

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article



Conditions for just offshore wind energy: Addressing the societal challenges of the North Sea wind industry

Tomas Moe Skjølvold ^{a,*}, Sara Heidenreich ^a, Ida Marie Henriksen ^a, Rita Vasconcellos Oliveira ^{b,c}, Dorothy Jane Dankel ^c, Julian Lahuerta ^d, Kristin Linnerud ^{e,f}, Espen Moe ^g, Birgitte Nygaard ^a, Isabel Richter ^h, Jon Birger Skjærseth ⁱ, Ivana Suboticki ^a, Mikaela Vasstrøm ^j

^a Department of Interdisciplinary Studies of Culture, Norwegian University of Science and Technology, Norway

^b Department of Industrial Economics and Technology Management, Norwegian University of Science and Technology, Norway

^c Department of Climate and Environment, SINTEF Ocean, Norway

^d Department of Geography, Norwegian University of Science and Technology, Norway

^e Faculty of Environmental Sciences and Natural Resource Management, Norwegian University of Life Sciences, Norway

^f Faculty of Engineering and Science, Western Norway University of Applied Sciences, Norway

^g Department of Sociology and Political Science, Norwegian University of Science and Technology, Norway

^h Department of Psychology, Norwegian University of Science and Technology, Norway

ⁱ The Fridtjof Nansens Institute, Norway

^j Department of Global Development and Planning, University of Agder, Norway

ARTICLE INFO

Keywords:

Offshore wind power
Public debate
Participation
Land and sea use
Political dynamics
Action research
Co-creation

ABSTRACT

Global investment in offshore wind energy is anticipated to surge in the coming decades. While improved technology, reduced costs, and generous policy support are frequently acknowledged as driving factors, many assert that there are fewer societal challenges with offshore renewable installations than with onshore ones. Drawing from a co-creation process with key Norwegian stakeholders and an interdisciplinary team of social science and humanities scholars, this article delves deeper than the prevalent techno-economic discourse. It seeks to: a) identify the societal challenges of fostering a just and legitimate offshore wind industry; b) explore solutions to these challenges; and c) understand the potential role of transdisciplinary action research in driving change. Through this collaboration, industry actors co-formulated an agenda for offshore wind, highlighting varied issues and concerns. This was operationalized into four primary societal challenges: 1) Navigating the public debate; 2) Improving public participation; 3) Minimizing land and sea use and co-existence conflicts, and 4) Understanding pace, political dynamics, and geopolitics. This paper offers an exhaustive discussion on possible strategies to tackle these issues, presenting a critical companion research agenda to the predominantly technology-focused studies on offshore wind within the sustainability transitions literature.

1. Introduction

Ramping up renewable electricity generation is an important element of sustainability transitions and decarbonizing energy systems

[1,2]. Offshore wind power has become a central technology in the pursuit of these goals, turning from immature niche to large global industry over the last 30 years [3,4]. In Europe, many analysts, policy makers and industry focus on the North Sea, with its large technical and

* Corresponding author.

E-mail addresses: tomas.skjolvold@ntnu.no (T.M. Skjølvold), sara.heidenreich@ntnu.no (S. Heidenreich), ida.marie.henriksen@ntnu.no (I.M. Henriksen), rita.bouman@ntnu.no, rita.bouman@sintef.no (R. Vasconcellos Oliveira), dorothy.dankel@sintef.no (D.J. Dankel), julian.r.lahuerta@ntnu.no (J. Lahuerta), kristin.linnerud@nmbu.no (K. Linnerud), espen.moe@ntnu.no (E. Moe), birgitte.nygaard@ntnu.no (B. Nygaard), isabel.richter@ntnu.no (I. Richter), jbskjaersth@fni.no (J.B. Skjærseth), ivana.suboticki@ntnu.no (I. Suboticki), mikaela.vasstrom@uia.no (M. Vasstrøm).

<https://doi.org/10.1016/j.erss.2023.103334>

Received 22 February 2023; Received in revised form 29 October 2023; Accepted 31 October 2023

Available online 22 November 2023

2214-6296/© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

economic potential for offshore wind [5,6]. Many believe that offshore wind will be less troubled by societal challenges than its onshore counterpart. Visual and acoustic disturbances have been described as few [7], and an abundance of space and few neighbors have been noted as benefits [3]. In the past, similar stories about offshore wind have circulated in the media, where it has been framed as “out of sight” and therefore “out of mind” [8]. Echoing this narrative, analysts combining energy systems scenario modelling with insights on social acceptance have shown how it is likely that low social acceptance for onshore wind could entail that “solar PV and offshore wind power would replace much of the investment in onshore wind” in countries like Denmark and Norway ([9], p. 8).

Rather than repeating a story about favorable societal conditions for offshore wind power, this article reports from a six-month long co-creation process where 19 actors from industry and public sector, alongside a team of interdisciplinary social scientists sought to identify and address the key societal challenges to advancing a just and legitimate offshore wind power development in Norway and the North Sea. The process coincided with important policy developments both in Norway and the EU. First, the opening of two offshore areas, Utsira Nord and Sørliche Nordsjø II, was announced in 2020 with modifications to the aim of installed capacity in the latter area presented in 2021. Project auctions for the areas were launched in March 2023, and together the installed capacity of the two areas is to make up 3 GW. Second, governmental ambitions for North Sea offshore wind were launched in mid-2022 with an aim of 30 GW offshore wind power commissioned by 2040 [10]. These are the first steps of what the former Norwegian minister of petroleum and energy in early 2022 dubbed a “new industrial adventure” [11], and potentially moving towards what some actors envisage as a fully-fledged North Sea electricity power grid, with implications for the energy systems in Norway, the UK, Denmark, as well as the wider European Union [6,12].

Third, the nine countries¹ of the North Seas Energy Cooperation (NSEC) in September 2022 agreed to reach at least 260 GW of offshore wind energy in the North Sea by 2050, with an intermediate target of 76 GW by 2030 [13]. In addition to this come sizeable installations from the UK. In terms of climate abatement, analysts have noted that offshore wind will likely be central for achieving the Norwegian climate policy goal of net-zero by 2050 [14]. More concretely, The European Commission’s Long Term Decarbonisation Strategy requires the expansion of offshore wind by a factor of 20 to reach climate neutrality by 2050. Thus, the ambitions for advancing offshore wind in the North Sea are substantial, and the need to understand the societal implications of the developments is urgent.

Our analysis takes cue from the large body of literature that urges scholars and practitioners to look beyond techno-economic factors when assessing the potential and feasibility for renewable energy production [15–17]. We mobilize a socio-technical perspective, which emphasizes how technologies co-evolve with changes in material, organizational, institutional, political, economic, and socio-cultural elements of society [18], through processes that are interpretative and conflictual in character [19]. Further, such work notes that developing energy systems can have unintended consequences, such as re-producing or even increasing existing social and economic inequalities and power asymmetries [20], or creating new forms of exclusion. Hence, dealing with issues related to legitimacy and justice, e.g., through addressing distributional, procedural and recognitional aspects of transitions [46] is central to achieving a development that is favorable for both industry and broader society [21].

We are inspired by process and action-oriented scholarship that emphasizes the potentially generative role of transdisciplinary research

in facilitating processes of reflection and change [22,23]. Building on such action-oriented research, our analytical ambition is accompanied by a normative ambition: through organizing and enabling co-creation processes where actors in industry and public sector work together with researchers to make new knowledge and principles, we seek to have an impact on how the actors that drive wind power development reflect on and engage with society. Three questions have guided our work:

- How do actors in and around the offshore wind industry interpret and operationalize societal challenges to advancing just and legitimate offshore wind power in the North Sea?
- How can these societal challenges be addressed by actors in the field to motivate a just offshore wind power development?
- How can transdisciplinary action research strategically be mobilized to motivate new types of conversations about transitions?

2. Knowledge status

Sustainability transitions research anchored in perspectives such as the multi-level perspective (MLP), strategic niche management (SNM), transition management (TM) and technological innovation systems (TIS) has emerged as a central body of literature for analyzing socio-technical change and informing policy [18]. At its core, the field has been interested in the inertia of dominant socio-technical regimes, and the challenges of replacing such regimes with more sustainable ones. There has been a strong focus on technological innovation journeys, and the conditions that enable or disable them. A relevant example of this is the analysis of the cumbersome introduction of wind power to electricity systems based on fossil fuels [24].

This technology-centric perspective carries over to offshore wind research, where previous studies have centered around innovation dynamics, market creation and value capture, and policy mixes that support or hinder industrial formation. Wieczorek et al. [25] use the TIS framework, highlighting that a lack of engineers, fragmented policies, technology costs and a lack of grid infrastructure are key challenges. Focusing on floating offshore wind, Bento and Fontes [26] study strategies for upscaling which involve changes across technological innovation systems. These include technology standardization, strengthening actor-networks and improving public acceptance, convincing governments to take a lead role and exploring synergies with adjacent industries. Kern et al. [27] examine how institutional arrangements may empower niche innovation, noting that for offshore wind, large and powerful actors that can work as system builders are important.

Such systemic perspectives on innovation have also been seen in comparative studies [3], where differences in political interest, sectoral configuration, as well as interaction with other innovation systems and geography have been deemed central. In situations where firms lack a domestic market, research indicates that large incumbent actors might manage, while smaller newcomers may struggle [28–30]. Other studies explore opportunities for value capture through the establishment of supply chains and knowledge networks [31], as well as the mobilization and redirection of incumbent resources [32–35]. Another group of studies has investigated policies and policy mixes [36–39], noting that policy developments and innovation systems tend to evolve in tandem, with different phases of innovation system development depending on different types of policies. MacKinnon et al. [40] highlight how legitimation narratives generate political support, and Normann [41] explores how political conditions such as conflicting government interests and changes of political actors impacted offshore wind development.

¹ Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway, Sweden and the European Commission are the current members of the NSEC. The UK has withdrawn [13].

Recently, sustainability transitions researchers have emphasized that as transitions accelerate, new dynamics and challenges emerge. Sectors and technologies begin affecting each other and interacting in new ways [42,43]. Further, dominant institutions begin to erode, the performance of dominant sectors is affected, new industries are formed, and new types of innovation emerge [44]. Formulated differently, it becomes clear that the introduction of new technologies has consequences beyond immediate value chains and socio-technical systems: it fundamentally changes the fabric of society and vice versa. The entanglement of technology with socio-economic structures and cultural practices has increased the focus on justice implications for transitions [45] and a need to focus on the politics, power dynamics, and political economy of energy transitions [46]. The growing field of energy justice [47] emphasizes that technical transitions often have unintended and unjust consequences that become apparent when scrutinizing the processes of implementing transitions, the actors and interests that are recognized as legitimate participants in such processes, or how the burdens and benefits from the developments are distributed. Such literature thus re-frames the challenge of socio-technical transitions, noting that technology implementation needs to be done through processes that ensure legitimacy and benefits across society.

