities of energy capture

Introduced by Jasanoff and Kim [13], the concept of sociotechnical imaginaries (STI) has evolved into a core analytical framework for examining how visions of desirable futures are fused with technoscientific developments, aiding social science energy researchers to understand the emergence, stabilisation and contestation of different visions for energy systems and transition [35]. This burgeoning field has delved into STIs concerned with, among others, nuclear energy (e.g., [13,14,36,37]), renewables (e.g., [38–43]), electricity (e.g., [44–49]) and fossil fuels (e.g., [16,30,50–53]).

In their comparative study of nuclear energy visions in the United States and South Korea, Jasanoff and Kim [13,p.120] define STIs as "collectively imagined forms of social life and social order reflected in the design and fulfilment of nation-specific scientific and/or technological projects". Drawing inspiration from anthropology and political science literature on social imaginaries (e.g., [54–56]), these scholars have been primarily concerned with interrogating different national imaginaries as useful sites for observing "long-lasting" variations in sociotechnical policies and developments. For Jasanoff and Kim [13], national STIs are "more durable" compared to other collectively held imaginaries due to the nation-state's capacity to exercise power and control "powerful instruments of meaning-making and goal-selecting" (p. 124). While they emphasise the durability of national imaginaries, these authors also understand the nation-state to be a vast reservoir of sociocultural and socio-political contexts with a capacity for (re)imagining both technoscientific futures and desirable norms of social order [13,57,58].

STI researchers employ the 'co-production' term to explore the reciprocal exchange between technical knowledge (about energy infrastructures and energy futures, for example) and nationhood (as a collectively experienced form of social order) and how these reciprocally produce one another. As Jasanoff and Simmet [58] argue, scholarship on sociotechnical imaginaries "symmetrically interrogate(s) who are the actors that collectively hold an imaginary and how that imaginary in turn supports that sense and claim of collectivity" [58,p.3]. Although the evolving concept of STIs has been extended in recent years to include collectives beyond and within nation-states [57,58], STI scholarship has continued to explore nationally-held imaginaries [35].

We find two strands of work on the durability of imaginaries particularly useful within the large STI literature on energy systems and transitions. The first highlights the persistence of certain visions of the future over time and the powerful grip of the past on a collective's capacity to imagine alternative or radical futures (e.g., [16,41]). Kuchler and Bridge's [16] work on STIs of coal in Poland across the long sweep of the 20th century, for example, illustrates how an enduring national imaginary of Poland "standing on coal" continues to shape contemporary struggles in the country to envision an energy future beyond "black gold" (p. 143). Work like this demonstrates how, in the face of "the unknown terrain of the future, societies tend to populate that future with representations and materialities of the present and/or past" [16,p.138]. The second strand highlights the evolution of STIs over time and shows how durability can be a function of active adaptation and incorporation rather than merely a residual or recalcitrant hold-over from the past. This work recognises the emergence and circulation of alternative, competing visions – often associated with novel and/or potentially disruptive technologies – but emphasises how these become aligned with (and incorporated within) the prevailing imaginary as part of a broader process of institutional stabilisation [15,59,60]. Lund and Christiansen [61], for example, describe how visions surrounding some negative emissions technologies and practices for carbon removal in Sweden challenge the prevailing national imaginary of the bioeconomy, but observe that other emission technologies actively repurpose, normalise and (re)legitimise features of this imaginary and have quickly become incorporated within it. Work like this highlights how the durability of an imaginary arises, in part, from "interpretive flexibility" [62–64] and how this "allows a broad coalition of actors to reach nominal agreement about a future vision and thereby increases the chances of this vision becoming widely shared and institutionalised" [61,p.2]. We find this work valuable because it sensitises researchers to the *ongoing* formation and stabilisation of an imaginary in the face of ideological and material challenges: in this sense it shows how durability is an active achievement and something to be explained beyond a passing nod to the tenacious grip of the past.

Given limited attention to national visions of hydrocarbons within the STI literature, we also draw in this paper on an insightful body of scholarship in critical resource geography that illuminates various processes of visioning and imagination around natural resources and extractive practices (e.g., [27,28,65–71]). This work highlights how political narratives and state developmental visions often mobilise powerful ideas about resources and their relation to a society's past, present and future [72,73]. It shows how state strategy is not limited to managerial tasks of resource development but also has a substantial imaginary element, through which potent ideas of nationhood and nationalism combine with resource management, economic planning and geopolitical dynamics. Perreault and Valdivia [27], for example, show how the state plays a crucial role in conflicts around hydrocarbons in Ecuador and Bolivia, noting these struggles are not just about the governance and distribution of resources but are also deeply connected to the processes of nation-making. The nation, in this context, is reimagined through the struggles over hydrocarbons, where state actors and social movements seek to redefine citizenship, territory, and national identity in opposition to neoliberal policies. Using Norway's energy industry as a case study, Heiret [71] explores how the concept of ground rent ties into a national narrative that fuses nature and nation, portraying energy resources like petroleum and hydropower as collective assets belonging to society as a whole. This imaginary, central to Norway's political identity and domestic energy rent distribution, has extended beyond borders as the country became a global rentier by capitalizing on international expansion. By contrast, Kennedy [65, p.273] emphasizes the "prosaics of the state" in relation to the geographies of oil, illustrating the state's deep involvement in the mundane aspects of life through its provision of the infrastructures and regulatory measures associated with oil. We value the way this work foregrounds visioning and imagination within accounts of state strategy and its recognition of how resource imaginaries shape both (national) futures and peoples.[2] It complements our approach, even though it does not use the formal conceptual device of a sociotechnical imaginary and has diverse theoretical points of origin.

In this paper, we consider energy capture on the UK Continental Shelf to be a *national* sociotechnical imaginary produced and performed by the British state. Indeed, the British state has had a pivotal role in producing the offshore as national territory and then turning it into a national energy asset, not least through the enactment of the Continental Shelf Act of 1964, which extended the UK's national land regime beyond territorial waters, and gave the British state rights over the seabed, subsoil resources and natural resources. At the same time, we acknowledge that energy capture on the UKCS is more than a *British* national story and that Scottish national imaginaries (in particular) have been – and continue to be – bound up with the possibilities of energy capture in the waters off its western, northern and eastern coasts. While focusing on the evolution of a British national imaginary of energy capture on the UKCS, then, we also recognise how that imaginary has been in tension with other national identities. Furthermore, we acknowledge that the British state is not a fixed and immutable entity and that its political-economic order has been co-produced with the envisioned futures of the UKCS over time. Indeed, since the start of the development of offshore energy sources and infrastructures in the 1960s, a wide range of governments, adopting different ideologies and political-economic priorities, have steered UK policy towards the UKCS [1–4]. For example, the social democratic politics of the Labour Government under Prime Minister Harold Wilson (1964–1970; 1974–76) motivated different understandings of the role and use of offshore oil and gas and its revenues than the neoliberal policies of Margaret Thatcher throughout the 1980s. Thus, while the paper's primary aim is to outline the evolving imaginary of energy capture on the UKCS, we also pay attention to "the political-economic contexts by which [STIs] are shaped and to which they ultimately also contribute" [61,p.7]. Our analysis is attuned, then, to how potential continuities and ruptures in this imaginary might emerge from these divergent political-economic contexts.

