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Research article

Exploring agenda-setting of offshore energy innovations: Niche-regime interactions in Dutch Marine Spatial Planning processes

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ABSTRACT

The foreseen large-scale growth of offshore wind energy towards 2050 in pursuit of an energy transition obliges scholars and policymakers to start considering its integration in the wider offshore energy system. Both technological innovations and advances in spatial policy are necessary to facilitate offshore system integration. This study draws from agenda-setting theory to explore barriers and opportunities affecting the prioritization processes surrounding three offshore energy storage and transport concepts in Dutch marine spatial planning practice. The findings demonstrate that although various arenas for agenda-setting exist, they are geared to the input of established stakeholders, including the oil and gas and offshore wind sectors. Also, prioritization is hindered by a short-term (2030) governmental fixation and long-term institutional ambiguity. Therefore, supportive institutions are needed, providing regulatory certainty and reliable incentive mechanisms, whilst remaining adaptive to address imminent uncertainties, in pursuit of system integration needed for an energy transition.

1. Introduction

In search of space for renewable energy infrastructure to facilitate an energy transition, governments are venturing out to sea. Moving offshore sounds appealing, as offshore activities may expect less opposition than on land since offshore space is considered less scarce (Spiropoulou et al., 2014). Nevertheless, social sustainability and justice considerations are increasingly discussed in literature on Marine Spatial Planning (MSP) and imply a need to further investigate this assumption (see e.g. Gilek et al., 2021; Saunders et al., 2020). Spatial competition has significantly intensified lately and resultantly complicates spatial planning of the offshore area. Considering the scarcity of space in proximity to shore (Gusatu et al., 2020; Jongbloed et al., 2014), solutions need to be sought farther offshore, where such scarcity is less pronounced. Moreover, the large-scale implementation of renewable energy brings about multiple techno-economic concerns: the mismatch between the intermittent supply and variable demand (Nordling et al., 2016; World Energy Council, 2016), grid instability and limitations (Mehigan et al., 2020), and the costly nature of sea-to-shore cables (Chen et al., 2018; Jepma and van Schot, 2017). Consequently, technological innovations and – recognizing this transition as a fundamentally policy-driven process (Lockwood et al., 2020) – corresponding policy innovations are needed to transform the offshore energy system.

The North Sea presents a hotspot for this transformation of the energy system, offering ideal conditions for generating offshore

Abbreviations: MSP, Marine Spatial Planning; OWE, Offshore Wind Energy.

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wind energy (OWE) due to its relatively shallow waters and its favourable wind climate. By 2020, the total installed capacity of OWE on the North Sea culminated to 20 GW, representing 79% of total installed capacity offshore across Europe (WindEurope, 2021). To enable the expected large-scale growth of OWE towards 2050, forming synergies between energy generation, transport and storage is key. Such offshore system integration may help to speed up the energy transition, presents an economically attractive pathway to carbon neutrality and allows for efficient use of offshore space (North Sea Energy, 2020). Particularly, synergies between OWE and oil and gas (O&G) infrastructures are deemed promising for decreasing carbon emissions (North Sea Energy, 2018) expecting to reach values of $275–360 billion across Europe over the next two decades (International Energy Agency, 2019). Offshore energy storage, offshore green hydrogen production and international grid connections, so-called *interconnectors* (specifically between offshore windfarms) are suggested as promising solutions offering the desired flexibility and cost-efficiency (North Sea Energy, 2020; World Energy Council, 2020). To date, they remain niche developments: only interconnectors find limited application, with storage and green hydrogen production lacking development. Considering the inflexible, long-term and costly nature of offshore infrastructures backed by powerful incumbent actors and their interests, the move towards offshore system integration requires these solutions to become part of a transition on a regime level. So, to facilitate a timely implementation corresponding to the expected OWE growth, it is imperative that policymakers and scholars start considering institutional innovations needed for these technologies to become integrated in upcoming policies and spatial plans (Fuenfschilling, 2019).

MSP is widely adopted as an approach to integrate such novel ocean uses within policies and anticipate on their development (Jay et al., 2013; Kannen, 2014). Within MSP processes, policymakers consider the various sectoral interests and coordinate decisions for the sustainable use of marine areas. Energy is regarded as a driver of MSP processes (see e.g. Ehler, 2018; Jay, 2010), where MSP is crucial in assessing where and how offshore energy infrastructures are developed considering other interests. The increasing focus on offshore system integration prompts questions, therefore, which innovations and solutions are considered and prioritized in MSP processes.

Although much has been written about key phases, steps and tasks in the MSP process (Douvere and Ehler, 2011; Ehler and Douvere, 2009), little is known about *how* and *why* new uses emerge in policy and come to be prioritized. Some scholars do touch upon these preliminary processes of policymaking (Agardy et al., 2011; Spijkerboer et al., 2020), but they rarely are the sole focus of study. Transition scholars have longer studied how sustainability niches emerge, influence and are influenced by the existing socio-technical regime (see e.g. Bui et al., 2016; Diaz et al., 2013) and call for more pluralized understandings of the roles of incumbents (for instance, Ampe et al., 2021; Turnheim and Sovacool, 2020). Still, only little reflection exists on how so-called niche-regime interactions materialize within and are shaped by MSP processes.