While the techno-centric transitions literature has become accompanied with justice scholarship, scholars have highlighted that these literatures seldom intersect, and that there is a need for thinking across the two [20,48]. Our research starts from an interest in offshore wind technology and industry development. Given the magnitude of developments envisaged in the North Sea, however, we strongly believe that it is central to probe an eventual offshore wind roll-out as a societal intervention, and that the involved actors should work actively to mitigate any noxious consequences of the developments, and to make projects that seek a wind power development that is just and legitimate amongst a multitude of stakeholders. Throughout the remainder of this paper, we will engage with literature in this direction, to better understand how wind power can fit in a just transition.

3. Method

Our work responds to calls in the literature to conduct energy social science that has a stronger impact on transitions [49,50], and engages in transdisciplinary work, i.e., collaborations between academics and non-academics [51]. Köhler et al. [45] note a tension between engaged and distanced analysis in sustainability transitions research. On this spectrum we position ourselves on the engaged side. Our work is inspired by sustainability transitions research through concepts such as multi-stakeholder engagement spaces [52], and the notion of transition arenas as developed within the literature on transition management [53,54]. Such concepts have been put forward with the ambition not only to analyze unfolding transitions, but also to co-create knowledge for action, making sense of contemporary transition dynamics, instigating social learning as well as building trust and social capital amongst actors in the field.

We have also been inspired by scholars that emphasize the problems of developing transition strategies based solely on techno-economic insights [15,55,56], and scholars who critique the dominance of techno-economic competence in energy policy and industry circles [57–59]. Norway is a case in point, having been dominated by what some have called a “global cost-efficiency discourse”, which allows the country to promote economically efficient climate mitigation internationally, rendering many domestic forms of mitigation economically inefficient

[60]. From this, we have built a normative ambition of establishing what we can call an extended peer community [61], with the purpose of expanding the types of conversations and reflections that are had amongst actors involved in offshore wind development. Hence, our work can be understood as a form of socially oriented epistemic intervention, intended to trigger new conversations and new concerns within this domain. We have no illusions that this will translate into immediate practice change in the industry. As social scientists, however, we believe that it matters how key actors frame and describe the world. Further, we believe that the types of knowledge mobilized to describe and frame the world matters. Hence, expanding on the ways that industry actors, the public sector and NGOs understand the world, should be a worthwhile endeavor, especially as the Norwegian energy industry has been described as epistemically conservative and strongly rooted in techno-economic thinking [57].

Norström and colleagues [23] developed a set of principles to guide co-creation work in transdisciplinary contexts. Adapted to our field of enquiry, we have adopted these principles. Our work has been:

- *Context based*, by engaging offshore wind actors in the Norwegian context.
- *Pluralistic*, by engaging academics from a broad variety of disciplines, as well as actors from different societal domains.
- *Goal oriented*, by actively working to produce strategies of engagement and change.
- *Interactive*, by facilitating frequent interaction between participants throughout the process.

Our transdisciplinary co-creation process consisted of five workshops between early February and late June 2022. These workshops involved a set of 19 actors from industries related to offshore wind and from the public sector with stakes in North Sea offshore wind development. Further, social science researchers representing the following nine disciplines participated: Applied Ethics, Economics, Environmental Planning, Geography, Marine Resource Management, Political Science, Psychology, Science and Technology Studies, and Social Anthropology. In total, 50 individuals (31 women and 19 men) were involved in the process. While not all participants were present in each workshop, a core group representing all three participating groups of actors (industry, public sector and research), remained stable throughout the process, which is vital to facilitate new forms of learning, building trust, and establishing a shared culture of work within the process (see Table 1). The workshops were collaboratively hosted by two research centers: The Norwegian center for energy transition strategies (NTRANS) focusing primarily on socio-technical aspects of offshore wind, and FME North-Wind, focusing on technological aspects of offshore wind power development. The participants involved were primarily recruited from partners associated with these centers, with some additions to ensure broader diversity of both scholarly voices and societal perspectives. While the actors represent a diverse range of interests in and perspectives on offshore wind development, we recognize the absence of e.g., civil society actors, such as environmental NGOs as well as participation from local communities, as limitations of our study. However, both the participants from industry and public sector and actors such as the Norwegian Fishermen’s Association contributed with critical perspectives to the discussions. Moreover, several scholars involved voiced community and citizen perspectives. That said, the lack of direct citizen participation is a weakness of our study.

The first of the five co-creation workshops had an explorative character aiming to identify the main societal challenges of offshore

Table 1
Actors from industry and governance involved in the co-creation process.

Actor	Description	Workshop attendance
Aker offshore wind	An offshore wind developer	Workshops 1, 2, 3, 4, 5
Energi Norge	A non-profit industry organization representing 300 companies involved in producing, distributing, and trading electricity	Workshops 1, 2, 3, 4, 5
ENOVA SF	A state-owned enterprise under the ministry of Climate and environment. Its goal is to reduce greenhouse gas emissions, strengthen security of energy supply, and contribute to technology development.	Workshops 1, 4, 5
Equinor	A state-owned multinational energy company. Has historically been a petroleum company, but is increasingly investing in renewable energy.	Workshops 1, 2, 3, 4, 5
Eviny	An electricity production company in western Norway	Workshops 1, 2, 4, 5
Fred. Olsen & Co.	Traditionally a shipping company, now involved in renewable energy development through transport- and installation vessels for offshore wind turbines and a portfolio of wind farm projects.	Workshops 1, 2
The Norwegian Fishermen's Association	The Norwegian Fishermen's Association is the professional fishermen's union and business organization.	Workshop 4
Norsk Hydro	A large industrial actor, primarily producing aluminum and aluminum products. Large consumer of electricity.	Workshops 1, 3, 4, 5
Proneo	Business consultancy firm focusing on sustainability.	Workshops 1, 2
Saga Fjordbase	An industrial park and logistics supplier focusing on offshore operations.	Workshop 1
Sogn og Fjordane Energi	A regional integrated entity who produces and distributes power the western region of Norway.	Workshops 1, 2, 3
Statkraft	A power company, fully owned by the Norwegian state. Primarily owns and invests in renewable energy projects in Norway and globally.	Workshops 1, 2, 3, 4, 5
Trøndelag county	The county administration for the central region of Norway.	Workshops 1, 4, 5
Trønderenergi	A regional power production company in the central region of Norway.	Workshops 1, 2, 4, 5
The Norwegian Coastal Administration	A transport agency under the Ministry of Trade, Industry and Fisheries. They seek to ensure safe and efficient traffic in fairways and into ports, and a national preparedness against acute pollution.	Workshops 1, 2, 3
The Norwegian Environment Agency	A government agency under the Ministry of Climate and Environment who implement and give advice on the development of climate and environmental policy.	Workshops 1, 2, 3
The Norwegian Water Resources and Energy Directorate	The Norwegian Water Resources and Energy Directorate (NVE) is a directorate under the Ministry of Petroleum and Energy.	Workshops 1, 2
Offshore Norge	A professional body and employer's association for oil, gas, and supplier companies.	Workshop 1
Vestland County	The county administration for the western region of Norway.	Workshops 1, 2, 3, 4, 5

wind, while the other workshops addressed each of the four specific challenges established during the first workshop in detail. All workshops were guided by the principles of “world café” as a participatory method to facilitate *dialogue and mutual learning* [62] and create collaborative discussion on real life questions [63]. World cafés are structured group conversations in smaller groups that aim for the feeling of a café that is represented as a neutral space for informal conversations and uncensored political debates [64]. In our co-creation process, we used a *digital world café* method. We used the digital collaborative tool Miro together with Microsoft Teams. Workshops were structured through a combination of plenary and breakout sessions, with each workshop having a minimum of two break-out sessions where 3–5 groups engaged in structured discussions. The breakout-sessions in many ways resembled focus-group discussions, and throughout the workshops, roughly 40 such discussions of around 1 h were conducted. A typical workshop would start with a plenary session with brief presentations by researchers, industry or government representatives introducing the topic. During the first breakout session, participants engaged in a structured and moderated discussion about challenges related to the topic and documented their discussion in the Miro tool. The breakout discussions were then briefly summarized in plenum followed by (an)other presentation(s) that pointed towards possible solutions to the challenges. In a second breakout session, participants were then asked to develop a description of an ideal situation and develop concrete recommendations for working towards such an ideal. The workshops ended with brief summaries of the second breakout sessions.

All breakout rooms had one researcher as the café host who facilitated the discussion, ensured that all voices were heard, and made sure it was documented in Miro [65]. Hence, each workshop resulted in rich written data material co-created by researchers, industry, and public sector representatives. In addition, the industry and public sector participants were invited to provide brief written accounts before the workshops which highlighted their interest in, and experience with, the topic to be discussed. The researchers were asked to provide reflection notes after the workshops. The inputs written before, during and after the workshops were then thematically coded and categorized according to 1) descriptions of (aspects of) the identified challenge, 2) descriptions of an ideal situation, and 3) recommendations. Based on this analysis as well as insights from bi-lateral meetings with stakeholders, a policy brief was written following each workshop [66–70]. Fig. 1 illustrates the co-creation research process.