Importantly, STIs are a "voyaging concept" able to bridge between ideational resources – cultural, political and social – and the material components of scientific and technological development, such as raw materials and infrastructure [15,p.321]. In this paper, we follow Kuchler and Bridge's [16] suggestion to pair the concept of STIs with a focus on the materialities of energy resources and infrastructure as a means of grasping how a national-level imaginary of energy capture in the British offshore is co-produced alongside the evolving material qualities of this space. Our emphasis on materialities foregrounds the qualities of the energy materials and infrastructures around which the vision of energy capture coheres or coalesces [16,31,32]. Specifically, it highlights the material heterogeneity of offshore energy capture, from the 'upstream' spaces of resource exploitation (e.g., oil and gas extraction, wind power generation, carbon capture and storage) to the 'midstream' transmission infrastructures that connect offshore energy capture with 'downstream' spaces of energy consumption onshore [32]. Our interest in the materialities of energy is consistent with work elsewhere in the social sciences, where materiality is invoked to spotlight how and why "things other than humans make a difference in the way social relations unfold" ([75], pp.17–18; [76]). Here, our focus on the materialities of the UKCS reflects our interest in understanding how the material qualities of this space enable different trajectories of the imaginary of energy capture to take hold and then either sustain these particular shifts over time or promote further evolution.

We think the analytical possibilities of pairing the concept of sociotechnical imaginaries with a focus on materialities are considerable. In the case of the UKCS, for example, it can shed light on how historic fishing grounds rapidly became understood as a world-class oil and gas reserve with the potential to power a nation in a period of post-imperial decline; how this same space then became imagined as a global hydrocarbon frontier, outside the spaces of OPEC's cartel, through which international oil companies could replenish their reserves; and subsequently, post-peak production, as a mature and declining basin in need of continual support to avoid being side-lined by new frontiers in the Caspian, East Africa and South America. And, at the level of specific energy infrastructures, pairing materialities with sociotechnical imaginaries reveals how the objects (oil wells, wind turbines, subsurface reserves) around which sociotechnical imaginaries coalesce are neither fixed nor stable. Subsurface hydrocarbon formations, for example, materialise differently over time as, variously, oil reserves for addressing a national balance of payments crisis, corporate assets facing the risk of 'stranding' in the context of climate change mitigation, or speculative sites for carbon storage and achieving net-zero.

3. Imagining the offshore: from national recovery to net zero

In this section we illustrate an evolving British national imaginary of energy capture on the UKCS. We identify four broad phases to this evolution in the period starting from the 1960s to 2022, which align (imperfectly) with broader shifts in political economic thought at the helm of government. We have chosen to focus on the period beginning in the 1960s because the formal definition of the UKCS (via the 1964

[2] Sociologist David McCrone [74,p.36] neatly expresses this broad conceptual orientation in relation to oil: "oil does not spring fully formed from the ground into existing socio-political systems; society and economy are, rather, constituted by the process of oil exploration itself." Our STI approach shares this 'constitutive' understanding of the role of energy in social life but offers a sharpened and more specific focus on the imagined forms of social order associated with energy capture. In this paper we are less focused on what energy capture from the North Sea does to UK economy and society, and more on what energy capture is *thought to be capable of doing* i. e., the "collectively imagined forms of social life and social order" associated with the fulfilment of energy capture projects (gas, oil, wind) in the UK North Sea.

Continental Shelf Act) is closely associated with the onset of oil and gas production.[3] While we distil the evolving imaginary into four distinct phases, we also recognise (as we discuss in Section 4) significant elements of continuity. Across all phases, we demonstrate how the imaginary coalesces around diverse materialities of the offshore; moreover, we illustrate how these materialities are differentially related to servicing the nation. Ultimately, we reveal how, although the UKCS is framed today as a multi-energy space associated with a suite of different energy sources and technologies, this contemporary imaginary of energy capture offshore retains the imprint of a formative period of oil and gas development beginning in the late 1960s – from calculations of abundance and projections of growth to the harnessing of offshore resources for onshore projects of social transformation.

3.1. Mastering materialities: placing hydrocarbons on the UKCS (early 1960s - 1979)

In the early 1960s, the North Sea became understood as a space of abundant and premium quality hydrocarbons at a time when the faltering economic performance of the UK was reaching crisis proportions (cf. [80]). Explorations for hydrocarbons in the southern part of the UK North Sea were launched following discoveries of gas in the (onshore) Groningen area of the Netherlands (1959), particularly when the scale of the Groningen field became apparent in the early 1960s as its size was "considered sufficient to alter the fuel economy of the Netherlands and adjoining land areas" [81,p.9]. These early explorations for natural gas quickly identified the additional presence of crude oil. While both hydrocarbons were appraised for their abundance and premium quality, the state linked gas and oil to servicing the body of the nation in different ways. Gas would be brought ashore by the state to modernise British energy services with an administrative state body (the Gas Council) acting as a monopoly buyer. Oil would be developed and exported by private actors as an internationally traded good, improving the country's balance of payments and supporting a national economic recovery.[4] These early days were also marked by several potential challenges to the British state's ability to secure these hydrocarbon resources for itself.'Placing' hydrocarbons on the UKCS through geological exploration, then, was also an act of articulating British nationhood through expanding the body of the nation offshore.

3.1.1. From gas for modern energy services to oil for national economic recovery

The potential to source natural gas, and the prospect of using offshore gas to supplement and replace town-gas within the UK's energy sector, initially drove energy extraction activities offshore. Significant gas reserves came to be 'placed' on the UKCS during the 1960s [83], with the Continental Shelf's subsurface being systematically mapped and defined by petroleum geologists [84,85]. Although unevenly distributed, gas and the geological properties associated with it increasingly became significant material aspects of the UKCS [4,86,87]. Through the calculative work of exploration companies and the state-owned Gas Council, offshore gas was established as both a UKCS asset and an aggregate termed "recoverable reserves" [88] – an accounting artefact with calorific properties available to the nation. By the mid-1970s, for instance, the UK's estimated recoverable gas reserves stood at about 51 trillion cubic feet (Tcf), fostering a vision of abundant supply that justified the substantial investment in necessary infrastructure such as pipelines and processing plants to transport and distribute gas within the nation [88].[5] This emerging imaginary of offshore energy capture was primarily driven by certain favourable material qualities of gas. Gas in the UK sector of the North Sea was not only plentiful, but also regarded as good quality: it had a higher calorific value than the gas discovered at Groningen and "require(d) only modest treatment to remove water vapour and the liquid condensate which can be sold separately" [87,p.180]. Gas was thus considered a "clean high-grade fuel" [88] which could be used to modernise a wide range of national energy services via the state-owned Gas Council. Gas from the North Sea promised a form of molecular modernisation right at the heart of domestic life: contrasted with coal or manufactured town gas, it was marketed to domestic consumers as a natural 'high speed' fuel (ignition was quick and easy, making cooking and heating faster) and as 'safe' (given a sharp reduction in poisonings relative to town gas) [90,91].[6]

Drilling campaigns in the central North Sea soon revealed substantial oil reserves – notably in the billion-barrel Forties (1970) and Brent (1971) fields – that, similarly to earlier gas findings, became 'placed' on the UKCS and subsequently systematised by petroleum geology [4,85,86]. The vast scale and higher commercial value of these reserves, combined with the feasibility of shipping 'seaborne' oil to global markets provided a significant opportunity for commercial exchange to take root. As a major oil basin outside of OPEC control, the UK North Sea offered vertically-integrated international oil firms access to new reserves, many of these firms having lost their upstream access elsewhere to nationalisation and growing equity participation by reserve-holding states [86,97]. Moreover, the UK – and North-western Europe more generally – had from the 1950s become increasingly dependent on imported oil (much of it from the Middle East), a vulnerability that was exposed by the 'first oil shock' in 1973 [86,98]. During 1973, OPEC governments used their collective power to push up oil prices and, towards the end of the year, Gulf oil producers within OPEC embargoed oil supplies to countries that had supported Israel in the Yom Kippur War, including the UK [99]. The overall effect on the UK was substantial as "oil had been cheap but was now expensive enough to register in the balance of payments" [82,p.296]. In this context, the discovery of oil in the North Sea and its development during the 1970s was "exceptionally fortunate" as "to produce oil at a time when oil was so expensive was supremely lucky" [82,p.296].