This paper generates insights on how MSP processes shape energy transitions by adopting agenda-setting theory to explore the processes through which niche innovations may emerge on the agenda, are prioritized and compete for attention. Therein, agenda-setting is conceptualized as a fundamentally normative process in which the interplay of problems, actors, and institutions is key (Knoepfel et al., 2011). This paper answers the following question: what opportunities and barriers exist affecting the agenda-setting processes of offshore energy storage, interconnectors and offshore green hydrogen production in Dutch MSP processes? The Dutch MSP process provides a relevant case to study, given the nation's long history of MSP (dating back to 2005) and a historically intensively used offshore area including a substantial presence of O&G. Further, the government explicitly committed to implementing 11.5 GW of OWE by 2030 (Minister of Economic Affairs and Climate Policy, 2020a) and advancing offshore system integration (TKI Wind op Zee, 2019). The development process for the new Dutch marine spatial plan (initiated in 2019 with the formal publication of the scoping document) offers a relevant moment in time to study its agenda-setting processes and involved processes of participation, deliberation and decision-making. Results of this study provide policymakers with insights into what barriers to address and opportunities to employ to advance the development of innovative ocean uses for system integration to transform the North Sea energy system. By adopting agenda-setting theory, this study presents a novel framework for studying transitions and offers a valuable perspective to better understand the diversity of incumbents' roles and strategies by looking at various emerging technologies or niches. The remainder of the paper reviews agenda-setting literature and presents the agenda-setting triangle (Section 2). Section 3 introduces the methodological approach. The findings are presented in Section 4, which are discussed in Section 5. Section 6 concludes with key learnings.

2. Agenda-setting

The agenda as an analytical concept first emerged in policy sciences literature in 1971, representing "a general set of political controversies […] viewed as falling within the range of legitimate concerns meriting the attention of the polity" (Cobb and Elder, 1971, p. 905). Though initially processes in which topics reach this agenda were named agenda-building, further work focused on agenda-setting and emphasized the role of problem definitions, institutions and actors (see Kingdon, 1984; Knoepfel et al., 2011; Zahariadis, 2016). The agenda is no static list of issues to be solved, but instead involves a normative process of filtering and prioritization in which subjects continuously drift on and off the agenda (Cobb and Elder, 1971; Kingdon, 1984). The concept has been addressed predominantly in the fields of communication studies (Johnson, 2013; Shaw, 1979) and political sciences (Baumgartner and Jones, 1993; Cobb and Elder, 1972), but is also useful to study (marine) planning practice and energy transition, since it enables a detailed analysis of how issues compete for attention within broader transition dynamics and of drivers or barriers affecting niche innovations to reach support on a regime level. To date, the phenomenon of agenda-setting is underexplored from a transition management perspective. Nevertheless, it is relevant for studying transitions, for it acknowledges the influence of problem attributes, actors and institutions on the societal embedding of technological innovations.

Table 1
Problem attributes.

Attribute	Description	References
Novelty	The degree of newness of certain issues.	(Cobb and Elder, 1972; Downs, 1972; Knoepfel et al., 2011; Portz, 1996; Rochefort and Cobb, 1993)
Urgency	Topics may be perceived more or less urgent, potentially opening up a 'window of opportunity' for action.	(Cobb and Elder, 1971; Knoepfel et al., 2011; Portz, 1996; Rochefort and Cobb, 1993)
Scope	The scale of the issue confronting government and the range of effects it produces. I. e. can an issue be disaggregated into smaller components.	(Portz, 1996; Rochefort and Cobb, 1993; Peters, 2005)
Solubility	Availability of a finite and definable solution, its acceptability and affordability.	(Portz, 1996; Rochefort and Cobb, 1993; Peters, 2005)

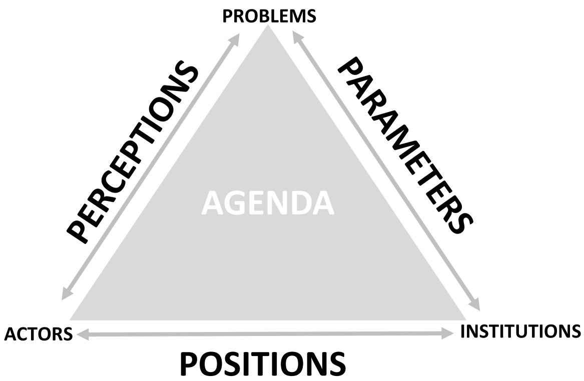

Fig. 1. Visual representation of the agenda-setting triangle.

2.1. *Theorizing agenda-setting*

A considerable body of literature reflects on the factors that drive agenda-setting processes (see Cobb and Elder, 1972; Downs, 1972; Knoepfel et al., 2011; Zahariadis, 2016). Following Knoepfel et al. (2011), it is the interplay of actors, problems and the institutional rules and resources which shape *how* and *why* certain problems are prioritized over others in policymaking.

First, actors (or stakeholders) function as problem initiators or owners, policy entrepreneurs or even form (advocacy) coalitions to put certain issues on the agenda through their actions and interactions with others (Knoepfel et al., 2011). Though MSP scholars address the importance of stakeholder participation in the earliest possible stages (Douvere, 2008; Pomeroy and Douvere, 2008), it is critiqued for its "assumed neutrality" (Tafon, 2017, p. 259) and legitimizing the advancement of "the agendas of elite actors" (Flannery et al., 2019, p. 208). Therefore, we go beyond analyzing actors' access to agenda-setting processes to include the rationale behind their actions. This is no impartial, objective determination, but rather emerges from norms and values tied to the interests of (regime) actors (Flannery et al., 2016; Flyvbjerg, 1998). These powerful actors may derive legitimacy for several reasons: their great public esteem, significant resources, identity as part of influential groups, or strategic location in the socioeconomic structure (Cobb and Elder, 1971). Further, it is not just individual stakeholders who enable or block prioritization; stakeholders are also affected by the wider regime, including dominant behavior, organizational routines and experiences, or lack thereof, which may resist access for innovations. Particularly when others' actions are uncertain or unpredictable, stakeholders may behave opportunistically to protect or advance their personal interests (Beckert, 1999; Ostrom, 2011).