This paper expands on the policy briefs through involving an interdisciplinary team of authors representing expertise on all four societal challenges and engaging with academic literature on the topic at hand. Hence, both the descriptions of the societal challenges and the recommendations have been refined in the writing process compared to how they have been presented in the policy briefs. Thus, for social science scholars who have been following the academic debates about the relationship between renewable energy development and broader society, parts of the narratives presented in this paper will be familiar. The result is a broad-canvas presentation of an agenda for addressing such concerns through research and practice, co-created with key stakeholders, rather than a deep dive into the specifics of resolving

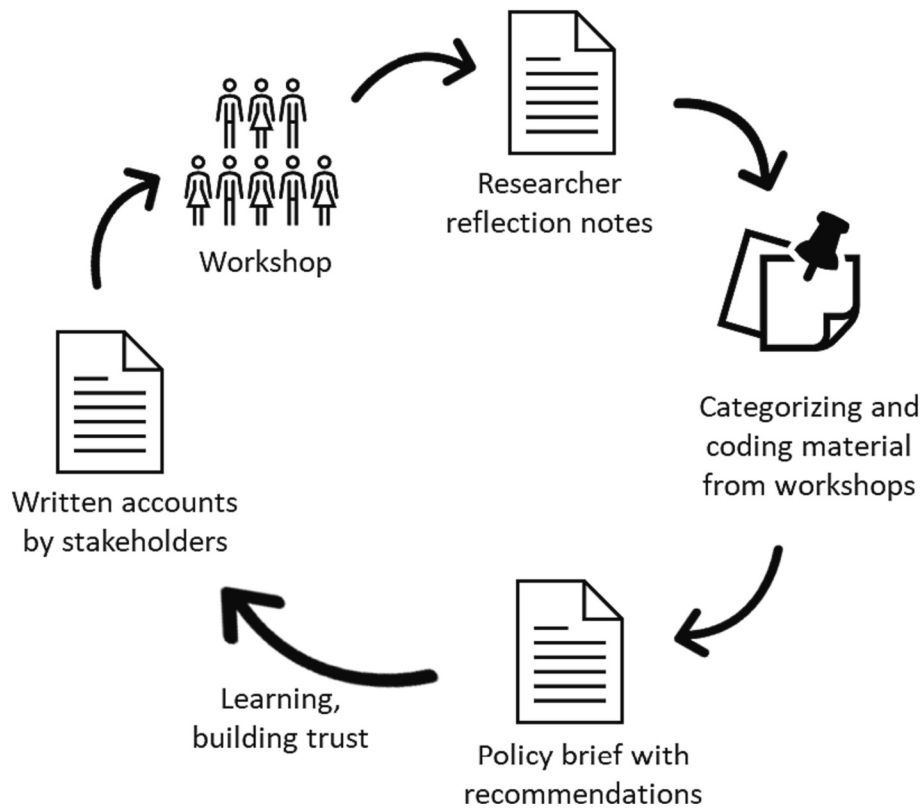


Fig. 1. The co-creation research process for identifying and addressing societal challenges for offshore wind.

each issue.

4. Results and discussion: four societal challenges for offshore wind

Through the co-creation process, we identified what the actors involved perceived as key societal challenges for offshore wind: a) Navigating the public debate, b) Improving public participation, c) Minimizing land and sea use and co-existence conflicts, and d) Understanding pace, political dynamics, and geopolitics. Over the next sections, we will provide a discussion on each topic structured in the following way. We begin with a brief social-scientific framing of the relevance of the topic. We then proceed to discuss the challenges at hand, and an ideal situation, as established through discussions between stakeholders and scholars. Finally, we provide a set of recommendations for addressing the topic. Table 2 briefly summarizes the key results from our process, before each challenge is discussed in subsequent sections.

4.1. Navigating the public debate about offshore wind

Social scientists note that the development and deployment of new energy technologies can be affected by how these technologies are debated publicly [16,71,72]. The character of such debates, whether they unfold in traditional or social media, has been highlighted as important for advancing or impeding the social acceptance of wind power [73,74]. For on- and offshore wind power, media framings have been shown to highlight the technology as both cause, victim and solution [75]. Within the field of sustainability transitions research, the role of public debate and the media is arguably under-theorized, but for many scholars the production of shared visions and shared understandings of reality lies at the heart of accelerating transitions [52,76]. Over the last years, however, public debates about energy technology have often become polarized [77,78], perhaps in part because shared cultural common ground has decreased in contemporary

societies [48,79]. In Norway, several lines of contestation have been noted. Hansen and Moe [80], e.g., argue that the public debate on Norwegian energy policy is divided between actors who support cost-effective expansion of renewable energy amongst other things for export and actors who represent a form of resource nationalism arguing for Norwegian energy sovereignty and hence opposing the development of renewable energy for export. There are also strong controversies between traditional nature conservation perspectives and climate arguments for energy transitions [81]. There is also a justice dimension to these discussions, circling around the role of workers in Norwegian oil and gas, and whether these workers can be mobilized in a new offshore wind industry [82].

The actors involved in our co-creation process pointed to the state of current public debates about renewables and offshore wind, as well as understanding how to navigate that debate, as a key challenge for advancing offshore wind. This should not be interpreted as opposition to public debate as a cornerstone of democratic society, but rather reflects sentiments in the group that both proponents and opponents did not always adhere to what was perceived as virtues such as honesty and openness. Many interpreted the public debate as fueled by emotions and a lack of knowledge. Hence, they echoed long standing critical research that identifies such interpretations of the public on behalf of industry and expertise [83–85]. Moreover, several actors interpreted the public debate as a proxy debate, where the arguments for or against offshore wind power were seen to stand in for broader positions on how integrated Norway should be with the European Union. The debate over EU-integration has been long-standing in Norway, indeed recently becoming more strongly linked to energy and climate policy debates, as Norwegian and European energy markets have become increasingly integrated [80,86]. For offshore wind power, these tensions often arise in discussions about where the electricity should be brought to shore and used. Should it be brought to shore in Norway, the EU or both? Further, several actors were very concerned that the debate over offshore wind would become “infected” with arguments from debates over onshore

Table 2

A summary of the four societal challenges discussed in this paper.

Challenge	Relevance	Challenge	Ideal	Recommendations
Navigating the public debate	The public debate might impact development, deployment, and acceptance of offshore wind power	Debate interpreted as emotional, lacking knowledge and as contaminated by debates about EU affiliation and onshore wind power.	A concrete, knowledge-based and inclusive debate.	<ul style="list-style-type: none"> • Build concrete and truthful narratives • Address values, norms, feelings, and facts • Be guided by principles of energy justice
Improving public participation	Participation can affect acceptance and be integral to innovation. Might affect the speed and legitimacy of transitions.	Finding the right time to do participatory processes. Ensuring that such processes affect outcomes. Identifying the relevant interests and stakeholders.	A process that considers sustainability broadly and impacts results. It is built on diverse knowledge and competence on participation. Starts early and is a continuous process. Is transparent and inclusive	<ul style="list-style-type: none"> • Make a strategy for participation • Institutionalize work on participation. • Include non-industry and marginal voices • Recognize opinions as legitimate • Develop metrics to assess participation and make these part of project evaluations
Minimizing land and sea use and co-existence conflicts	Land and sea-use conflicts can affect the deployment of offshore wind. Using the land and sea in good ways may enable the co-existence of interests and synergistic innovation.	Hard to identify future interests. Co-existence may hide dilemmas, e.g., environmental sustainability vs. industry interests. Onshore land use not part of current discussions. Lack of integrated knowledge.	Based on new form of marine spatial planning. Based on holistic assessment of marine space and affected interests. Based on inclusive and effective forms of participation.	<ul style="list-style-type: none"> • Develop interdisciplinary and cross-sectoral marine spatial planning • Harmonize rules and institutional frameworks across sectors • Build and activate new networks to identify potential conflicts and synergies
Understanding pace, political dynamics, and geopolitics	Policy mixes affect transitions. Politics and power struggles affect policies. Geopolitics might affect offshore wind.	Fragmented policies anchored in sector specific interests. Vague policy mechanisms and unclear processes. Lack of knowledge. Nationalist narratives hampering international collaboration	Stable, concrete policy mix anchored in cross-sectoral interests. Legitimation of international collaboration through political narratives. Politics is built on holistic knowledge production.	<ul style="list-style-type: none"> • Increase offshore wind R&D • Create strategy to become pioneers in translating theoretical insights on legitimacy/acceptance into practical politics.

wind, the strongest energy controversy in Norway during the last decade [87,88]. The protests against onshore wind have been fueled by concerns for nature conservation, indigenous rights, what has been understood as illegitimate processes of siting, arguments over the importance of local and national ownership as well as concerns for a lack of local value creation from the projects [81,89].

From identifying these perceived challenges, the co-creation process resulted in the production of three ideal characteristics of a good public debate:

- A concrete debate: Debating concrete projects, policies and plans was highlighted as enabling the engagement of legitimate interests around topics such as the preservation of nature and local participation and disabling what was interpreted as the illegitimate hijacking of the debate by other interests. Hence, a good public debate was seen to address and engage what some scholars have described as ‘publics in particular’ rather than ‘publics in general’ [90].
- A knowledge-based debate: The group reached an agreement about appraising a public debate based on different types of knowledge. This includes the knowledge of actors that might be negatively affected by offshore wind power, as well as different types of disciplinary knowledge (e.g., technical-, environmental-, social science). Being knowledge-based in this context also means acknowledging uncertainties and the implicit assumptions of different arguments, including those made by offshore wind power proponents. In sum, a good public debate embraces principles of epistemic justice [91].
- An open and inclusive debate: The group acknowledged the importance of a public debate that raised different perspectives, and where arguments were tried against each other. This would entail striving for a respectful tone in the debate.

While these ideal traits might seem unsurprising, they comprise a radical step away from the tendency amongst many involved actors to

primarily communicate offshore wind as a win-win oriented “industrial adventure” [92]. As steps to work towards such an ideal, the group agreed on the following recommendations:

- 1) Wind power project developers should build concrete and truthful narratives about offshore wind projects. This might sound trivial, but standard narratives about industrial adventures and win-win-win opportunities suggest that this might indeed be a challenge for profit seeking companies. Such narratives could e.g., address how offshore wind contributes to national and regional development, security of energy supply and decarbonization, but should also include potential negative consequences e.g., with respect to biodiversity, the use of land, and consequences for the electricity grid. Exaggerated optimism should be avoided.
- 2) Communicators working within both the industry and different levels of public authorities should be aware that what they perceive as ‘facts’ will not always persuade others. Recognizing and addressing values, norms, and feelings as legitimate and important aspects of public debate rather than as a problem to be overcome might improve the climate of debate.
- 3) Principles of energy justice [47] can both explain elements of current public debates and should guide how offshore wind power developers and authorities engage publicly. This entails acknowledging and engaging a broad set of actors in the debate, publicly discussing not only the technology, but also the shaping of regulations and procedures relevant to offshore wind. An example of this would be publicly debating the terms and principles that will apply for the envisaged concession process for offshore wind in 2025.