It was not only oil's abundance and location that mattered, however: the qualities of North Sea crude were also important – specifically its international potential as a "low-sulphur, fairly light crude" which was "in relatively short supply" globally and could hence "command a premium value on account of these qualities" and its seaborne character [88]. Expectations of rapid production growth after 'first oil' in 1975

[3] We recognise, however, that the waters around the UK have provided its population with a major source of food energy (calorific value) for centuries so that, in this sense, there is a significantly longer national energy imaginary centred on offshore food provisioning [77–79].

[4] Gas is illustrative of what David Edgerton [82,p.xxviii] has referred to as the rise of the 'British nation' as a "distinctive economic, political and social unit within the borders of the United Kingdom" characterised by, among other things, "a culture of national self-supply" (p.xxix). By contrast "there was relatively little British nationalism in oil" (p.296) as, for example, development of the North Sea relied on "private oil, dependent on overseas equipment" (p.298).

[5] For comparison, total gas consumption in the UK in 1975 stood at around 400,000 GWh [130] converting to around 1.4 Tcf.

[6] The 1967 Fuel Policy classed natural gas as a "premium fuel": in an effort to maximise savings in resources, gas was to be allocated to meeting existing demand for town gas (i.e., primarily residential heating and cooking) which was regarded as the 'premium market' [92]. The effect of this policy was to exclude gas from electricity generation where it was deemed too "valuable" to compete with coal [93,94]. The exclusion of gas from the power sector was codified in the UK's 1976 Energy Act (which implemented a European Community Directive restricting the burning of natural gas in power stations). It remained in place until 1990 when the European Directive was revoked, in the context of electricity privatisation in the UK (Electricity Act 1989) [95] and increasing concerns about acid rain in Europe linked to emissions from coal-fired power stations [94]. The availability of gas from the North Sea in the 1970s led to the closure of (what at the time was) the UK's only LNG receiving terminal (Canvey Island) in 1979 [96].

coincided with a period of unprecedentedly high prices which continued until the start of the 1980s [93]. The combination of these material properties – volumetric abundance, geographical location, rapid growth in production, and high-quality oil – formed the building blocks of a national vision centred on "the attainment as early as practicable of *net self-sufficiency* in oil" [88]. This distinctive terminology – which applied to oil but not to gas in these formative years – privileged the economic value of oil through international exchange rather than the national utility of its calorific (or other) physical properties [88]. Net self-sufficiency was, in essence, an accounting exercise in which the UKCS provisioned the UK with oil only in a virtual sense – international exports of crude oil from the UKCS would offset oil imports to UK refineries. Consequently, the abundance and material qualities of North Sea crudes amplified an imaginary of offshore energy capture while also extending it beyond a national modernisation project centred on transitioning the UK from town gas to cleaner and more efficient natural gas. Although oil from the North Sea was understood as a "unique opportunity" to improve the UK's balance of payments and achieve a "lasting national economic recovery" [100], its value to the nation was envisioned primarily in terms of economic exchange: oil would be exported to power other nations, while the ensuing revenues would bolster the UK's international position.

3.1.2. 'Britain's own resources': stabilising a national imaginary of energy capture on the UKCS

The visions of volumetric abundance and economic potential that had come to surround North Sea oil also acquired a sense of jeopardy and potential loss if corrective state action was not taken: as a national imaginary of offshore energy capture took hold, it was simultaneously conditioned by an anticipation of oil and gas' eventual exhaustion. The state sought to manage this tension by establishing its ownership of offshore resources, governing the pace and location of offshore development via licensing, and ensuring that "the depletion of our reserves of oil and gas is regulated" [88]. Foundational work to stabilise the imaginary centred on establishing sovereign rights to the Continental Shelf and, in effect, annexing the material qualities of this offshore space to the territorial body of the nation-state. The United Kingdom Continental Shelf Act of 1964 [101] vested in the Crown "(a)ny rights exercisable by the United Kingdom outside territorial waters with respect to the seabed and subsoil and their natural resources." The incoming Labour Government [102] sought to intensify the state's power to control the pace of hydrocarbon flows beyond the lever of licensing. For both current and future licences, it would "take power to control the level of production in the national interest" and, anticipating depletion, it noted that while the "question of reducing the rate of depletion is unlikely to arise for some years… the Government believe that they should take the necessary powers now" [103]. The state's anticipatory stance also involved developing production and depletion profiles to inform decisions about the pace of development and the scale of hydrocarbon flows [88]. While it considered several different possible futures and identified desirable outcomes, the state also sought to maintain "as much flexibility as possible, so that we can decide nearer the time what production levels would best serve the national interest" [88]. It sought in effect to generate sufficient knowledge about the resource base and its future characteristics that it might then be managed to deliver a durable flow of benefits to the nation.[7]

By asserting ownership and control over the Continental Shelf's hydrocarbon resources, the state sought to subjugate the UKCS' material properties to the objectives of national modernisation and economic recovery, forging an imaginary of offshore energy capture centred on the 'British national collective,' an undifferentiated national body encapsulated in references to "the whole community" [102], "the whole nation" [100] and "the British people as a whole" [100]. Yet, some of the material qualities of oil in particular – the location of large oil reserves in the central and northern North Sea, the technical challenges of depth and distance offshore, and the premium quality of its oil – undercut this 'collective' imaginary in two significant ways. First, the emergence and stabilisation of North Sea oil as a distinctly British asset spurred elements of Scottish society to challenge this vision, and amplified Scotland's ambitions for independence. The Scottish National Party, in particular, used the discovery of oil near Scottish shores to revive a political impetus for independence from the rest of the UK. The British state responded to Scottish challenges by shoring up a national British collective, comprising multiple communities with a shared interest in the gains from oil, and doubling down on the economic benefits of resource abundance. UK hydrocarbon policy would "ensure that as a result of the exploitation of North Sea oil and gas resources, maximum benefit is conferred on the community, and particularly in Scotland and regions elsewhere in need of development" [100].