Second, the nature of problem definition affects whether or not they reach and/or rise on the agenda. Four problem attributes appear relevant to investigate the present case: novelty, urgency, scope, and solubility (Table 1). Though individual attributes may reveal underlying reasons for prioritization, they cannot be considered in an isolated manner only; e.g. where novel issues are more likely to be prioritized on the agenda (Rochefort and Cobb, 1993), it is less probable that acceptable solutions exist, assuming it takes time and resources for those to be developed. Collectively, problem attributes constitute a filter through which stakeholders generate individual problem definitions in an inter-subjective manner (Birkland, 2007; Knoepfel et al., 2011). Within resulting narratives, actors can emphasize or downplay certain attributes to advance or obstruct prioritization. As such, both the greater narrative and how stakeholders deploy specific problem attributes to promote their interests are of concern. This problem definition is not set in stone, but rather is a dynamic representation of stakeholders' normative and cognitive frameworks (Saurugger, 2016).

Third, institutions guide how actors make decisions, interact and share power (Ehler, 2014; Greenhill, 2018) and are held critical to the success of any (MSP) initiative (Frazão Santos et al., 2018; Olsen et al., 2014). Various strands of institutionalism exist (Hall et al., 1996; Schmidt, 2010) and have been applied to study energy transition (Andrews-Speed, 2016; Kuzemko et al., 2016; Lockwood et al., 2016). This article conceptualizes institutions as regularized practices established in formal and informal frameworks of norms, rules and procedures, which shape and are shaped by interaction in social contexts (Giddens, 1984; González and Healey, 2005; North, 1992). These institutional arrangements not only shape actors' ideas and interests, they also enable and constrain how actors initially conceive them (Saurugger, 2016; Schmidt, 2010). The existing dominant institutional arrangements (constituting the regime) therefore, are crucial in creating support or constraint for certain agenda topics and solutions depending on how they fit these arrangements. Yet, uncertain, complex and unprecedented situations – e.g. these technological and institutional innovations – may obscure which perceptions are held legitimate and generate institutional ambiguity. In that case, actors may fall back on previous routines or experiences to legitimize their interests (Saurugger, 2016). Or, particularly in absence of an evident authority leading institutional changes, actors may opt for a more opportunistic or risk-averse attitude. Nonetheless, institutional path dependencies remain a hindering factor in the emergence of innovations (Geels, 2004; Rosenbloom et al., 2019).

2.2. The agenda-setting triangle

Based on the three dimensions of agenda-setting, we concentrate on the interdependencies between them: perceptions, parameters and positions (Fig. 1).

Actors form individual *perceptions* of a topic through interaction with others (Birkland, 2007; Knoepfel et al., 2011). Independent of a topic's manifestation, varying interpretations and considerable competition may emerge among actors over problem definition and solubility. Normative and cognitive frameworks mediate the filter through which they perceive, emphasize or downplay the four problem attributes (i.e. novelty, urgency, scope and solubility). *Parameters* influence the extent to which difficulties can be converted into problems and prioritized. Both formal planning processes and informal organizational routines delineate what type of issues are prioritized (Ostrom, 2011). In practice, these emerge through available information and networks to share information, and the range of outcomes enabling issues to be considered. Actors' *positions* in the regime's agenda-setting processes (including their bargaining power and influence) are shaped by their rights – formally established through regulatory frameworks and informally though inter-organizational relations – and resources, such as knowledge and power. The perceived legitimacy of actors is even said to be of at least equal importance compared to the legitimization of the problem itself (Cobb and Elder, 1972). As such, the regime becomes dominant through its ability to mobilize more resources than niches do (Avelino and Rotmans, 2009) and not only shapes what is being discussed, but also how issues are discussed (Geels, 2014).

When studying institutional designs and processes of agenda-setting, both institutional theorists (Alexander, 2005; González and Healey, 2005) and agenda-setting scholars (Ansell et al., 2016; Saurugger, 2016; Zahariadis, 2016) call for a contextualized understanding of the object under study. Comparably, transitions literature poses that niche-regime movements largely depend on the ability to seize opportunities as they arise (Diaz et al., 2013; Elzen et al., 2012; Tongur and Engwall, 2017). Such windows of opportunity may enable niche innovations to break through and destabilize existing regimes (Geels and Schot, 2007). Alternatively, niche-regime movements may occur by stretching the regime favorable to the uptake of niche developments or by making niches conform to an existing regime (Mylan et al., 2019; Smith and Raven, 2012).

As follows, this article holds that the agenda-setting process depends on how perceptions, positions and parameters align or conflict across niches and regimes. Opportunities are identified when (a combination of) perceptions, parameters or positions within the niche align with those on the regime level, enabling the niche development to reach and/or rise on the agenda, e.g. those with influential positions in the regime see value in the niche development. Barriers emerge when (a combination of) perceptions, parameters or positions within the niche do not match those on the regime level, limiting a niche development from reaching and/or rising on the agenda, e.g. short-term oriented parameters of the regime limit the prioritization of niche developments perceived as long-term solutions.

3. Methodology

A qualitative research design is adopted to examine the agenda-setting processes surrounding offshore energy storage and transport alternatives, and reconstruct the corresponding positions, perceptions and parameters. Therein, a distinction is made between (1) offshore energy storage systems, (2) interconnectors, potentially between offshore windfarms, and (3) green hydrogen production offshore.