4.2. Improving public participation and the involvement of diverse interests and actors in offshore wind developments

The literature on participation in energy transitions is vast [93,94]. From an instrumental perspective, good participatory processes, and the

inclusion of citizens e.g., as economic participants in renewable energy projects, can increase the societal acceptance of such projects [95,96], e.g., through facilitating a feeling of responsibility and ownership [97,98] and through bringing forward important local critique [99], being supportive of distributive and recognitional justice [100]. Transparent and just processes have been deemed as central to successful offshore wind siting [101], highlighting the merits of procedural justice [100]. This, however, is contingent on processes that explicitly consider and integrate the principles of human cognitive and affective mechanisms, to avoid adverse effects of intergroup aversiveness and biases [102]. Research on the Norwegian publics' preferences concerning wind power ownership points in a similar direction, as local or national ownership strengthens the acceptance of offshore wind [103].

Participation, however, can also challenge energy transitions, especially in situations where publics lack influence on the outcomes of participatory processes [104]. Much literature on participation in transitions is part of a conceptual shift, where policy and research have moved from trying to understand how to promote social acceptance of ready-made solutions, to wanting to understand how citizens and relevant interest groups can become active resources in shaping innovation and implementation [105]. Notably, scholars have argued for the need to connect participation to energy justice [47], viewing procedural-, distributional- and recognition-based justice as key to good participatory processes [106]. This means that participatory processes need to consider 1) who is affected by the outcomes of offshore wind developments, 2) who is represented and who is excluded in participatory processes (as well as the associated challenge of identifying and giving voice to silent publics, see [107]), and 3) if processes and decision making are conducted fairly. Given this need for well-designed and inclusive participation processes, scholarship has also discussed the tensions between fostering transitions that are both inclusive and rapid [108]. Key Norwegian policy documents currently make this justice-oriented tension explicit by highlighting that over the coming years, rapid technology deployment is the main energy policy objective.²

When discussing challenges with current participatory practices in renewable energy development, the involved actors in our co-creation process noted two key and related issues: the timing of participatory processes, and the challenge of designing processes that really impact offshore wind projects. Many actors feared that participation would be organized too late in the decision-making process and with little impact. They expected that siting and licensing for offshore wind in the North Sea would be determined through auction processes which would establish most framework conditions for offshore wind developments without explicit demands for upfront participatory processes. This would result in participatory processes with low impact and consequently low legitimacy and low acceptance. This discussion further hints at the challenge of who should be responsible for participatory processes. The co-creation process did not reach a conclusion on this point, but rather noted that strong criteria for evaluating such processes should be implemented and institutionalized. This suggests that if industry is to be responsible, there should be ways of ensuring accountability for the process, but also points towards the merit of responsibility on behalf of authorities.

The fears for poor processes were partly based on the actors' previous experiences where participation was conducted in a hurry, resulting in poor and controversial decisions without support amongst key actors. Here, a central justice concern in Norway has been the procedural failure of creating legitimacy for key decisions amongst the indigenous Sami population [109]. However, there were also actors with other types of experiences, especially with respect to onshore wind. Namely,

processes that had been conducted early and were able to secure legitimacy and local anchoring, were met with challenges when ten years could pass before construction started. In the years after the participation processes, local politicians would often have been replaced, the technology had developed, the local memory of the participatory process had faded, and the projects built looked very different from those originally envisaged. Further, many pointed to a lack of systematic knowledge both about social and environmental impacts of offshore wind, making it difficult to know which actors should be involved in participatory processes.

Based on the discussions between the researchers and the practitioners, the co-creation process resulted in the following principles describing good participatory processes for offshore wind. Good participatory processes:

- Consider how social and environmental sustainability can be ensured by striving for cooperation between and future co-existence of offshore wind, industry actors, and local communities.
- Are built on diverse forms of knowledge (technical, environmental, social), and mobilize specialized competence in participatory processes.
- Start early and are continuous throughout the lifetime of a project.
- Are transparent and inclusive. This means openness about what can be influenced, who has participated, how decisions have been made, and efforts to include marginalized voices.

Through the co-creation process, these principles were operationalized in the following recommendations:

- 1) National authorities who grant concessions for offshore wind power project permits need to ensure that solid participatory processes are undertaken. This can be done through conducting the process themselves, giving responsibility to a third party or local governments, or by ensuring that industry led processes are evaluated based on clear criteria. The latter would entail developing metrics and benchmarks to assess the quality of participatory processes, as well as mechanisms of accountability and sanctions with consequences for poor processes.
- 2) If the offshore wind project developers continue to be responsible for such processes, they should make strategies for transparent participatory processes that ensure an impact on decision making regarding the proposed project. The strategy should contain:
 - A description of why a participatory process is needed, including an assessment of which parts of the project require participation and which matters of the process can be influenced.
 - A mapping of relevant actors based on an assessment of which groups are expected to have advantages and disadvantages from the project, as well as marginalized voices not represented in the public debate.
 - A choice of inclusive methods to engage the relevant groups.
- 3) Offshore wind actors should institutionalize work on participation by having responsible personnel in-house and well-integrated routines.
- 4) Actors who grant project permits need to ensure that projects are evaluated on more than techno-economic criteria. This entails developing metrics and benchmarks to assess the quality of participatory processes.

4.3. Minimizing land and sea use and co-existence conflicts

Conflicts over the use of land are one of the most frequent challenges for renewable energy [87,110,111]. On the one hand, renewable energy projects commonly become entangled in discussions about nature where climate abatement goals and biodiversity goals can be conflicting [112]. On the other hand, countless studies explore tensions between using land for renewable energy generation, and existing interests such as the military [113], farming [114], tourism [115], and indigenous land use

² This can be exemplified by a key policy document recently published by the energy commission, entitled *More of everything — faster* (<https://www.regjeringen.no/contentassets/5f15fcccac3143d1bf9cade7da6afe6e/no/pdfs/nou202320230003000dddpdfs.pdf>, accessed 04.09.2023).

[116]. To this we can also add studies about how place is valued, and how renewable energy production can affect the qualities of place, hence resulting in conflict with communities at various scales [117]. Conflicted feelings can also emerge in individuals. Such dynamics of conflict have also been observed offshore, and in communities that are affected by offshore developments [118], leading scholars to conclude that “deployment of offshore wind energy still needs to account for societal and ecological factors” [119]. In many discussions about offshore wind, the concept of co-existence is mobilized to resolve such challenges, signaling an ambition of developing offshore wind parks that allow e.g., for continued fishing in the area [120,121]. Other discussions point to the potential land and sea use synergies, e.g., involved in using offshore wind energy developments to establish offshore energy hubs with a variety of intended uses [122], or in potentially improving certain forms of fishing [121].

While the actors involved in the co-creation process all noted that co-existence was important, many felt that it was currently too narrowly conceptualized, because it primarily signals co-existence between fishing and offshore wind. Echoing past research [123], many actors noted that the North Sea is an emerging space of future interests associated with the blue economy. There are strong visions for nascent industries such as carbon capture and storage (CCS), hydrogen production and transport, deep sea mining, and offshore aquaculture. If identified early, the actors noted that co-existence with such industries could cater for innovation, but as competing interests they might also impede developments. One form of co-existence that many Norwegian actors highlight, entails the use of offshore wind to electrify North Sea oil and gas installations. This points towards some key paradoxes in the Norwegian energy transition [82], where the use of renewables might feed into the extension of the fossil fuel era. In Norway, this form of co-existence feeds into a particular form of justice debate, where the potential loss of jobs and revenue from the fossil fuel industry is a major concern.

Others noted that the concept of co-existence was naïve, and that it concealed dilemmas and tradeoffs e.g., by downplaying the environmental challenges posed by offshore wind. Importantly, many noted that co-existence tended to point towards the co-existence of different industries, but that co-existence with nature was disregarded. Further, co-existence was typically discussed from the point of view of offshore wind, which means that other interests become responsible for finding a good practice of co-existence. Could this be turned around, e.g., by asking fishing interests about good sites for wind power? Moreover, some actors noted that the development of offshore wind in the North Sea would require significant *onshore* infrastructure and development, suggesting that onshore land conflicts resulting from offshore developments might become significant. Following the co-creation process, such conflicts have recently materialized in the south of Norway, where one of the biggest political battles in the town of Mandal leading up to the local elections of 2023 has circled around the development of an industrial port area onshore, intended to cater for the future needs of offshore wind actors. The battles over this land area intersect with classical energy justice concerns: procedures of decision making have been strongly critiqued, while opponents fear an unjust distribution of burdens and benefits, including natural destruction, displacement of citizens and few local economic benefits.³ How these processes will play out remains to be seen, but it illustrates that the development of an offshore wind industry has land-based social consequences.

Throughout the themes discussed over the last three paragraphs, a

³ This has been extensively reported on in the media, e.g. in the story “Voted yes for controversial offshore wind port” (<https://www.nrk.no/sorlandet/sa-ja-til-omstridt-havvind-havn-1.16447292>, accessed 04.09.2023) and “Mandal residents about offshore wind port: absolutly crazy!” (<https://www.nrk.no/sorlandet/mandalitter-strides-om-vindkrafthavn-1.16402939>, accessed 04.09.2023)”.

recurring theme was related to a frustration with what many actors understood as the dominance of a sector and interest-oriented knowledge production and governance. It was noted how there was a lack of an interface between expertise on land- and sea governance, how energy- and industry developments were largely governed by different political institutions, as well as how issues of environment, energy, fisheries, transport etc., were often treated as compartmentalized forms of governance. As a contrast, many argued that there was a strong need to connect these and create a more overarching mode of governance.

The co-creation process resulted in the following characterizations of ideal land and sea-use processes for offshore wind in the North Sea. Such processes are:

- Based on a new form of marine spatial planning that a) integrates environmental, social, and economic assessments in a credible way, and b) captures the diverse and cross-sectoral current and future interests that will be affected by North Sea offshore wind developments.
- Based on a holistic assessment of the marine space, ideals of efficient land use, and an understanding of the sum of effects that this space will see from offshore wind developments, rather than a project-by-project approach.
- Based on the types of inclusive and effective processes of participation described in Section 4.2. of this paper.