A second challenge to the stabilisation of the imaginary arose around the foreign-owned (mainly American) international oil firms that took up the task of developing the North Sea and to whom huge revenues flowed as oil production (and prices) rose in the second half of the 1970s. Between the time of oil discovery in 1970 and the first flow of oil in 1975, the prevalence and growing wealth of these external actors potentially undermined the prospects of a British collective benefiting from offshore energy capture – a pilfering of national wealth. The Labour Party, for example, declared in its 1974 political manifesto, "We cannot accept that the allocation of available world output should continue to be made by multi-national oil companies and not by Governments. We will not permit Britain's own resources to be parcelled out in this way" [102]. Under Labour, the state reaffirmed and intensified the national character of North Sea oil: through establishing "full public ownership" and ensuring "control (…) to fix the pace of exploitation of our oil, and the use to which it is put", the state would "secure maximum public advantage from our own resources" [102]. When in power, the Labour government's first policy paper on the offshore cemented the state's new role in controlling and safeguarding flows of value derived from North Sea oil. Its two primary objectives were "to secure a fairer share of profits for the nation and to maximize the gain to the balance of payments"; and "to assert greater public control" in the interests of "safeguard(ing) the national interest in an important resource which belongs to the nation" [103]. In effect, the state sought to stabilise an imaginary of national development through offshore energy capture that was being rendered increasingly precarious by materialities of oil field development in the 1970s. It sought to do this by supplementing existing national ownership and regulatory powers with additional oil company taxation, and by establishing a publicly owned company, the British National Oil Company (BNOC), through the Petroleum and Submarine Pipeline Act in 1975. BNOC enabled the state to gain majority participation in existing and future licences for commercial fields and simultaneously to build its experience offshore [88,103]. Both measures rested on materialities of abundance and depletion, and on the material infrastructures of a seaborne oil trade that enabled oil from the UKCS to be sold on international markets. In this context, Labour invoked the state's responsibility to act in the national public interest – noting explicitly in the Green Paper on Energy Policy [88] how this "may diverge from the oil company interests" – and control the pace and geographical allocation of oil development. The Petroleum and Submarine Pipeline Act, for example, vested additional powers in the Secretary of State for Energy, including the abilities to "regulate the rate at which fresh territory is licensed for exploration, control the establishment and carrying out of development and production programmes, delay development of a field… and require, within limits, that

[7] Weszkalnys [104] has pointed out how oil and gas development necessarily contend with the 'double obscurity' of indeterminate resources and uncertain future market conditions. The orientation of the state towards the North Sea in this period is shaped by a core imaginary of energy capture for the nation that, at the same time, is trying to reckon with material conditions which are uncertain and dynamic (e.g. depletion).

production should be cut back or expanded" [88].

Hence, in the early days of hydrocarbon exploration and extraction, the British state crafted, performed and aimed to stabilise a fledgling imaginary of energy capture offshore – forming around distinct material qualities of hydrocarbons (abundance, eventual decline) and of the North Sea space (seaborne, proximity of resources to distinct segments of the onshore) – in which the UKCS would sustain and enhance the body of the nation both tangibly (modernisation of energy services through gas) and virtually (economic recovery through oil). As the British state's claims to offshore hydrocarbons were jeopardized on two fronts, this period of exploration and early development was marked by an imaginary aimed at establishing the national character of offshore energy resources, an imaginary which was stabilised through distinct forms of statecraft including imposing sovereign rights, licensing and participation in production. Quantitative devices such as depletion profiles functioned as forecasting tools, enabling the state to forge an anticipatory relationship with the future development of these resources, which it deployed to ensure maximum benefits from North Sea oil to the nation.

3.2. Expanding market society via energy capture from the North Sea (1979–1997)

The imaginary of energy capture on the UKCS evolved in the 1980s and 1990s, while still being firmly tethered to hydrocarbon extraction and to a primarily economic evaluation of the national contribution of oil extraction on the UKCS. The period stretching from the election of Thatcher's Conservatives in 1979 to the late 1990s was one of significantly lower oil prices, including a sustained period of low prices in the 1990s which coincided with the peak of North Sea oil production (see Fig. 2). During this period, which was marked by the consolidation and entrenching of neoliberal political economic thought, the state continued to view the UKCS as a space for producing oil and gas, but one whose pace (and geography of hydrocarbon flows) would be determined by the free circulation of capital and the play of market forces. Emblematic of this receding role of the state was the virtual disappearance of energy policy, the state's withdrawal from practices of forecasting and anticipating future energy needs, and the privatisation of multiple 'commanding heights' of the energy economy including British Gas and British Petroleum (BP) [105]. Like the previous phase, oil continued to be viewed primarily in economic terms, rather than in terms of physical security of supply or the energy services it could provide. However, it took this economic trajectory of the evolving imaginary of energy capture further still, seeing the offshore as merely another market arena and the production of energy as no different to any other commodity. This was a national imaginary filtered through the veins of the market – no longer exclusively about a collective of citizens (security, sovereignty, nationhood) but a collective of consumers (markets, private enterprise, goods).

Thatcher's decision to sell part of the Government's 51% stake in BP and the privatisations of BNOC and British Gas were three symbolic moments of this era, redefining energy as a fungible commodity like other components of the wider economy rather than a strategic asset [106]. In a 1983 speech that laid out the Thatcherite view of the UKCS, Nigel Lawson (Secretary of State for Energy), proclaimed: "For the United Kingdom with its own indigenous supplies of all the fossil fuels, and a highly developed and diversified economy, the pre-eminent objective must be to ensure that the vitally important energy sector functions as efficiently and effectively as possible….there is neither need, nor particular virtue, in having domestic production equal to consumption…We should use our ability to import or export fuels at the margin to the best advantage" [107].

The market logic extolled in Lawson's speech stripped North Sea oil of any special status, normalising it as just another commodity whose production and allocation should be subject to market forces. The double reductionism at work in this normative vision of an efficient market – oil as energy, and energy as a commodity – not only stripped oil of its material qualities but, at the same time, also reduced the visibility of the North Sea as a distinctive extractive space within the UK economy. Oil retained some residual national character by virtue of its brute

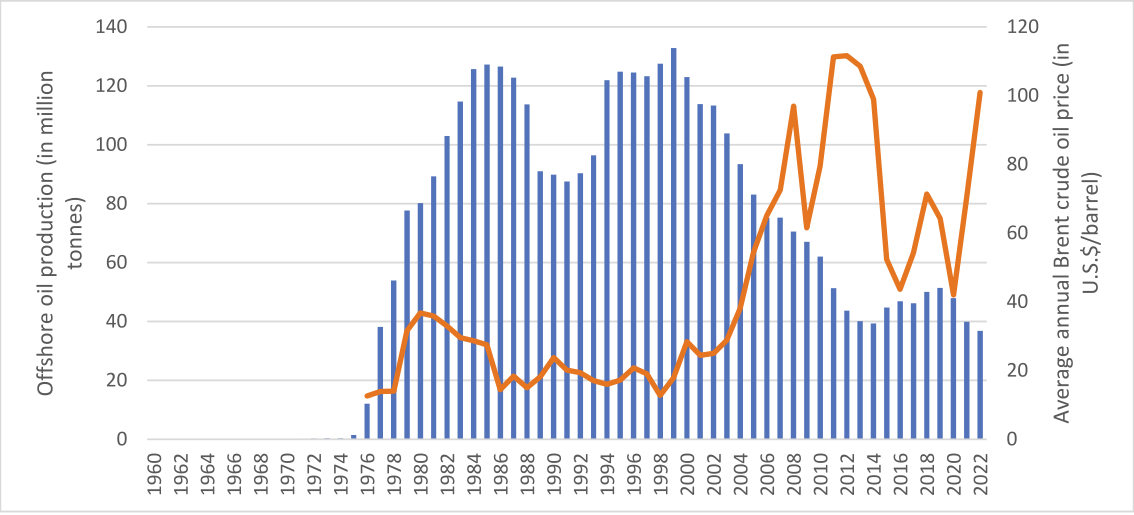

Fig. 2. Oil production on UKCS and Brent crude oil prices, 1960–2022. Drawn by lead author from the Digest of UK Energy Statistics (DUKES) 3.1.1 [89] and Statista [132].

location – Lawson's reference (above) to the UK's "own indigenous supplies" – but the desirable futures imagined for the national collective through offshore oil came to centre mainly on its cost to consumers. Indeed, the national potential of North Sea oil became contingent on – even derivative of – these market forces (Lawson's reference to "neither need, nor particular virtue" in domestic production): offshore oil's value to the nation depended on it being the lowest cost source of supply and it was not to be preferred or favoured if cheaper imported sources could be found.