A wide range of publicly available governmental documents dealing with the MSP process and offshore energy published between 2019 and September 2021[1] (see Table A1) were selected and explored for the presence of the following search words: storage, interconnection, international energy connections or hydrogen. Including documents outside of the formal MSP process (e.g. parliamentary minutes) enabled us to consider the influence of wider policy and institutional contexts, which are important in informing past and future MSP processes. This yielded an initial overview of key perceptions and (governmental) actions undertaken in regard to offshore energy storage and transport. Although the term 'system integration' also could have pointed to further general insights, the focus on explicit manifestations of technical solutions in documents allowed for a more-detailed, in-depth analysis of their prioritization. This document analysis provided a basis for the preparation of 22 semi-structured expert interviews conducted between June and September 2021. The interviewees came from industry, government, network operators and academia (see Table A2) and were selected for their (professional) involvement in the MSP process, e.g. as a planner or policymaker, participating stakeholders or

[1] Taking the publication of the scoping document for the marine spatial plan as the formal start of the MSP process for the development of the 2022-2027 marine spatial plan, the analysis includes documents published between 2019 and September 2021. Appendix 1 presents more details on the selection of documents.

Table 2
Overview of three arenas through which stakeholders may influence the agenda.

How	What	Who
Formal, written view	Stakeholders may submit a written reply to the design of the plan's environmental impact assessment or draft version, as required by Dutch law (*Algemene wet bestuursrecht*, 2021; *Waterbesluit*, 2020). The government responds through the established plan.	All interested stakeholders, made aware through a publication in the Government Gazette.
Information sessions	Policymakers presents policy developments to stakeholders on various sub-domains of the marine spatial plan (e.g. energy, shipping et cetera). Government deploys these sessions to include stakeholders' technical expertise, find support and foster understanding for resulting policy.	Majority of sessions are organized within existing networks of stakeholders, including the *North Sea Dialogues* and the *Community of Practice North Sea*.
Informal contacts	Stakeholders with established contacts within the various ministries may utilize those and take initiative to set meetings and present their projects and associated interests.	Stakeholders with a long history of using the offshore area and highly valuable informal connections with relevant policymakers.

experts. The present research is conducted within the DOSTA project,[2] which provided an initial network for the purposive sampling of interviewees. Interview guides were based on the three dimensions of agenda-setting (Section 2.2) and adapted based on the expertise and position of each interviewee. Interviews lasted between 30 min and 1 hour and were audio-recorded. Interviews were transcribed during the data collection process which permitted issues from early interviews to be fed into the subsequent interviews and explored in greater depths. Also, it allowed for an additional check on the quality of gathered data and correction of any problems along the way. All resulting transcripts were checked with the experts.

Next, data were analyzed using Atlas.ti (qualitative research software) following the developed codebook (see Table A3). Codes were developed in an iterative manner, i.e. defining initial code categories deductively, and later adjusting inductively through an active reading of data (Hennink et al., 2020). The first round of coding focused on critically reflecting upon emerging issues and the meaning they convey, and utilizing these insights to develop effective codes. In a second round of coding, these code categories were applied to the data to validate the coding, eventually leading to a list of ten codes. By returning to the documents as well as the interview data throughout the analysis, potential discrepancies and nuances could be uncovered.

4. Results

The following section reconstructs the perceptions, parameters and positions in Dutch MSP processes and illustrates how emerging opportunities and barriers affect the agenda-setting of offshore energy storage, interconnectors and green hydrogen production offshore. We wrap up by presenting the complications for these innovative and long-term solutions to emerge and move onto the agenda in the future.

4.1. Arenas for agenda-setting

Participation processes and stakeholder input are seen as an integral part of Dutch policymaking.[3] Three arenas for agenda-setting are identified (see Table 2), as established by law and the informal institutional environment.

Though a majority of non-governmental experts praise the Dutch MSP process for its easy access and inclusivity [I1; I2; I3; I4; I5; I7; I9; I10; T1; T2], the identified arenas are better tailored to actors with sufficient resources and established governmental connections, i.e. inside the regime. Two dominant reasons help explain why access to these arenas is easier for those well-connected to or part of the dominant regime. First, the fragmentation of responsibilities (see Table B1) on North Sea matters has resulted in a variety of policy processes taking place simultaneously – each with its own participation process – whose outcomes each feed into the marine spatial plan.[4] This provides advantages to those with sufficient resources to follow all, yet, for those stakeholders without sufficient time, money or staff, it is demanding to even be aware of all formal and, most prominently, informal opportunities for agenda-setting. Interviewed policymakers refer to the use of the existing networks for information sessions [G1; G3; G4]. Though the Community of Practice North Sea[5] is open to all those interested and presents opportunities for new industry-government contacts, the North Sea Dialogues[6] include a fixed group of key stakeholders.

Nevertheless, unclarity exists about these participation opportunities [I1], increasing the time and effort needed for participation. This is accurately illustrated by one interviewed policymaker [G3], who critically reflects on the unintentional organization of multiple information sessions within one week by various ministries on similar topics, but for separate marine policy processes. Although

[2] The DOSTA project (Development of Offshore Storage and Transport Alternatives) is a collaboration between the University of Groningen, Utrecht University and 10+ industrial partners active in offshore energy.

[3] There is a long tradition of stakeholder participation for consensus-based decision-making, i.e. the 'polder model'. See Glasbergen (2002) or Van Der Linde et al. (2021) for more on this.

[4] Examples mentioned include the exploration of landing points for OWE (*VAWOZ 2030*), the integral infrastructure study 2030-2050 (*Integrale Infrastructuurverkenning 2030-2050*) and the roadmap towards OWE in 2030 (*Routekaart Wind op Zee 2030*).

[5] See https://www.noordzeeloket.nl/omgeving/community-practice-noordzee/

[6] See https://www.noordzeeoverleg.nl/

Table 3
Overview of themes deemed most urgent in each interview (in alphabetical order).