Through the co-creation process, these principles were operationalized in the following recommendations:

- 1) The authorities should begin developing a new form of marine spatial planning based on environmental, social, and economic insights. The Ministry of Climate and Environment should play a key role here, alongside the Ministry of Petroleum and Energy and the Norwegian Environment Agency due to the organizations’ complementary mandates and areas of work. The involvement could be extended to other institutions including research and sectorial ones as they could provide valuable information on the most relevant environmental, social, and economic factors to be considered for the elaboration of an integrated marine spatial planning.
- 2) The authorities should harmonize rules and institutional frameworks across sectors with interests in the North Sea. The close collaboration of authorities mentioned under recommendation 1 would be key to facilitate this. The work put on elaborating an integrated marine spatial planning would allow for a deeper understanding of the differences in the current governance frameworks and clear the way for a common understanding and action towards the rules and institutional frameworks across sectors with interests in the North Sea.
- 3) Actors with interests in the North Sea should establish networks to identify potential future conflicts, and potential future synergies. This would entail mapping systematically stakeholders and interests in the North Sea in an unbiased way to guarantee the relevance and legitimacy of the networks. This work requires more research. Further, it might be necessary to create means of additional support for some networks that include non-sectorial interests to ensure their actual capacity of influencing the governance processes. The inclusion of societal interest groups and NGOs is essential to the quality and impact of these networks. It is equally essential to create governance and procedural mechanisms to deal with conflicting interests amongst actors and networks, especially when trying to build new or re-structure existing governance mechanisms and institutional frameworks.

4.4. Understanding pace, political dynamics, and geopolitics

Within the sustainability transition field, many scholars have focused on the role of policies, often operationalized through concepts such as policy mixes [124]. Such research tends to analyze the interaction

between policy instruments, strategies and processes intended to foster transitions with a focus on how such mixes promote shared directionality, pace, and common goals [125]. In practice, implementing policies is a political process, one that involves power struggles over how societies should organize the sharing of burdens and benefits, how to understand what the key legitimate goals in society are, as well as which actors are recognized as legitimate in these processes [126–128]. A concern over the last years has been how the rise of populism and increased political fragmentation affect transitions [129]. Further, international politics and geopolitical power struggles likely affect how transitions unfold. As an example, Russian use of gas and energy to promote their own geopolitical goals was described as a driver for offshore wind power developments in some European regions before the country's war on Ukraine [130] but might also lead to a fossil fuel backlash, with some countries phasing in new coal power capacity. Scholars have also noted how an offshore power grid based on offshore wind power in the North Sea might serve to strengthen the energy security of nations in proximity to such a grid in a situation of war between Russia and the west, given that such nations are able to cooperate [131].

While the ambitions for offshore wind are substantial, it is not given that rolling out an offshore grid will be a seamless process. Several scholars warn that large-scale international grid interconnections may trigger the sovereignty impulses of countries. What seems like energy interdependencies, mutual gains, and win-win for one country, may be perceived as getting trapped in asymmetric dependency relationships and the resultant erosion of energy sovereignty and overall control over energy policy by others. Small countries may be wary of the consequences of making themselves too dependent on larger countries/entities. Thus, it is the energy security perceptions of countries that determine whether they perceive of regional grid interconnections as something that makes them more energy secure or not [80,132,133]. We see this clearly in Norway, where there is major political tension between on the one hand catering for national energy needs, and on the other hand crafting international and export-oriented policy goals [80,86]. This is reflected in research that finds the public to be more supportive of new energy projects if they cater for local or national needs, than if they primarily serve international needs [103,134].

Actors who participated in the co-creation process noted that they interpreted Norwegian policy mixes as fragmented, and too influenced by sector specific interests. Participants noted that offshore wind power discursively mainly served energy policy interests, i.e., catering for future energy demands and lowering energy prices in Norway, and that there was a missed political opportunity in addressing also the climate and industry implications of offshore wind. This could be a challenge, as the success of offshore wind has been highlighted as hinging on concerted and innovative political action across policy domains [135]. Beyond this, many actors were quite happy with the government's new policy goals of granting permits for offshore wind power plants of around 30 GW capacity by 2040. There was a frustration, however, that this ambition was operationalized through what was understood as vague policies and unstable framework conditions and processes for realizing these ambitions. As with the other themes discussed in this article, many linked the vagueness to a lack of ambition in acquiring the wide interdisciplinary knowledge that would be needed to make policies that catered to diverse interests. Further, the actors noted that wind power, particularly onshore, but increasingly also offshore, was reliant on legitimacy amongst different societal actors, but that there was a lack of political support for creating such legitimacy. Many noted that discussions on onshore wind often became embroiled in what they interpreted as nationalistic narratives and saw tendencies of the same happening with offshore wind. In other words, having for many years had the somewhat mythical status of "the next Norwegian industrial adventure", suddenly the only thing that matters about offshore wind power is whether it reduces or increases the electricity price. Policy makers and politicians, many of our participants noted, seemed afraid to counter such narratives, perhaps due to a fear of polarizing the debate

and strengthening nationalist and populist narratives. Given this political climate, many feared that Norwegian implementation of offshore wind would remain slow, delayed by lukewarm political compromises necessary to keep a tenuous government coalition together, and that it would be difficult for Norway to realize a strategy anchored in international collaboration.

The co-creation process resulted in the following characteristics of an ideal political situation for increased tempo for offshore wind:

- A situation characterized by stable, and concrete framework conditions, enabling industry actors to create and evaluate their own strategies based on concrete policy mechanisms and processes rather than visions.
- A situation where policies are built on a holistic knowledge base spanning social, economic, and environmental disciplines.
- A situation where international collaboration is valued and legitimated through political narratives that counter nationalistic ones.

Based on this, the group formulated the following recommendations:

- 1) Norwegian research funders should increase the funding for truly interdisciplinary research and innovation activities around offshore wind. There has been a trend of cutting research funding in Norway, and commitment to avoiding this in the offshore wind domain could allow for the mitigation of deficits when it comes to actively linking different forms of knowledge with the development of a stable policy framework that integrates such broad insights. In geopolitically unstable times, this focus is increasingly important.
- 2) Norwegian researchers should engage society more actively. This entails establishing new forms of collaborations, especially between critical social science and humanities scholars and actors within industry, governance and civil society. A central element of such an increased transdisciplinary agenda, might also entail working towards making Norway a pioneer nation in translating the rich social scientific literature on acceptance, legitimacy, energy justice and related topics into practical-political tools and strategies.

5. Conclusion

Based on a co-creation process that involved industries that work with or have plans within offshore wind, public authorities (e.g., local governments and directorates), civil society actors and an interdisciplinary team of social scientists, this article has presented four societal challenges for advancing offshore wind in a way that is not only profitable, but also socially just and legitimate. The explicit starting point of our exercise was the observation that industry and policy discussions on offshore wind tend to be framed in techno-economic terms, and that this framing externalizes and does not capture most social aspects. By bringing together a diverse set of voices and perspectives, our exercise has served to re-iterate the conversations that professional actors are having on offshore wind, but with different concerns than the techno-economic at the center. As a transdisciplinary intervention rooted in the social sciences and humanities, we thus see our work as not simply uncovering a set of objective and underlying challenges that should be addressed with offshore wind, but as an exercise that has served to articulate new conversations and issues that need to be recognized, not only amongst critical academics observing at a distance, but amongst practitioners in the industry and the public sector. Moving forward, an important next step is to operationalize some of the broad stroke and principal recommendations provided in this paper into very concrete recommendations about practical execution in concrete projects.

This re-articulation of the offshore wind debate is also an important element of what we bring to the socio-technical sustainability transitions literature. Debates on offshore wind within this research literature, have largely been technology and innovation centric. Co-creation and active

engagement over time between a set of dedicated researchers and actors within industry and the public sector have resulted in distinctly different discussions. Past research has shown that innovation and development trajectories can create new path-dependencies and lock-ins [58], which can result in difficulties both in opening new conversations, and in establishing new types of working relations. While our co-creation process can certainly also be critiqued for mobilizing a small segment of Norwegian society, our ambition throughout the process has been to avoid contributing to the creation of a path where issues of justice, legitimacy and politics are externalized, and to bring such issues to the frontline of a discussion about how the offshore wind industry should evolve. Moving forward, we believe there are strong gains to be made by cultivating new spaces of debate and engagement to enabling legitimacy for a better and more just transition over time.

At the same time, the challenges we have discussed in this paper have clearly been shaped by the actors that were involved in our process, and the experiences, competences, and knowledge that they brought to the table. A few reflections are in order. First, while our process did not explicitly involve actors representing civil society actors and local communities, the topic of how to deal with local publics was a recurring theme across all workshops. This suggests that through years of public controversy over renewable energy projects, actors across diverse domains have come to gain an understanding of how important public support might be for new technologies. On the other hand, their non-participation in our process means that we less legitimately can claim that our paper speaks to the concerns of the public. As offshore wind power advances to the stage of implementing concrete projects in Norway, bringing this group and the many interests they represent to the table will be central. Secondly, it is interesting to note the relatively low focus on concrete environmental challenges in our discussions. Examples include those associated with marine life and migratory birds. The absence of such issues from our discussions should not signal that we do not find them important. Rather, it points towards the importance of an even broader involvement of actors and interests in future work, and a more active push to involve potential antagonists to narratives about new industrial adventures. The topic of tourism is another aspect that received little to no attention in our process. This can perhaps be explained by our process discussing offshore wind in relatively general terms. It might be easier to articulate tourist interests later, when broad policy visions are to be translated into concrete projects.

Finally, it should be noted that we are not naively thinking that our exercise will radically transform the development of offshore wind in Norway and beyond. As with other forms of interventionist action research it might be difficult to measure the degree of change achieved [136]. The involved actors are not formally obligated to adjust their current practices. That said, as social science and humanities scholars we believe that shifting the discourses within established networks, strengthening new types of links within such networks, and working actively to legitimate concerns beyond the techno-economic, are important elements in contributing to what some scholars have called a more humble energy transition [137].

Above all, our exercise illustrates that advancing a just and legitimate transition involving a technology such as offshore wind, is an endeavor that requires engagement from across disciplines. We do not mean this narrowly, and in an exclusively academic sense. Instead, finding new modes of engagement across disciplines as well as between research and various strands of society appears central in a time where finding shared common ground across political, economic and epistemic divides arises as key barrier to moving forward.

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.

Data availability

Data will be made available on request.

Acknowledgements

This research received funding from the Research Council of Norway through two projects: FME NTRANS (grant no. 296205) and FME Northwind (grant no. 321954).