3.2.1. Recasting the role of the state

Whereas the state had previously taken an active role in anticipating, planning and (under Labour) participating in production, it now largely abdicated these roles in relation to the offshore, turning them over to individual market participants.[8] The purported false promises of forecasting and planning were a target of Lawson's speech, in which he noted that "by treating energy as a traded commodity, we greatly reduce the need for, and importance of, projections of UK demand and production." Rather than planning, he opined, "we will do far better to concentrate our efforts on improving the efficiency with which energy is supplied and used, an objective that will remain valid and important whatever the future may bring." In other words, the state would no longer seek to mediate the relation between energy capture offshore and the future via the anticipatory logics of planning and/or state control. As Lawson explained: "in general, as Secretary of State for Energy in the UK, I do not see the government's task as being to try to plan the future shape of energy production and consumption. It is not even primarily to try to balance UK demand and supply for energy. Our task is rather to set a framework which will ensure that the market operates in the energy sector with a minimum of distortion and that energy is produced and consumed efficiently" [107]. This logic, of abdicating state planning in favour of an absolute relinquishment to the market to guide decision-making, was similarly applied to the uses of revenues derived from oil: "We have to ask ourselves whether we are really so unenterprising as not to be able to put to good use the wealth which derives from oil, whenever it arises" [107].

The North Sea was, in this sense, no different to the rest of the UK economy – an investible space to be made subject to market forces. Indeed, it was through offshore oil that Thatcher's Conservatives demonstrated the neoliberal logics of competition and efficiency in energy supply that would come to define their period of government [109]. For example, Lawson's speech coincided with the establishment of Britoil (via privatising the greater part of the British National Oil Corporation) which he described "as an independent private sector oil company in its own right, and will very significantly increase the competitive pressures to which the British Gas Corporation is subject. For the first time ever, there will be the prospect of competition for the custom of all gas consumers in the private sector" [107]. In the 1980s, then, Lawson and his fellow Conservatives publicly performed an imaginary of energy capture offshore that was subject to market forces and that presaged a future of market-driven energy supply for the nation as a whole. In this sense, oil on the UKCS became fused with the broader political economic logic of the state's neoliberal thought. As Lawson extolled,

> "There is, of course, one major energy industry that is fully subject to the disciplines of the market. For North Sea oil (…) we have a genuinely free market approach. This is most unusual among the oil-producing countries of the world (…). The price of North Sea oil is determined not by government fiat but in response to market forces, and North Sea producers are free to produce as much oil as they wish." [107].

During the 1980s and 1990s, then, technologies and infrastructures of energy capture in the North Sea – centred on oil and gas production – were an important pathway for the introduction and consolidation of the Thatcherite market-driven and consumer-centred national social order. The state's imaginary of offshore energy capture evolved in this transition to neoliberal markets. With decision-making turned over to market actors – and the state less concerned with anticipating the future of the North Sea as a means of statecraft – many of the materialities upon which planning had centred (abundance, depletion, the reservation of gas as a premium fuel) became less central to the state's imaginary of the offshore.

3.3. Energy transition: offshore renewable electricity generation (1997–2020)

The national imaginary of energy capture offshore evolved markedly in the 2000s. Two significant material conditions – the peaking and decline of oil and gas production (see Figs. 2 and 3), and a growing urgency to address climate change – began to alter the long-standing association of the UKCS with hydrocarbon production. At the same time, concerns over the aging nuclear and thermal power fleets and the country's electricity generating capacity spurred efforts to supplement electricity supply [110]. Consequently, the materialities of the offshore became increasingly appraised for their renewable energy potential and, specifically, as a site for low-carbon electricity generation to augment supply to the national grid and contribute to decarbonising the UK power generation sector. Wind became central to this shifting national imaginary of offshore energy capture, with the shallow depth and high wind speeds on the UKCS offering particular affordances for wind power generation [110–112].

Wind entered the national imaginary of offshore energy capture at a moment of both continuity and change in the state's approach to energy policy. In 1997, Tony Blair's New Labour government came into power, sustaining the Thatcher era commitment to liberalizing the UK economy, though with a renewed appreciation for government intervention in markets [105]. This phase saw the return of state-crafted energy policy papers [105] and of the logic and tools of anticipation (e.g. predictions, deployment potentials) now with the primary purpose of guiding market development (rather than ensuring a share of benefits to the nation as in the early days of oil and gas). Offshore renewables became increasingly understood through metrics of potential and crude geographies of (national) supply. Both highlighted the capacity of offshore renewables to 'solve' the two primary energy policy objectives in this period – ensuring security of energy supply and addressing climate change by decarbonising the power sector onshore [110].

3.3.1. 'Placing' offshore wind on the UKCS

By the turn of the millennium, the potential of renewable energy sources to address national strategic objectives like diversifying electricity supply and mitigating climate change was increasingly recognised. In the UK, the extensive and relatively shallow seas of the UKCS were appraised as having particular affordances for the deployment of renewables at scale, and for wind in particular [111]. Reliable wind speeds, large expanses of limited depth, and relatively short transmission distances provided viable sites for locating wind turbines and associated infrastructures, while the offshore location offered an opportunity to inconspicuously modernise and augment national electricity generating infrastructures. As the Department of Trade and Industry noted in their early strategic framework for offshore wind (2002):

> "the particular advantage of offshore renewables is their potential for greater public acceptability, chiefly because of the likelihood of

[8] There is a longer discussion to be had here about the shift from a proprietorial to non-proprietorial regime on the UKCS in this period (based on Mommer's [106] categorisation, see also Abdo [108]) and how the state's reduced interest in rent in a non-proprietorial regime makes it less concerned with material qualities of the offshore space.

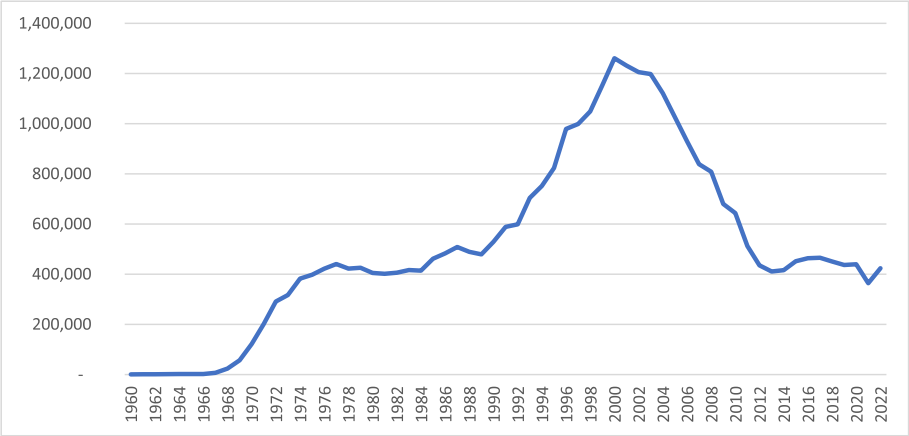

Fig. 3. Natural gas production on UKCS in GWh, 1960–2022. Drawn by lead author from the historical gas data series [130].

lower visual impact. On land, wind farms can have a conspicuous visual impact, leading to planning difficulties. Offshore, the visual impact is likely to be less significant, and the area of potentially suitable seabed much greater than onshore sites. The lower visual impact offshore will mean that it will be possible to build much larger turbines than might be acceptable on land, with capacities of 2 MW and above. This benefit will be further augmented by the higher wind speeds encountered at sea." [111].