Themes (# times mentioned)	Examples
Clarity in long-term policy (7)	Lacking clarity in spatial integration of future uses, no clear future plan post-2030 developed with industry, no central tenets exist of how to use our resources sustainably.
Ecological carrying capacity (3)	Doubts if OWE ambitions post-2030 can be realized in view of strict legal boundaries on ecological impact, too little knowledge on ecological impacts of OWE.
Financial support (5)	High (economic) risks in innovative projects for private parties, non-existent market for hydrogen, lacking support for reaching short-term climate targets.
Regulatory barriers (2)	Uncertainty in requirements for innovation projects, limiting regulatory framework.
Strengthening grid infrastructure (2)	Current infrastructure cannot handle future implementation of large-scale storage and transport solutions, congested electricity grid onshore.
Timing of reuse of existing infrastructure (3)	No combined 2050 vision of the development of RE and the dismantling of fossil fuel production offshore, unknown what existing infrastructure has potential to be reused for carbon capture and storage or hydrogen production in light of their lifetime.

Table 4
Overview of perceptions of the offshore storage and transport solutions under study, as based on the analysis of interviews and policy documents.

	Novelty	Urgency	Scope	Solubility
Offshore energy storage	Offshore storage options are still in low technological readiness levels (research and development)	No shared understanding on the timeline for potential implementation, but not before 2030. Energy storage may emerge as a more urgent solution when the offshore renewables exceed the electricity demand onshore.	Storage is perceived as a means for system integration. It is just one of many solutions towards an integrated offshore energy system.	Promising offshore storage options for offshore with sufficient capacity and duration include pumped-hydropower, compressed air energy storage and power to gas applications (e. g. hydrogen). Hydrogen storage is dominant among stakeholders, lacking awareness about other storage options.
Interconnectors	Regular interconnectors already exist. WindConnectors utilize same technology and only differ in what points they connect (i.e. offshore windfarms), however, they have not been implemented yet.	Positioned as solution to: grid congestion, economic impacts of variable supply and demand, security of energy supply. These challenges are not perceived as most urgent by interviewees (found feasible post-2030). Sense of urgency is further compromised by awareness that exporting renewables does not contribute to achieving national carbon reduction targets.	Interconnection is perceived as a 'simple' solution contributing to a more integrated energy system.	WindConnectors enable more economically efficient interconnection: since the electricity grid from the windfarm to shore already exists, only the windfarms have to be connected across borders. Regulatory barriers create uncertainty for economic feasibility of WindConnectors.
Offshore hydrogen production	Though hydrogen has long been used as a resource for industrial processes, green hydrogen has never been produced offshore.	Government aims for implementation post-2030, however, investments and regulatory clarity are needed now to enable post-2030 implementation due to needed technical development and long development trajectories.	Framed as a 'one solution fits all' approach. A wide variety of applications exist.	Serious doubts exist if hydrogen production is technically and economically feasible offshore. No agreement exists on who will be main consumers of hydrogen and if demand will be sufficient.

recognizing the existence of the inter-ministerial North Sea consultation body (*IDON*), another policymaker corroborates the lack of intra-governmental communication: "within the ministry, [the organization] is still somewhat fragmented. […] to really bring [various policies] together within our own organization, that is something that is being worked on right now" [G2]. This lack of communication between and within ministries disproportionately affects newcomers, for they generally lack widespread connections across ministerial departments and are therefore less able to broadly express their interests.

Secondly, an established group of actors exists with a long history of offshore activities and highly valuable informal connections with relevant policymakers. Particularly, O&G producers have been of great economic importance to the Netherlands historically and more recently, OWE developers solidified their position by contributing to the decarbonization of the energy system. Experts involved in O&G and OWE sectors substantiate this by stating that they respectively "know who is behind what door" [T1] and "are in touch with officials from the Ministry [of Economic Affairs and Climate Policy] almost daily" [I8], suggesting that they can initiate greater opportunities for agenda-setting. Also, results imply a greater receptivity to these interests with interviewed policymakers stating their dependence on industry's technical expertise. This is particularly influential for the (low) prioritization of offshore energy storage, largely propagated by innovators new to the arena (see Section 4.2.1), and implies path dependencies sustaining incumbents' vested interests and influence.

Overall, these arenas for agenda-setting provide various opportunities for actors, although the results demonstrate they are better tailored to regime actors and risk excluding those new to the playing field to penetrate the dominant regime. Perceptions of these incumbents thus appear to hold greater ability to legitimize prioritization and may 'lock-in' current technological and institutional arrangements.

4.2. A variety of challenges and solutions for offshore energy

The integration of large-scale renewable energy generation in the offshore energy system presents a wide variety of challenges (Table 3). Two interviewees consider the challenge a fundamentally technical one [A2; I14] – e.g. strengthening grid infrastructure – but others regard ecological, economic or governance challenges as most urgent. The results reveal that the perceived challenges complicate the niche developments under study to penetrate the regime.

The offshore energy system deals with a wide variety of multi-faceted and complex issues (see Table B2). Interviewees broadly agree (20 of 22) that these cannot be handled in isolation, that no easy solutions exist and the need for shared understandings of issues. A clear distinction in emphasis exists between the scope of priorities of government as compared to the offshore energy sector. The Dutch government focuses on achieving the 2030 carbon reduction targets (which are legally binding through the Paris Agreement and the National Climate Agreement) through a large-scale rollout of OWE (Minister of Economic Affairs and Climate Policy, 2020b). Alternatively, the offshore energy sector emphasizes the need for sustaining their business cases post-2030 [I5; I8; I9; T1]. Both O&G and OWE developers deal with long lead times up to 10 years. Accordingly, out of the 10 interviewees from O&G and OWE sectors and respective network operators, 7 explicitly call for long-term guidance to substantiate investment decisions for projects after 2030. These conflicting timelines complicate the agenda-setting process; governmental focus on 2030 shrinks the scope of the agenda, leaving little room for the prioritization of innovative solutions potentially crucial post-2030, which require further testing and development. More generally, the sectoral focus on OWE and related short-term approach narrows down actors' perceptions of the possibilities of an energy transition and, subsequently, which niche developments may be taken up by the regime.