References

- [1] F.W. Geels, B.K. Sovacool, T. Schwanen, S. Sorrell, Sociotechnical transitions for deep decarbonization, *Science* 357 (6357) (2017) 1242–1244.
- [2] IEA, World Energy Outlook 2021, IEA, Paris, 2021. <https://www.iea.org/reports/world-energy-outlook-2021> (accessed 22.02.2022).
- [3] A. van der Loos, H.E. Normann, J. Hanson, M.P. Hekkert, The co-evolution of innovation systems and context: offshore wind in Norway and the Netherlands, *Renew. Sustain. Energy Rev.* 138 (2021), 110513.
- [4] D. MacKinnon, S. Dawley, M. Steen, M.P. Menzel, A. Karlsen, P. Sommer, H. E. Normann, Path creation, global production networks and regional development: a comparative international analysis of the offshore wind sector, *Prog. Plan.* 130 (2019) 1–32.
- [5] L.F. Gusatu, C. Yamu, C. Zuidema, A. Faaij, A spatial analysis of the potentials for offshore wind farm locations in the North Sea region: challenges and opportunities, *ISPRS Int. J. Geo-Inf.* 9 (2) (2020) 96.
- [6] Mølnevik, M. J., Tande, J. O. G., Tomassgard, A., Torsæter, M., Gardarsdottir, S. O., Korpås, M., ... & Bjørgum, Ø. (2021). Nordsjøen som plattform for grønn omstilling.
- [7] E.P. Soares-Ramos, L. de Oliveira-Assis, R. Sarrias-Mena, L.M. Fernández-Ramírez, Current status and future trends of offshore wind power in Europe, *Energy* 202 (2020), 117787.
- [8] S. Heidenreich, Out of sight, out of mind? Controversy over offshore wind energy in Norway's news media, *Sci. Cult.* 25 (4) (2016) 449–472.
- [9] S. Bolwig, T.F. Bolkesjø, A. Klitkou, P.D. Lund, C. Bergaentzle, K. Borch, K. Skytte, Climate-friendly but socially rejected energy-transition pathways: the integration of techno-economic and socio-technical approaches in the Nordic-Baltic region, *Energy Res. Soc. Sci.* 67 (2020), 101559.
- [10] Regjeringen.no, Official government website. *Offshore wind — time line.* <https://www.regjeringen.no/en/topics/energy/vindkraft-til-havs-tidslinje/id2873850/>, 2022 accessed 02.06.2023.
- [11] Marte Mjøs Persen, Vi legger til rette for et nytt industrieventyr innen havvind [Accommodating a new industrial adventure within offshore wind] in: *Bergens Tidende*, 2022, 21.02.2022, <https://www.bt.no/btmeninger/debatt/i/e/EwyGa/vi-legger-til-rette-for-et-nytt-industrieventyr-innen-havvind>. accessed 24.02.2022.
- [12] M. Koivisto, J. Gea-Bermúdez, P. Kanellas, K. Das, P. Sørensen, North Sea region energy system towards 2050: integrated offshore grid and sector coupling drive offshore wind power installations, *Wind Energy Sci.* 5 (4) (2020) 1705–1712.
- [13] European Commission, The North Seas energy cooperation. https://energy.ec.europa.eu/topics/infrastructure/high-level-groups/north-seas-energy-cooperation_en, 2022.
- [14] J. Fagerberg, H.E. Normann, Innovation Policy, Regulation and the Transition to Net Zero (Working paper, No. 20220531), Centre for Technology, Innovation and Culture, University of Oslo, 2022.
- [15] P. Enevoldsen, F.H. Permién, I. Bakhtaoui, A.K. von Krauland, M.Z. Jacobson, G. Xydís, G. Oxley, How much wind power potential does Europe have? Examining European wind power potential with an enhanced socio-technical atlas, *Energy Policy* 132 (2019) 1092–1100.
- [16] S. Krupnik, A. Wagner, O. Koretskaya, T.J. Rudek, R. Wade, M. Mišić, T. von Wirth, Beyond technology: a research agenda for social sciences and humanities research on renewable energy in Europe, *Energy Res. Soc. Sci.* 89 (2022), 102536.
- [17] G. Walker, N. Cass, Carbon reduction, 'the public' and renewable energy: engaging with socio-technical configurations, *Area* 39 (4) (2007) 458–469.
- [18] J. Markard, R. Raven, B. Truffer, Sustainability transitions: an emerging field of research and its prospects, *Res. Policy* 41 (6) (2012) 955–967.
- [19] F.W. Geels, Micro-foundations of the multi-level perspective on socio-technical transitions: developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory, *Technol. Forecast. Soc. Chang.* 152 (2020), 119894.
- [20] O.W. Johnson, J.Y.C. Han, A.L. Knight, S. Mortensen, M.T. Aung, M. Boyland, B. P. Resurrección, Intersectionality and energy transitions: a review of gender, social equity and low-carbon energy, *Energy Res. Soc. Sci.* 70 (2020), 101774.
- [21] S. Sareen, H. Haarstad, Legitimacy and accountability in the governance of sustainable energy transitions, *Glob. Trans.* 2 (2020) 47–50.
- [22] J.M. Wittmayer, N. Schöpke, Action, research and participation: roles of researchers in sustainability transitions, *Sustain. Sci.* 9 (4) (2014) 483–496.
- [23] A.V. Norström, C. Cvitanovic, M.F. Löf, S. West, C. Wyborn, P. Balvanell, H. Österblom, Principles for knowledge co-production in sustainability research, *Nat. Sustain.* 3 (3) (2020) 182–190.