While the state considered an array of marine energies including tidal and wave power, wind took frontstage in the evolving imaginary of offshore energy capture, as it was deemed most ripe for industrial development [110,111]. Appraisals of aggregate supply potential helped to bolster a national imaginary of future energy capture from wind, in a similar move to the 'placing' of oil and gas on the UKCS four decades earlier. While offshore hydrocarbons came to be known through measures of volumetric abundance and contained content, a wind-centred imaginary of offshore energy capture centred on the potential of the UKCS to host electricity generation capacity and the scale of future electricity flows. An early estimate, for example, deemed an impressive 919 GW and 3213 TWh/yr [111] – for comparison, the UK's total electricity generating capacity at the time was around 71 GW and electricity production 385 TWh/year [89] – fuelling an imaginary of abundant offshore potential relative to onshore demand. Prospective offshore areas for wind turbine installation were generated by combining different points of data (e.g., on sea depth, distance from shore) within a GIS database to identify and map optimal sites [111]. However, given the need to adapt (and then optimise) fledgling technologies for harnessing and converting flow energy resources (like wind, waves and tides) to the material conditions of the UK offshore, the integration of renewables into a national imaginary of offshore energy capture also incorporated a trope of experimentation and its accompanying patch-like geography of laboratories or proving grounds (cf. [113,133]).

3.3.2. State anticipation and planning for market development

In the early 2000s, the UK's power grid was still dominated by gas (38%) and coal (32%), with nuclear providing 23% of electricity and renewables contributing a mere 3% [110]. Offshore wind was an emerging technology with just 250 MW of global capacity and 4 MW in UK waters, less than 1% of the installed wind capacity onshore [110,131]. Despite growing enthusiasm for offshore wind, material challenges – including technical issues and high costs of deployment around renewables – remained a key concern [110,111]. As the imaginary of offshore energy capture increasingly fused offshore energy with renewable sources (and especially wind) – and positioned the offshore as a key space for accelerating national decarbonisation and (ecologically) modernising the energy system with 'clean' electrons – the state worked to stabilise this imaginary by returning to practices of anticipation. Under Blair's Labour government, the state balanced distinct commitments – to the primacy of economical liberalism in the provision of (offshore) energy and to the responsibility to address the globally significant problem of climate change – by aiming to create a regulatory and planning framework that would attract investment into offshore wind [110]. While this presented a shift from the laissez-faire approach to the North Sea devised under Thatcher, the imaginary nonetheless retained the imprint of a national collective formed around the market (investors, consumers). Through a number of measures, including enacting a Renewables Obligation in 2002 and supporting industry to drive down costs of offshore wind electricity generation, the state aimed "to give investors the certainty they need to commit to renewables investment" [114].

The state proved successful in stabilising the imaginary of offshore energy capture around wind. By 2009, the UK had installed more wind power generating capacity than any other nation and was projected to maintain this position into the next decade [115]. By 2019, continued government support for offshore wind (in contrast with uneven support for onshore wind) and a sharp fall in electricity generating costs from renewables had produced 10 GW of operational offshore wind capacity (see Fig. 4), approximately three-quarters the capacity installed onshore [10,131]. The growing mastery of offshore materialities for wind power generation resulted in the rapid maturity of this renewable technology and, in turn, has allowed the offshore imaginary of energy capture via wind to evolve. The vision of offshore wind modernising and decarbonising the country's energy system has been recently augmented by its representation as symbolic geopolitical capital, reinforcing the country's commitment to climate strategy and energy transition. Where oil became tied in the imaginary of offshore energy capture to a project of national economic recovery, offshore wind has now been positioned as a tool to bolster and sustain the country's claims to geopolitical leadership on the global stage. For example, the right-of-centre Conservative Party touted the UK's position as "the largest offshore wind market in the world" [116,p.57] and its desire to "maintain our position as a global leader in offshore wind" [117,p.22]. More recently a target of 50 GW by 2030 was embedded in the British Energy Security Strategy [12] – implying a threefold increase in offshore generating capacity in under a decade – as offshore materialities have increasingly become valued for their ability to deliver (and publicly demonstrate) the state's decarbonisation goals (see 3.4). Offshore wind is central to the Labour government's Clean Power 2030 plan, described by the UK's National Energy System Operator as "the bedrock" of the future electricity system as it will provide over half of the country's generating capacity [118].

Such growth in capacity, however – and the growing contribution of renewables (and offshore wind in particular) to UK electricity supply –

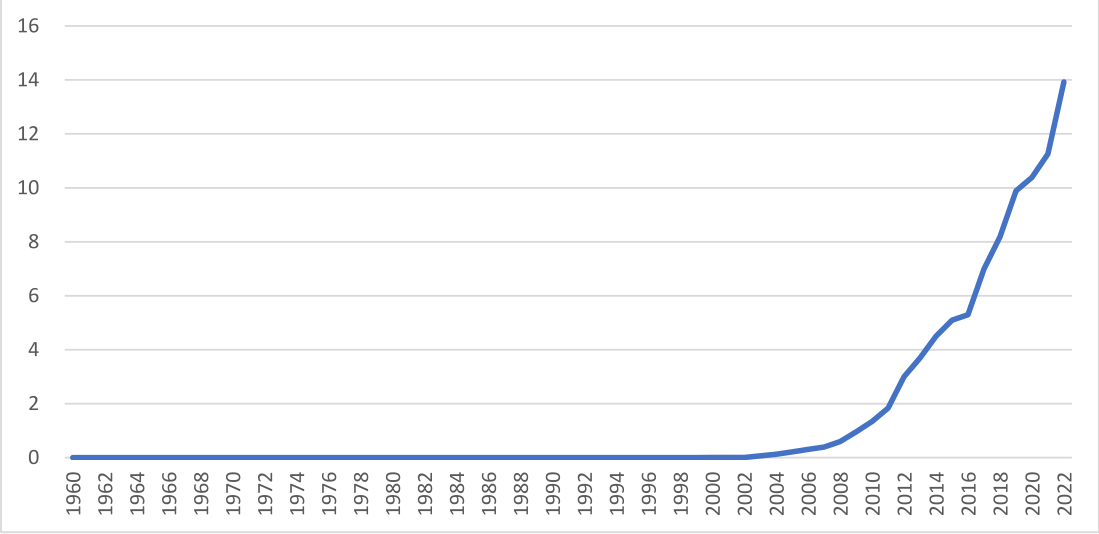

Fig. 4. Installed capacity for offshore wind in GW, 1960–2022. Source: Drawn by lead author from the Digest of UK Energy Statistics (DUKES) 6.2 [131].

has created its own material challenges. The variable and intermittent flow character of the electrical power generated from wind undercut an imaginary of secure supply and national modernisation that had initially buoyed the growth of wind [114]. Offshore wind at scale, then, requires onshore interventions to balance its intermittency, whether from gas fired power plants (which increasingly have been asked to play a flexible role) or – more recently – via battery energy storage [119]. At the same time, the material infrastructures needed to connect growing offshore supply to onshore demand have created social friction around the siting and costs of high voltage transmission lines and substations, significantly troubling an imaginary of 'offshore' energy capture smoothly and invisibly powering the body of the nation [120]. These emergent challenges have been accommodated within the prevailing imaginary through playing up the national quality of offshore supply versus a growing dependence on internationally imported fuels – and, in the process, blurring the distinction between electricity and other energy sources: for example, "The UK has become the world leader in offshore wind and boasts some of the best natural resources for renewable energy in the world. This renewable energy will help safeguard the security of our energy system by reducing our reliance on fossil fuels and the mixture of technologies being developed will enable constant and intermittent technologies to complement each other" [121].