Moreover, the inherent uncertainty surrounding novel solutions hinders their perceived solubility and consequently prioritization. The development of innovative solutions does not only bring about significant technical and economic risks, the lack of clear regulatory frameworks, permitting processes or guiding policies also fuel uncertainty for private parties [I3; I5; I6; I7; T1]. The following three accounts of perceptions and policy developments surrounding offshore energy storage, interconnection and offshore hydrogen production (Table 4) illustrate how these obstacles affect prioritization.

4.2.1. Low-priority for offshore energy storage options

Dutch energy policy documents position energy storage solutions as potential relief for grid congestion or as a means to increase flexibility (Minister of Economic Affairs and Climate Policy, 2020c, 2020d). Though technical development is still in its infancy, some interviewees hold that energy storage is among the key ingredients for an energy transition [A1; A2; G5]. Correspondingly, subsidies are available for energy storage projects in all technological readiness levels, albeit under the theme of system integration (TKI Wind op Zee, 2019). The positioning under the large scope of system integration allows the Dutch government to refrain from stating decisive technological preferences and to remain technology-neutral. Although several interviewed policymakers signify the need for decision-making [G1; G2; G3] – for they cannot keep supporting all innovations and vagueness now may delay innovation needed to achieve the 2030 climate targets – the results imply that learning and innovation do not yet translate into institutional changes to fuel and allow such decision-making. Rather, the current institutional regime sustains the focus on the 2030 targets. This institutional inertia is also captured by the lack of regulation or policy guaranteeing future implementation or incentivizing market parties to initiate (pilot) projects.

A similar inertia is observed among industry stakeholders, corresponding to the lacking awareness on types of offshore storage technologies. Out of the eight industry interviewees who identify the mismatch of supply and demand and system integration as challenges facing the offshore energy system (see Table B2), only two consider offshore energy storage to be (part of) the solution. When confronted with offshore energy storage as a potential solution, most start describing hydrogen-based solutions. Concepts of offshore mechanical energy storage (e.g. pumped-hydro or compressed air energy storage) resonated only with those representing the Dutch branch organizations for energy storage (*Energy Storage NL*; I7) and OWE (*NWEA*; I8). Where the awareness of storage types is self-explanatory for the former, its integration in the current tender system for OWE[7] explains awareness for the latter. Aforementioned findings (Section 4.1) allude to a comparatively greater ability of the OWE sector to influence the agenda as regime actor and therefore push for a higher prioritization. However, 2 of 3 interviewed OWE developers indicate the regulatory vagueness – i.e. unclear certification of renewables and storage systems – as a deterrent for promoting and prioritizing storage systems. Thus, the attention given to offshore energy storage appears marginalized by the current (narrow) governmental scope of the agenda and potential energy transition.

4.2.2. Undisputed need for interconnection

Opposed to the low awareness of offshore energy storage, interconnectors are a widely accepted and largely unquestioned solution. Though no clear objectives or long-term visions exist in policy, interviewees broadly agree on the utility of interconnectors to increase

[7] The tender procedure for OWE area *Hollandse Kust (west) lot VII* includes criteria on the integration of innovations for system integration.

flexibility in the energy system. Existing interconnectors already facilitate electricity transport with the UK, Norway and Denmark. However, so-called WindConnectors (i.e. interconnection between offshore windfarms rather than shorelines) are yet to be implemented. WindConnectors are positioned as a more economically attractive alternative [T2], but ongoing regulatory difficulties compromise its economic feasibility [G3]. Namely, the EU obligation that minimum 70% of interconnection capacity needs to be constantly available for regular electricity trading (European Commission, 2019) constrains the capacity for transporting locally generated OWE. Further, existing interconnectors rely on bilateral agreements between governments and lack guidance from international legal frameworks. Also, increasing OWE export capacity does not contribute to achieving national carbon reduction targets [T2], potentially compromising a governmental sense of urgency in developing interconnectors.

It becomes clear that the challenges to which interconnection may provide a solution (e.g. grid congestion, variable supply and demand, security of supply) are not perceived as sufficiently urgent for industry actors to (currently) undertake action. Also, current regulations require the government to select smart connections, who then commissions offshore transmission system operator *TenneT* for development and construction [A2]. Yet, zero mention of interconnectors appears in the parliamentary minutes of the Dutch House of Representatives' committee on climate and energy policy. Nonetheless, WindConnectors are included in plans for future offshore windfarm lot *IJmuiden Ver* (Minister of Economic Affairs and Climate Policy, 2019). Interestingly, the above indicates that a solution perceived as highly soluble (i.e. technically feasible and widely accepted), small in scope and familiar does not automatically imply (high) prioritization. Rather, the low sense of individual urgency and the lack of a supporting regulatory framework moving beyond the current temporal and sectoral targets undermine regime uptake.

4.2.3. *The hydrogen hype*

Hydrogen is historically used as resource for industrial processes, when produced with natural gas. Connecting hydrogen production facilities to OWE enables the production of 'green hydrogen'. Regardless of the momentum hydrogen currently seems to possess – see the existence of information platforms (*H2Platform, WaterstofNet*), promotion campaigns (*MissieH2, Nederland Waterstofland*, Hydrogen Valley) and subsidies (available through the climate and transition fund) – no shared conviction exists on the utility of hydrogen as an energy carrier for OWE. Two general sentiments are observed. First, great confidence and enthusiasm are visible among regime actors involved in O&G; as two representatives state "it is an important lifeline for us" [T1] and "it is a premium product from renewable energy" [I1]. Namely, given a diminishing business case for fossil fuel production pending an energy transition, O&G producers must search for alternative ways to sustain their position in the regime; offshore green hydrogen production allows for a reuse of existing infrastructure and lengthening of assets' lifetime. Governmental documents recognize the following benefits: hydrogen transport is less expensive than electricity transport for far-shore OWE (Cleijne et al., 2020; Peters et al., 2020), hydrogen offers greater flexibility in the energy system and a stable energy supply (Minister of Economic Affairs and Climate Policy, 2020c), and pipeline transport bypasses the nearshore spatial competition for electricity cable landings and the already overloaded onshore electricity grid (Minister of Economic Affairs and Climate Policy, 2020a). This framing as a one-size-fits-all solution fits the current technological and institutional regime and helps sustain, what several interviewees name, the 'hydrogen hype'.