- [24] B. Rennkamp, R. Perrot, Drivers and barriers to wind energy technology transitions in India, Brazil and South Africa, in: *Handbook on Sustainability Transition and Sustainable Peace*, Springer, Cham, 2016, pp. 775–791.
- [25] A.-J. Wiecezorek, S.O. Negro, R. Harmsen, G.J. Heimeriks, L. Luo, M.P. Hekkert, A review of the European offshore wind innovation system, in: *Renewable and Sustainable Energy Reviews* 2013 Vol. 26, 2013, <https://doi.org/10.1016/j.rser.2013.05.045>.
- [26] N. Bento, M. Fontes, Emergence of floating offshore wind energy: technology and industry, *Renew. Sustain. Energy Rev.* 99 (2019) 66–82, <https://doi.org/10.1016/j.rser.2018.09.035>.
- [27] F. Kern, B. Verhees, R. Raven, A. Smith, Empowering sustainable niches: comparing UK and Dutch offshore wind developments, *Technol. Forecast. Soc. Change* 100 (2015) 344–355, <https://doi.org/10.1016/j.techfore.2015.08.004>.
- [28] A. van der Loos, R. Langeveld, M. Hekkert, S. Negro, B. Truffer, Developing local industries and global value chains: the case of offshore wind, *Technol. Forecast. Soc. Change* 174 (2022), 121248.
- [29] H.A. van der Loos, S.O. Negro, M.P. Hekkert, International markets and technological innovation systems: the case of offshore wind, *Environ. Innov. Soc. Trans.* 34 (2020) 121–138.
- [30] S. Afewerki, S. Karlsen, D. MacKinnon, Configuring floating production networks: a case study of a new offshore wind technology across two oil and gas economies, *Nor. J. Geogr.* 73 (1) (2019) 4–15, <https://doi.org/10.1080/00291951.2018.1494209>.
- [31] M. Tsouri, J. Hanson, H.E. Normann, Does participation in knowledge networks facilitate market access in global innovation systems? The case of offshore wind, *Res. Policy* 50 (5) (2021), 104227.
- [32] T. Mäkitie, A.D. Andersen, J. Hanson, H.E. Normann, T.M. Thune, Established sectors expediting clean technology industries? The Norwegian oil and gas sector's influence on offshore wind power, *J. Clean. Prod.* 177 (2018) 813–823.
- [33] A.D. Andersen, M. Gulbrandsen, The innovation and industry dynamics of technology phase-out in sustainability transitions: insights from diversifying petroleum technology suppliers in Norway, *Energy Res. Soc. Sci.* 64 (2020), 101447, <https://doi.org/10.1016/j.erss.2020.101447>.
- [34] T. Nilsen, Innovation from the inside out: contrasting fossil and renewable energy pathways at Statoil, *Energy Res. Soc. Sci.* 28 (2017) 50–57, <https://doi.org/10.1016/j.erss.2017.03.015>.
- [35] G.H. Hansen, M. Steen, Offshore oil and gas firms' involvement in offshore wind: technological frames and undercurrents, *Environ. Innov. Soc. Trans.* 17 (2015) 1–14, <https://doi.org/10.1016/j.eist.2015.05.001>.
- [36] B. Verhees, R. Raven, F. Kern, A. Smith, The role of policy in shielding, nurturing and enabling offshore wind in the Netherlands (1973–2013), *Renew. Sustain. Energy Rev.* 47 (2015) 816–829, <https://doi.org/10.1016/j.rser.2015.02.036>.
- [37] K. Reichardt, S.O. Negro, K.S. Rogge, M.P. Hekkert, Analyzing interdependencies between policy mixes and technological innovation systems: the case of offshore wind in Germany, *Technol. Forecast. Soc. Change* 106 (2016) 11–21, <https://doi.org/10.1016/j.techfore.2016.01.02>.
- [38] K. Reichardt, K.S. Rogge, S.O. Negro, Unpacking policy processes for addressing systemic problems in technological innovation systems: the case of offshore wind in Germany, *Renew. Sustain. Energy Rev.* 80 (2017) 1217–1226, <https://doi.org/10.1016/j.rser.2017.05.280>.
- [39] J. Park, B. Kim, An analysis of South Korea's energy transition policy with regards to offshore wind power development, *Renew. Sustain. Energy Rev.* 109 (2019) 71–84, <https://doi.org/10.1016/j.rser.2019.04.031>.
- [40] D. MacKinnon, A. Karlsen, S. Dawley, M. Steen, S. Afewerki, A. Kenzhegaliyeva, Legitimation, institutions and regional path creation: a cross-national study of offshore wind, *Reg. Stud.* 56 (4) (2022) 644–655.
- [41] H.E. Normann, The role of politics in sustainable transitions: the rise and decline of offshore wind in Norway, *Environ. Innov. Soc. Trans.* 15 (2015) 180–193.
- [42] A.D. Andersen, J. Markard, Multi-technology interaction in socio-technical transitions: how recent dynamics in HVDC technology can inform transition theories, *Technol. Forecast. Soc. Change* 151 (2020), 119802.
- [43] A.D. Andersen, M. Steen, T. Mäkitie, J. Hanson, T.M. Thune, B. Soppe, The role of inter-sectoral dynamics in sustainability transitions: a comment on the transitions research agenda, *Environ. Innov. Soc. Trans.* 34 (2020) 348–351.
- [44] J. Markard, The next phase of the energy transition and its implications for research and policy, *Nat. Energy* 3 (8) (2018) 628–633.
- [45] J. Köhler, F.W. Geels, F. Kern, J. Markard, E. Onsongo, A. Wiecezorek, P. Wells, An agenda for sustainability transitions research: state of the art and future directions, *Environ. Innov. Soc. Trans.* 31 (2019) 1–32.
- [46] N. Healy, J. Barry, Politicizing energy justice and energy system transitions: fossil fuel divestment and a “just transition”, *Energy Policy* 108 (2017) 451–459.
- [47] K. Jenkins, D. McCauley, R. Heffron, H. Stephan, R. Rehner, Energy justice: a conceptual review, *Energy Res. Soc. Sci.* 11 (2016) 174–182.
- [48] T.M. Skjølsvold, L. Coenen, Are rapid and inclusive energy and climate transitions oxymorons? Towards principles of responsible acceleration, *Energy Res. Soc. Sci.* 79 (2021), 102164.
- [49] I. Fazey, N. Schäpke, G. Caniglia, A. Hodgson, I. Kendrick, C. Lyon, P. Saha, Transforming knowledge systems for life on earth: visions of future systems and how to get there, *Energy Res. Soc. Sci.* 70 (2020), 101724.
- [50] B.K. Sovacool, J. Axsen, S. Sorrell, Promoting novelty, rigor, and style in energy social science: towards codes of practice for appropriate methods and research design, *Energy Res. Soc. Sci.* 45 (2018) 12–42.
- [51] B.K. Sovacool, D.J. Hess, S. Amir, F.W. Geels, R. Hirsh, L.R. Medina, S. Yearley, Sociotechnical agendas: reviewing future directions for energy and climate research, *Energy Res. Soc. Sci.* 70 (2020), 101617.
- [52] N. Frantzeskaki, A. Rok, Co-producing urban sustainability transitions knowledge with community, policy and science, *Environ. Innov. Soc. Trans.* 29 (2018) 47–51.
- [53] D. Loorbach, *Transition Management: New Mode of Governance for Sustainable Development*, 2007.
- [54] N. Frantzeskaki, D. Loorbach, J. Meadowcroft, Governing societal transitions to sustainability, *Int. J. Sustain. Dev.* 15 (1–2) (2012) 19–36.
- [55] S. Bolwig, T.F. Bolkesjø, A. Klitkou, P.D. Lund, C. Bergaentzlé, K. Borch, K. Skytte, Climate-friendly but socially rejected energy-transition pathways: the integration of techno-economic and socio-technical approaches in the Nordic-Baltic region, *Energy Res. Soc. Sci.* 67 (2020), 101559.
- [56] F.W. Geels, A. McMeekin, B. Pfluger, Socio-technical scenarios as a methodological tool to explore social and political feasibility in low-carbon transitions: bridging computer models and the multi-level perspective in UK electricity generation (2010–2050), *Technol. Forecast. Soc. Change* 151 (2020), 119258.
- [57] I.F. Ballo, Imagining energy futures: sociotechnical imaginaries of the future Smart Grid in Norway, *Energy Res. Soc. Sci.* 9 (2015) 9–20.
- [58] A. Silvast, C. Foulds, *A Sociology of Interdisciplinarity*, Palgrave Macmillan, Cham, 2022.
- [59] M. Ryghaug, T.M. Skjølsvold, Pilot Society and the Energy Transition: The Co-shaping of Innovation, Participation and Politics, Palgrave Pivot, 2021.
- [60] E.L. Boasson, T. Jevnaker, Energy governance in Norway: too much of a good thing? *Handbook of Energy Governance in Europe* (2022) 897–921.
- [61] S.O. Funtowicz, J.R. Ravetz, Uncertainty, complexity and post-normal science, *Environ. Toxicol. Chem.* 13 (12) (1994) 1881–1885.
- [62] K. Löhr, M. Weinhardt, S. Sieber, The “World Café” as a participatory method for collecting qualitative data, *Int. J. Qual. Methods* 19 (2020), 1609406920916976.
- [63] M. Broom, B. Brady, Z. Kecskes, S. Kildea, World Café methodology engages stakeholders in designing a neonatal intensive care unit, *J. Neonatal Nurs.* 19 (5) (2013) 253–258.
- [64] I.M. Henriksen, A. Tjora, Situational domestication and the origin of the café worker species, *Sociology* 52 (2) (2018) 351–366.
- [65] J. Aakre, H.S. Scharming, *Prosjekthåndboka 2.0: verktøykasse for kreative team*, Universitetsforlaget, 2013.
- [66] T.M. Skjølsvold, S. Heidenreich, Fire samfunnsutfordringer for havvind. http://www.ntnu.no/documents/1284688443/1285504199/Policy+brief_1_UC6.pdf/fd4ac1ba-c5d7-580c-1f36-e67472466fae?i=1645196227509, 2022.
- [67] S. Heidenreich, T.M. Skjølsvold, M. Vasstrøm, I. Richter, Havvind: strategier for et bedre offentlig ordsifte. https://www.ntnu.no/documents/1284688443/1285504199/Havvind+++strategier+for+et+bedre+offentlig+ordsifte+++policy+brief+04_22.pdf/6856df44-7fcd-7290-1986-b7a8826d8c8a?t=1648209578987, 2022.
- [68] T.M. Skjølsvold, S. Heidenreich, I. Suboticki, Havvind: deltakelse og involvering av interessegrupper og innbyggere. https://www.ntnu.no/documents/1284688443/1285504199/Policybrief3_final.pdf/33aea630-0192-6402-2d98-7fa653ad4da7?t=1653898896698, 2022.
- [69] S. Heidenreich, T.M. Skjølsvold, D. Dankel, Havvind: Areal, sted og sameksistens. https://www.ntnu.no/documents/1284688443/0/Policybrief07_areal%2Bsamesistens_DJD.pdf/4c2068a4-c152-402a-8157-787bb1f47fe8?t=1665496020821, 2022.
- [70] T.M. Skjølsvold, S. Heidenreich, K. Linnerud, E. Moe, J.B. Skjærseth, Havvind: Tempo, politisk dynamikk og storpolitikk. <https://www.ntnu.no/documents/1284688443/1285504199/Havvind+++Tempo+politisk+dynamikk+og+storpolti+itikk+policy+brief.pdf/95f67b25-00ed-4da2-9e01-e38f8e7f3c?t=1660901096162>, 2022.
- [71] K. Buhr, A. Hansson, Capturing the stories of corporations: a comparison of media debates on carbon capture and storage in Norway and Sweden, *Glob. Environ. Chang.* 21 (2) (2011) 336–345.
- [72] T.M. Skjølsvold, Curb your enthusiasm: on media communication of bioenergy and the role of the news media in technology diffusion, *Environ. Commun.* 6 (4) (2012) 512–531.
- [73] S.H. Lundheim, G. Pellegrini-Masini, C.A. Klöckner, S. Geiss, Developing a theoretical framework to explain the social acceptability of wind energy, *Energies* 15 (14) (2022) 4934.
- [74] M.D. Leiren, S. Aakre, K. Linnerud, T.E. Julsrud, M.R. Di Nucci, M. Krug, Community acceptance of wind energy developments: experience from wind energy scarce regions in Europe, *Sustainability* 12 (5) (2020) 1754.
- [75] T. Bjärstig, I. Mancheva, A. Zachrisson, W. Neumann, J. Svensson, Is large-scale wind power a problem, solution, or victim? A frame analysis of the debate in Swedish media, *Energy Res. Soc. Sci.* 83 (2022), 102337.
- [76] U. Pesch, Tracing discursive space: agency and change in sustainability transitions, *Technol. Forecast. Soc. Change* 90 (2015) 379–388.
- [77] S. Haikola, A. Hansson, J. Anshelm, From polarization to reluctant acceptance—bioenergy with carbon capture and storage (BECCS) and the post-normalization of the climate debate, *J. Integr. Environ. Sci.* 16 (1) (2019) 45–69.
- [78] J. Lyytimäki, T. Assmuth, R. Paloniemi, J. Pyytiäinen, S. Rantala, P. Rikkonen, E. Winquist, Two sides of biogas: review of ten dichotomous argumentation lines of sustainable energy systems, *Renew. Sustain. Energy Rev.* 141 (2021), 110769.
- [79] H. Rosa, *Social Acceleration. A New Theory of Modernity*, Columbia University Press, New York, 2013.
- [80] S.T. Hansen, E. Moe, Renewable energy expansion or the preservation of national energy sovereignty? Norwegian renewable energy policy meets resource nationalism, *Polit. Geogr.* 99 (102760) (2022) 1–11, <https://doi.org/10.1016/j.polgeo.2022.102760>.