In the first two decades of the new millennium, then, the imaginary of offshore energy capture increasingly fused appraisals of renewable resource potential with a broad economy of anticipation. It centred on a future abundance of renewable electricity generation, and also extended to prospects of a new industrial base linked to energy capture offshore but not tied to the fate of an oil and gas sector whose production was in decline.

3.4. Towards a multi-energy UKCS: the North Sea as a 'net zero basin'? (2020–)

While energy capture remains at the core of the UK's offshore imaginary in relation to the UKCS, its scope has expanded beyond securing a national supply of fuels and electricity, decarbonising the energy system and driving economic growth. Under the energy transition umbrella, a plethora of potentials – oil, gas, wind, hydrogen, carbon capture and storage – are increasingly viewed together, emphasizing synergies over differences and envisioning the UKCS as a multi-energy space central to the national "net zero economy" ([122,p.46]; see Fig. 1). Developments in global climate politics, rooted in the material challenge of mitigating carbon dioxide emissions, have been central to steering this trajectory of the evolving imaginary such as, specifically, the incorporation of a net zero objective into UK climate law in 2019. The *North Sea Transition Deal*, for example, agreed between government and the oil and gas sector in 2021, "enable(s) oil and gas production while facilitating a transformation of the UK Continental Shelf into a net zero basin by 2050" ([9]; see also [10,123]). This novel imaginative device – a 'net zero basin' – crops up in other major energy policy documents alongside allusions to a multi-energy space [10,12]. Although it retains some of the global leadership ambitions associated with offshore wind capacity (see Section 3.3), it is also qualitatively different as the imaginary of offshore energy capture has expanded. It is now more plural in its embrace of different energy technologies and offshore practices; more spatially expansive in the sense that it positions the UKCS as key to *overall* decarbonisation of the nation (not just the power system); and more complex in the materialities around which the imaginary takes shape as it involves flows (of carbon dioxide) *to* the UKCS from onshore as well as *from* the UKCS (fuels, electrons, revenues).

3.4.1. Mastering multiple materialities for net zero

The evolution of the energy capture imaginary around a 'net zero' future incorporates this offshore space into the body of the nation in a more profound way than hitherto, layering several different – and potentially competing – objectives onto the UKCS. Through the prism of 'net zero', the offshore is appraised for an increasing array of materialities of both old and new energy technologies, and buoyed by familiar imaginative techniques, such as aggregate assessments of volumes and scales. The deployment of renewables and low carbon technologies offshore are quantitatively aggregated in ways that project volume and scale, 'placed' on the UKCS in ways that demonstrate uneven distribution, and then embedded in policy as normative targets and trajectories. Prominent examples are a target of 50 GW of offshore wind, 5 GW of floating wind and 10 GW of low carbon hydrogen by 2030 [12]. In addition, the offshore imaginary expands beyond a logic of energy capture and supply to include the capture and storage of carbon dioxide produced elsewhere. In the state's eye, the UKCS is increasingly becoming a space for managing – even cleansing – legacies of carbon emissions in the UK and beyond, widening the range of materialities for which this space is appraised. Estimates that the UKCS has the "potential to store more than 78 billion tonnes of carbon dioxide" [124,p.31] reflect this shift in orientation – capturing carbon emitted elsewhere and then storing it on the UKCS, i.e., appraising and repurposing the materialities of the UKCS for their potential to bring circulation to an end (in the interests of securing a threatened social order) rather than seeking to

initiate circulation to modernise and bring about a new social order. What was once valued for their indications of hydrocarbon potential – old oil and gas wells, saline aquifers – can now be re-appraised, filled anew with carbon content, driving similar forms of speculation around the volumetric quality of the subsurface, its composition, and the flow rates it is capable of sustaining.

What we see here, then, is a gradual conditioning of the imaginary offshore, as it becomes increasingly open-ended and speculative. Multiple potentials are aligned within an adapted imaginary of energy capture by stressing their complementarities and synergies (primarily around skills, infrastructures and investment), held together by a trope of experimentation. The diverse materialities and infrastructures of the UKCS can be trialled and combined in new permutations – prominent examples include combined hydrogen and CCS 'clusters' in the North Sea and Irish Sea, and floating offshore wind. The UKCS becomes both a laboratory for testing novel low carbon technologies and a crucial piece of the state's net zero solution by balancing out remaining emissions from various onshore activities, hence providing the 'net' in net zero. Infrastructural reconfiguration is also a feature of this adapted energy capture imaginary, with the imagined coupling of high carbon and low carbon technologies offshore. Examples include the "electrification of offshore assets" for oil and gas – i.e., wind-powered hydrocarbon extraction – and "the creation of integrated energy hubs" [124,p.26] along with hydrogen production proposals that segue from 'blue' to 'green' production routes over time [125].

In this re-conditioned imaginary of a net-zero basin (which includes the volumetric potential of the UKCS for vast carbon storage), the UKCS serves not only to cleanse the terrestrial body of the nation but also to secure the UK's future as a "world leader" in the technologies, knowledges and skills essential to achieving net zero [124]. This occurs both through the monetisation via trade of skills and technologies honed in the North Sea, and by turning the UKCS into a "facility to import carbon dioxide from overseas" [124,p.31]. In sum, it is *through* the materialities of the UKCS – by, for example trialling novel low carbon energy technologies, building operational capacity in CCUS and hydrogen, and developing and demonstrating skills in decommissioning energy infrastructure – that the UK is imagined to secure its future geoeconomic and geopolitical position [10,12,124,126].[9]

3.4.2. *Maintaining hydrocarbon extraction in a maturing basin*

Hydrocarbon capture remains central to the state's imaginary of a net zero future on the UKCS, alongside (rather than opposed to) the roll out of low carbon energy technologies. The persistence of oil and gas within the net-zero phase of the energy capture imaginary draws, in part, on long-standing characterisations of the North Sea as a 'mature basin.' Maturity here gestures towards material qualities of the basin that make it increasingly difficult to recover large volumes; and, consequently, to the need for state support if remaining hydrocarbons are to be extracted and put to use. This element of the offshore imaginary – residual fossil fuel availability enabling continued extraction into the future – pre-dates net zero, as there is an obligation on the state to maximise the economic recovery of oil and gas from the UKCS embedded in the 1998 Petroleum Act [114,123,127]. Nonetheless, re-centring potential abundance (as the Conservative government sought to do prior to its defeat in 2024) – "7.9 billion barrels of oil reserves and resources remain under our seas, and 560 billion cubic metres of gas" [12,p.14] – is a pre-condition for aligning continued energy capture via hydrocarbons with net zero. Any tension between maturity and potential abundance here is mediated by a notion of economic fragility – the possibility that abundance will not be realised if capital goes elsewhere – so that maximising recovery of oil and gas requires "boosting investment in the North Sea and ensuring it remains competitive as it matures" [114,p.20].