Regardless, policymakers and OWE developers seriously question the aforementioned promises, resulting technical and economic feasibility and the desirability of allocation offshore [G2; G3; I8]. Uncertainty most notably persists surrounding future hydrogen demand and potential end-users [I10; T2]. Current policy foresees green hydrogen to become economically feasible offshore only post-2030 (Minister of Economic Affairs and Climate Policy, 2020e, 2020f) and the harsh offshore environment presents additional technical difficulties. Additionally, no supporting regulatory framework, market structure or reliable, long-term financial support mechanisms presently exist incentivizing developments of large-scale offshore electrolyzers [I11; T1]. Nevertheless, first steps are taken by positioning hydrogen as a vital part of the 2050 energy system, see e.g. the national strategy on hydrogen (Minister of Economic Affairs and Climate Policy, 2020a) and efforts to develop a national hydrogen pipeline network (State Secretary for Economic Affairs and Climate Policy, 2021). Overall, the large scope and governmental ambiguity allow green hydrogen to be framed as a one-size-fits-all solution by a wide variety of stakeholders, yet it simultaneously complicates the development of a concrete vision or further prioritization of specific hydrogen applications.

4.3. *The temporal parameters of MSP processes*

Offshore energy storage, interconnectors and offshore green hydrogen production are positioned, both by interviewees and in policy, as long-term solutions, i.e. post-2030. However, Dutch MSP processes appear less receptive to long-term solutions beyond the six-year timeline of the marine spatial plan [G3]. Governmental urgency instead lies with the legal obligation to meet the 2030 carbon reduction targets [G3; I1, I8; I9; I10]. Industry stakeholders also point to the four-year political cycle and politically-determined policy context in which MSP operates as an important institutional barrier hindering the development of any long-term policy [I1; I4; I5; I8; I9; I10; T1]. Moreover, a distinction must be made between a collective perception of urgency and solubility, and consecutive individual action. To illustrate, while interconnector desirability is broadly accepted, Section 4.2.2 reveals that actors refrain from undertaking action when not formally responsible. Instead, government is held responsible for coordination. Similarly, without supportive 'rules of the game' establishing reliable guidelines and responsibilities beyond 2030, actors lack incentive to advance novel offshore energy solutions and the regime rather remains path dependent.

Additionally, insufficient knowledge of offshore energy storage and transport alternatives hinders the creation of any long-term, comprehensive vision on its integration in the energy system. The novel nature of innovation implies the need for further research and development, before large-scale implementation is possible. All interviewed stakeholders acknowledge the uncertainties surrounding marine ecosystems and environmental consequences of human activities. Numerous research projects (WOZEP, *De Rijke*

Table A1
Overview of analyzed documents.

Document title	Date	Author
Parliamentary minutes of general meeting held on 13 February 2019 on Climate and Energy	February 2019	House of Representatives
Parliamentary minutes of general meeting held on 21 February 2019 on Climate and Energy (second term)	February 2019	House of Representatives
Letter to Parliament – Progress execution roadmap offshore wind energy 2030	April 2019	Minister of Economic Affairs and Climate
Parliamentary minutes of general meeting held on 16 May 2019 on Climate and Energy	May 2019	House of Representatives
Parliamentary minutes of general meeting held on 6 June 2019 on Climate and Energy (follow-up of general meeting of 16 May 2019)	June 2019	House of Representatives
Parliamentary minutes of general meeting held on 4 September 2019 on Climate and Energy	September 2019	House of Representatives
Scoping report for Strategic Environmental Assessment of National Water Program 2022–2027	October 2019	Arcadis (commissioned by Ministry of IWM)
Parliamentary minutes of general meeting held on 28 November 2019 on Climate and Energy	November 2019	House of Representatives
Response note Procedure National Water Program 2022–2027	January 2020	Central government
Parliamentary minutes of general meeting held on 12 February 2020 on Climate and Energy	February 2020	House of Representatives
Letter to Parliament – Cabinet's vision hydrogen	March 2020	Minister of Economic Affairs and Climate
Letter to Parliament – Future growth offshore wind	May 2020	Minister of Economic Affairs and Climate
Letter to Parliament – Governmental vision market development for the energy transition	June 2020	Minister of Economic Affairs and Climate
The North Sea Agreement	June 2020	Physical Environment Consultative Council
Letter to Parliament – Follow-up regarding commitments lack of transport capacity	June 2020	Minister of Economic Affairs and Climate
Parliamentary minutes of note meeting held on 10 June 2020 on Climate and Energy	June 2020	House of Representatives
Parliamentary minutes of general meeting held on 2 July 2020 on Climate and Energy	July 2020	House of Representatives
Letter to Parliament – Result of subsidy-free tender for offshore wind energy Lot V Hollandse Kust (north)	September 2020	Minister of Economic Affairs and Climate
Advise agreements on governance of the North Sea Dialogues	September 2020	Physical Environment Consultative Council
Parliamentary minutes of note meeting held on 7 October 2020 on Climate and Energy	October 2020	House of Representatives
Parliamentary minutes of note meeting held on 26 November 2020 on Climate and Energy	November 2020	House of Representatives
Letter to Parliament – Progress policy agenda climate vision hydrogen	December 2020	Minister of Economic Affairs and Climate
Letter to Parliament – Offering the North Sea Energy Outlook with appreciation	December 2020	Minister of Economic Affairs and Climate
Parliamentary minutes of note meeting held on 3 December 2020 on Climate and Energy (follow-up)	December 2020	House of Representatives
Parliamentary minutes of committee debate held on 10 June 2021 on Climate and Energy	June 2021	House of Representatives
V Parliamentary minutes of note meeting held on 7 July 2021 on Climate and Energy	July 2021	House of Representatives
Parliamentary minutes of committee debate held on 8 September 2021 on Climate and Energy	September 2021	House of Representatives
Participation plan National Water Program 2022–2027	November 2019	Central government