- [81] M. Vasstrøm, H.K. Lysgård, What shapes Norwegian wind power policy? Analysing the constructing forces of policymaking and emerging questions of energy justice, *Energy Res. Soc. Sci.* 77 (2021), 102089.
- [82] M. Korsnes, B. Loewen, R.F. Dale, M. Steen, T.M. Skjølsvold, Paradoxes of Norway's energy transition: controversies and justice, *Clim. Pol.* (2023) 1–19.
- [83] K. Burningham, J. Barnett, G. Walker, An array of deficits: unpacking NIMBY discourses in wind energy developers' conceptualizations of their local opponents, *Soc. Nat. Resour.* 28 (3) (2015) 246–260.
- [84] S. Heidenreich, Sublime technology and object of fear: offshore wind scientists assessing publics, *Environ. Plann. A Econ. Space* 47 (5) (2015) 1047–1062, <https://doi.org/10.1177/0308518X15592311>.
- [85] M. Ryghaug, T.M. Skjølsvold, S. Heidenreich, Creating energy citizenship through material participation, *Soc. Stud. Sci.* 48 (2) (2018) 283–303.
- [86] E. Moe, S.R. Sæther, J.K.S. Rottereng, S.T. Hansen, Kraftmangel i horisonten: Norsk klima-utenrikspolitikk fra konsensus til strid? *Int. Polit.* 80 (1) (2022) 197–209.
- [87] B.K. Sovacool, D.J. Hess, R. Cantoni, D. Lee, M.C. Brisbois, H.J. Walnum, S. Goel, Conflicted transitions: exploring the actors, tactics, and outcomes of social opposition against energy infrastructure, *Glob. Environ. Chang.* 73 (2022), 102473.
- [88] J.B. Skjærseth, K. Rosendal, Implementing the EU renewable energy directive in Norway: from tailwind to headwind, *Environ. Polit.* (2022), <https://doi.org/10.1080/09644016.2022.2075153>.
- [89] P.P. Otte, K. Rønningen, E. Moe, Contested wind energy: discourses on energy impacts and their significance for energy justice in Fosen, in: *Energy, Resource Extraction and Society*, Routledge, 2018, pp. 140–158.
- [90] M. Michael, Publics performing publics: of PiGs, PiPs and politics, *Public Underst. Sci.* 18 (5) (2009) 617–631.
- [91] G. Valkenburg, A. Mamidipudi, P. Pandey, W.E. Bijker, Responsible innovation as empowering ways of knowing, *J. Responsible Innov.* 7 (1) (2020) 6–25.
- [92] T.B. Flobak, Stille vann har dypest grunn: Skjær i sjøen for Norges nye industrieventyr. En kvalitativ studie av verdiforståelse som en kilde til utfordringer for fremtidens energiomstilling i Norge., Master's thesis, NTNU, 2022.
- [93] J. Chilvers, H. Pallett, T. Hargreaves, Ecologies of participation in socio-technical change: the case of energy system transitions, *Energy Res. Soc. Sci.* 42 (2018) 199–210.
- [94] H. Pallett, J. Chilvers, A decade of learning about publics, participation, and climate change: institutionalising reflexivity? *Environ. Plan. A* 45 (5) (2013) 1162–1183.
- [95] J. Baxter, Energy justice: participation promotes acceptance, *Nat. Energy* 2 (8) (2017) 1–2.
- [96] I. Stadelmann-Steffen, C. Dermont, Acceptance through inclusion? Political and economic participation and the acceptance of local renewable energy projects in Switzerland, *Energy Res. Soc. Sci.* 71 (2021), 101818.
- [97] S. Sheppard, Visualizing Climate Change: A Guide to Visual Communication of Climate Change and Developing Local Solutions, Routledge, 2012.
- [98] I. Richter, J. Sumeldan, A. Avillanosa, E. Gabe-Thomas, L. Creencia, S. Pahl, Co-created future scenarios as a tool to communicate sustainable development in coastal communities in Palawan Philippines, *Front. Psychol.* 12 (2021) 1–16.
- [99] L. Desvallées, X.A. de Sartre, In the shadow of nuclear dependency: competing pathways and the social acceptance of offshore wind energy in France, *Energy Res. Soc. Sci.* 98 (2023), 103029.
- [100] K. Jenkins, D. McCauley, A. Forman, Energy justice: a policy approach, *Energy Policy* 105 (2017) 631–634.
- [101] J. Firestone, C. Hirt, D. Bidwell, M. Gardner, J. Dwyer, Faring well in offshore wind power siting? Trust, engagement and process fairness in the United States, *Energy Res. Soc. Sci.* 62 (2020), 101393.
- [102] I. Richter, E. Gabe-Thomas, A.M. Queirós, S.R.J. Sheppard, S. Pahl, Advancing the potential impact of future scenarios by integrating psychological principles, *Environ. Sci. Policy* 140 (2023) 68–79, <https://doi.org/10.1016/j.envsci.2022.11.015>.
- [103] K. Linnerud, A. Dugstad, B.J. Rygg, Do people prefer offshore to onshore wind energy? The role of ownership and intended use, *Renew. Sustain. Energy Rev.* 168 (2022), 112732.
- [104] C. Fraune, M. Knodt, Challenges of citizen participation in infrastructure policy-making in multi-level systems—the case of onshore wind energy expansion in Germany, *Eur. Policy Anal.* 3 (2) (2017) 256–273.
- [105] L. Ingeborgrud, S. Heidenreich, M. Ryghaug, T.M. Skjølsvold, C. Foulds, R. Robison, R. Mourik, Expanding the scope and implications of energy research: a guide to key themes and concepts from the social sciences and humanities, *Energy Res. Soc. Sci.* 63 (2020), 101398.
- [106] I. Suboticki, S. Heidenreich, M. Ryghaug, T.M. Skjølsvold, Fostering justice through engagement: a literature review of public engagement in energy transitions, *Energy Res. Soc. Sci.* 99 (2023), 103053.
- [107] C.S. Fleming, S.B. Gonyo, A. Freitag, T.L. Goedeke, Engaged minority or quiet majority? Social intentions and actions related to offshore wind energy development in the United States, *Energy Res. Soc. Sci.* 84 (2022), 102440.
- [108] Laurence L. Delina, Benjamin K. Sovacool, Of temporality and plurality: an epistemic and governance agenda for accelerating just transitions for energy access and sustainable development, *Curr. Opin. Environ. Sustain.* 34 (2018) 1–6.
- [109] R.F. Dale, H. Dannevig, Planning for whose benefit? Procedural (in)justice in Norwegian Arctic industry projects, in: *Arctic Justice*, Bristol University Press, 2023, pp. 109–123.
- [110] V. Kati, C. Kassara, Z. Vrontisi, A. Moustakas, The biodiversity-wind energy-land use nexus in a global biodiversity hotspot, *Sci. Total Environ.* 768 (2021), 144471.
- [111] B.J. Rygg, Wind power—an assault on local landscapes or an opportunity for modernization? *Energy Policy* 48 (2012) 167–175.
- [112] A.L. Jackson, Renewable energy vs. biodiversity: policy conflicts and the future of nature conservation, *Glob. Environ. Chang.* 21 (4) (2011) 1195–1208.
- [113] F. Lindgren, B. Johansson, T. Malmlof, F. Lindvall, Siting conflicts between wind power and military aviation—problems and potential solutions, *Land Use Policy* 34 (2013) 104–111.
- [114] R. Steinhäuser, R. Siebert, A. Steinführer, M. Hellmich, National and regional land-use conflicts in Germany from the perspective of stakeholders, *Land Use Policy* 49 (2015) 183–194.
- [115] A.M. Hjalager, Land-use conflicts in coastal tourism and the quest for governance innovations, *Land Use Policy* 94 (2020), 104566.
- [116] S. Normann, Green colonialism in the Nordic context: exploring Southern Saami representations of wind energy development, *J. Community Psychol.* 49 (1) (2021) 77–94.
- [117] P. Devine-Wright, Place attachment and public acceptance of renewable energy: a tidal energy case study, *J. Environ. Psychol.* 31 (4) (2011) 336–343.
- [118] C. Haggett, Understanding public responses to offshore wind power, *Energy Policy* 39 (2) (2011) 503–510.
- [119] E.A. Virtanen, J. Lappalainen, M. Nurmi, M. Viitasalo, M. Tikanmäki, J. Heinonen, A. Moilanen, Balancing profitability of energy production, societal impacts and biodiversity in offshore wind farm design, *Renew. Sustain. Energy Rev.* 158 (2022), 112087.
- [120] T. Hooper, M. Ashley, M. Austen, Perceptions of fishers and developers on the co-location of offshore wind farms and decapod fisheries in the UK, *Mar. Policy* 61 (2015) 16–22.
- [121] M. Roach, A. Revill, M.J. Johnson, Co-existence in practice: a collaborative study of the effects of the Westernmost rough offshore wind development on the size distribution and catch rates of a commercially important lobster (*Homarus gammarus*) population, *ICES J. Mar. Sci.* 79 (4) (2022) 1175–1186.
- [122] H. Zhang, A. Tomasgard, B.R. Knudsen, H.G. Svendsen, S.J. Bakker, I. E. Grossmann, Modelling and analysis of offshore energy hubs, *Energy* 261 (2022), 125219.
- [123] P. Steinberg, B. Kristoffersen, Building a blue economy in the Arctic Ocean: Sustaining the sea or sustaining the state?, in: *The Politics of Sustainability in the Arctic* Routledge, 2018, pp. 136–148.
- [124] K.S. Rogge, K. Reichardt, Policy mixes for sustainability transitions: an extended concept and framework for analysis, *Res. Policy* 45 (8) (2016) 1620–1635.
- [125] K.S. Rogge, F. Kern, M. Howlett, Conceptual and empirical advances in analysing policy mixes for energy transitions, *Energy Res. Soc. Sci.* 33 (2017) 1–10.
- [126] F. Avelino, J. Grin, B. Pel, S. Jhagroe, The politics of sustainability transitions, *J. Environ. Policy Plann.* 18 (5) (2016) 557–567.
- [127] D.J. Hess, Energy democracy and social movements: a multi-coalition perspective on the politics of sustainability transitions, *Energy Res. Soc. Sci.* 40 (2018) 177–189.
- [128] J. Meadowcroft, Engaging with the politics of sustainability transitions, *Environ. Innov. Soc. Trans.* 1 (1) (2011) 70–75.
- [129] S. Četković, C. Hagemann, Changing climate for populists? Examining the influence of radical-right political parties on low-carbon energy transitions in Western Europe, *Energy Res. Soc. Sci.* 66 (2020), 101571.
- [130] K. Pronińska, K. Księżopolski, Baltic offshore wind energy development—Poland's public policy tools analysis and the geostrategic implications, *Energies* 14 (16) (2021) 4883.
- [131] B. Flynn, Marine wind energy and the North Sea offshore grid initiative: a multi-level perspective on a stalled technology transition? *Energy Res. Soc. Sci.* 22 (2016) 36–51.
- [132] I. Fischhendler, L. Herman, J. Anderman, The geopolitics of cross-border electricity grids, *Energy Policy* 98 (2016) 533–543, <https://doi.org/10.1016/j.enpol.2016.09.012>.
- [133] P. Thaler, B. Hofmann, The impossible energy trinity, *Polit. Geogr.* 94 (2022), 102579, <https://doi.org/10.1016/j.polgeo.2021.102579>.
- [134] D. Bidwell, J. Firestone, M.D. Ferguson, Love thy neighbor (or not): regionalism and support for the use of offshore wind energy by others, *Energy Res. Soc. Sci.* 90 (2022), 102599.
- [135] J.P. Roux, O. Fitch-Roy, P. Devine-Wright, G. Ellis, “We could have been leaders”: the rise and fall of offshore wind energy on the political agenda in Ireland, *Energy Res. Soc. Sci.* 92 (2022), 102762.
- [136] R. Kemp, D. Loorbach, Governance for sustainability through transition management, in: *Open Meeting of Human Dimensions of Global Environmental Change Research Community*, Montreal, Canada vol. 20, 2003.
- [137] S. Jasanoff, Just transitions: a humble approach to global energy futures, *Energy Res. Soc. Sci.* 35 (2018) 11–14.