There is a more substantial tension, however, as the material qualities of oil and gas once extracted from the UKCS – as high carbon fossil fuels – directly challenge their continued production and consumption in the context of decarbonisation. State policies aimed at reducing territorial greenhouse gas emissions therefore confront and potentially disrupt an imaginary of energy capture on the UKCS via oil and gas. It is here, however, that the multiple materialities of the UKCS – loosely held together through the imaginative device of a 'net zero basin' – facilitate an expanded energy capture imaginary which sustains rather than extinguishes hydrocarbon extraction. The materialities of gas (and gas infrastructure) loom large in this process of aligning energy capture from fossil fuels with net zero, given gas's role in maintaining norms of social life via the provision of heating and power generation. Gas is envisioned, for example, as "the glue that holds our electricity system together and… an important transition fuel" [12,p.14]. Gas from the UKCS is seen as providing "flexibility" for offshore wind deployment and is appraised as having "a lower carbon footprint well under half that of most imported gas" ([12], p.14; see also [128]). Also looming large are the materialities of the UKCS for carbon capture and storage, and its potential to take and store carbon dioxide in excess of territorial emissions (including those from producing and consuming oil and gas). Furthermore, the skills and supply chains required to harness these materialities position oil and gas extraction within (rather than against) the imaginary of a net zero basin: for example, the net zero basin, will "harness the power of the oil and gas sector and anchor it to the UK for the energy transition" [124,p.6]. More generally, the net zero basin phase of the energy capture imaginary not only multiplies the complex materialities of the UKCS but, significantly, also reduces them to indeterminate potential – a 'standing reserve' of raw matter awaiting investment so it may be configured, combined and assembled in different ways [129]. As the Conservative Government's Energy White Paper [10,p.137] put it: "[e]nsuring that the UK remains an attractive destination for global capital is the best way to secure an orderly and successful transition away from traditional fossil fuels."

4. Conclusion

Our primary goal in this paper has been to apply the concept of sociotechnical imaginaries to the novel setting of energy capture on the UKCS. We find this concept valuable because it allows us to recast the technologies, infrastructures, and strategies of offshore energy capture – which are often considered the domain of energy policy – as important sites through which shared ideas about nationhood, modernisation and the exercise of geopolitical leadership are reproduced. While the potential of this approach will be familiar to STI researchers, its application to the evolution of energy capture on the UK Continental Shelf is an original contribution.

By recourse to the concept of sociotechnical imaginaries, we have shown how an offshore space like the North Sea is more than merely an enduring extractive zone: it has been, at the same time, a significant 'imaginative resource' for constructing national visions of social order and the public good. We have described a national imaginary of offshore energy capture from the UKCS that initially took hold around oil and gas in the 1960s and 1970s. Estimates of hydrocarbon abundance in the early years anticipated future resource development and, as a result, a growing capacity of the UKCS to drive modernization of the nation's energy system (via gas) and national economic recovery (via oil). The potency of this vision was the way it placed large quantities of extractable hydrocarbons within national territory, and its anticipation that rapidly growing volumes of hydrocarbons would be produced from this

[9] For example, "Through the UK's international leadership on climate change action, we will seek new opportunities in overseas markets to export our expertise in subsea engineering, decommissioning and other supply chain capacities" [10,p.144].

space over the coming decade (cf. [72]).[10] This imaginary has subsequently evolved, however, linking the materialities of the UKCS and their potential for energy development to the body of the nation in different ways. We have described this evolution of a national imaginary of energy capture in relation to the offshore via four distinct phases: economic recovery, market society, energy transition, net-zero basin (see Table 1). These shifts do not map in a simple way onto different energy technologies (e.g., from oil to wind): we have shown how a national imaginary of energy capture has evolved in relation to a single energy technology (in relation to oil and wind, for example) and how there are important imaginative commonalities across technological differences, particularly in relation to ideas of modernising the nation, national sufficiency, and the UK's capacity for leadership in a period of post-imperial decline. From the vantage point of the present, we can see how the contemporary sociotechnical imaginary of the UKCS as a multi-energy space retains long-standing ideas about national social order while also mobilising some new ones.

Our account of a national sociotechnical imaginary of offshore energy capture has focused on the interaction of two forces. First, we have focused on the role of the nation-state (collective) in forging and sustaining a national imaginary. Here we have shown how offshore energy development has been situated within national policy goals in a way that will be familiar to STI researchers working in other contexts. The modernisation of British life (economy/society) through energy capture offshore has been a common theme, although the details of this theme have evolved considerably over time. Economic modernisation – via ambitions for national economic recovery through oil, or via modernisation of industry and heating via natural gas – were a central ambition of the early years of offshore hydrocarbon development; while ecological modernisation, via decarbonising the power grid through offshore wind and storing CO_2 offshore, are more recent ambitions. Offshore energy capture has also been imagined to secure national autonomy, with contemporary claims for national energy security via offshore hydrocarbons providing an echo of early ambitions for 'net self-sufficiency' in relation to offshore oil.

Second, we have explored the role of materialities (material qualities, physical abundance, technological forms) in enabling, reshaping or constraining the evolution of a national imaginary of energy capture offshore. We have paid attention to how a sociotechnical imaginary of energy capture takes shape around particular material qualities (of resources, space, infrastructure) offshore, and how these material qualities are a source of (generative) friction in the evolution and sustainability (i.e. duration over time) of this imaginary. Here we have sought to extend and deepen a growing strand of work on sociotechnical imaginaries that recognises the materiality of energy infrastructures and technologies and the role these material qualities play in enabling (or frustrating) the social 'grip' of imaginaries. We have shown in this paper how the material qualities of offshore space are central to an imaginary of energy capture offshore: specifically, we have shown how volume and abundance are central ways in which these spaces become known; how quantification and projection are key tools; and that similar processes unfold across oil/gas, wind and the potential for CCUS on the UKCS. We have also shown how material qualities of the UKCS have challenged an imaginary of energy capture, and how over time these challenges have been stabilised and accommodated within an expanding imaginary.

At the same time, the contemporary UKCS is increasingly understood – by policy makers and others – as a 'multi-energy space', a managerial designation that obscures the contestation and struggle over energy futures and over the relation between offshore and onshore. This offshore space has often been marginal to debates over the direction and trajectory of national social life in the UK. In the context of twin concerns about energy security and climate change, however, it has assumed a more prominent position. Yet reflection on these contemporary concerns reveals how this space has always been connected to national ideas about social order and the 'good life'. We do not think the UKCS is unique in this regard and there is scope for further work on how similar offshore spaces reproduce nations of social order 'onshore'. The concept of sociotechnical imaginaries provides a valuable analytical purchase on the role that ideas about the spaces and forms of energy capture play in national life, as it recasts these as more than technological, managerial or policy decisions. In particular, we have shown how its capacity can be enhanced by bringing it into conversation with work on materialities. Our analytical sensitization to the variety of resources, infrastructures and technologies that have emerged on the UKCS has enabled us to demonstrate how these qualities sustain or disrupt a national imaginary of offshore energy capture.

[10] The Green Paper on Energy Policy [88], for example, anticipated a 10-fold increase in oil production in less than a decade: "North Sea production began in 1975 and amounted to 12 million tonnes in 1976. This year production should reach 40–45 million tonnes, equivalent to nearly half our consumption. (…) The level of production (…) during the early 1980s, is expected to lie within the range 100–150 million tonnes per annum."

CRediT authorship contribution statement

Naima Kraushaar-Friesen: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Gavin Bridge:** Writing – review & editing, Writing – original draft, Supervision, Conceptualization. **Magdalena Kuchler:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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