Noordzee, North Sea Energy, PosHYdon, HyWay27), stakeholder networks (Community of Practice North Sea, North Sea Dialogues, Nexstep) and subsidy structures (*TKI Energie*, SDE++, HER+, DEI+, Horizon 2020; Connecting Europe Facility) have been set up collectively by government, industry and knowledge institutes to address both knowledge gaps. Though it suggests some prioritization, these funding opportunities are tailored to the larger theme of system integration and cover more than just storage or transport solutions, risking a lock-in by prioritizing solutions propagated by dominant existing regime. What industry stakeholders and academic experts consider of greater value is to 'start doing' [A1, I4, I7], but the risk-averse and safety-first attitude embedded in planning and permitting processes postpones the development of (large-scale) demonstration projects [I5; I10]. A complex tension arises. The knowledge gap hinders policymakers' ability to anticipate on future developments. Conversely, knowledge development itself is hindered by the wish to regulate all before 'putting something in the water'.

Given the uncertainties, Dutch policymakers consciously opt for an adaptive MSP process: "we try to move along" [G1]. The marine spatial plan makes spatial reservations for 'uses of national importance', rather than providing a detailed zoning plan of potential uses. Yet, embracing an adaptive approach risks generating solely incremental progress based on emerging insights and jeopardizes the uptake of innovative, out-of-the-box solutions with long-term potential. It allows policymakers to postpone decision-making or remain ambivalent about goals to allow for future adjustments. This does not mean that no attempts have been made for more long-term plans: the North Sea Spatial Agenda 2050 published in 2014 presents a "form-free exploration of ambition, potential, challenges and potential measures" (Ministry of Infrastructure and Water Management and Ministry of Economic Affairs and Climate Policy, 2014, p. 6). Yet, aside from establishing the need for closer study, it did not provide an explicit vision for the development of offshore energy storage

Table A2
Overview of expert interviewed experts. (A: academia. G: government. I: industry).

Interview code	Sector
A1	Research
A2	Research
G1	Policy and regulation
G2	Policy and regulation
G3	Policy and regulation
G4	Policy and regulation
G5	Public funding agency
G6	Public funding agency
I1	Oil and gas
I2	Marine energy innovation accelerator
I3	Oil and gas
I4	Oil and gas
I5	Oil and gas
I6	Oil and gas
I7	Energy storage
I8	Offshore wind
I9	Offshore wind
I10	Oil and gas
I11	Oil and gas
I12	Offshore wind
T1	Transmission system operator
T2	Transmission system operator

and alternative transport solutions.

In sum, the institutional frame of the MSP process impedes long-term decision-making under great uncertainties, by limiting the temporal parameters of the agenda to 2030 with OWE as the prevailing solution and by not allowing step-by-step learning to translate into institutional changes. Currently, actors largely avoid actively engaging in debates on governance matters. However, if offshore energy storage and transport solutions are deemed desirable for the future energy system, a careful balance must be found in embedding room for adaptability whilst providing sufficient regulatory certainty to accommodate long development trajectories.

5. Discussion

The results show that MSP processes may support an energy transition through the (1) three arenas for agenda-setting, (2) close government-industry relations and (3) existence of stakeholder networks. However, the following paragraphs illustrate how the identified barriers affect the role of MSP in energy transition.

First, the identified arenas for agenda-setting – although including various moments for stakeholders to make their voice heard – provide greater opportunities for incumbent actors with established governmental connections compared to those new to the playing field. This risks a lock-in; niche actors wishing to prioritize innovations come to depend on incumbents for gaining access and conveying their interests (Almpanopoulou et al., 2019; van der Loos et al., 2020). Offshore hydrogen production owes its prominence on the agenda, at least partly, to an explicit link with the dominant regime, i.e. the O&G industry. Yet, its prioritization can further be explained by its broad scope, yielding great support on a general level (Schmidt and Donsbach, 2016). In comparison, offshore energy storage and interconnectors receive less attention and lack a direct connection to regime actors who may legitimize prioritization.

Second, the short-term fixation embedded in Dutch MSP practice curtails the parameters of the agenda and subsequently hinders prioritization of the long-term solutions under study. This creates concerns already presently: given the long lead times of offshore infrastructure and uncertainties surrounding development, additional demonstration projects and reliable institutional arrangements are required to justify long-term investment decisions. The technology-neutral approach embedded in Dutch subsidy mechanisms and within wider EU policy (Cambini et al., 2020) risks further path dependencies by adopting currently cheap and mature technology over investing in more costly technology with long-term transformative potential. Such technology-neutral approach is harmonious with the global emphasis on adaptive governance (Craig, 2019; Douvere and Ehler, 2011; Greenhill et al., 2020) for offshore energy technologies (Bradshaw et al., 2018) and the risk-averse attitude institutionalized in Dutch policymaking. We further discuss the implications of taking an adaptive approach below.

Third, the innovative nature of the technologies under study induces a certain institutional ambiguity, which obscures the parameters in which the agenda is formed and muddles actors' perception of the solubility of innovations. The identified unclarity on responsibility and ownership structures does not by definition stem from deliberate design; rather, it emerges from continuous incremental adjustments to an offshore energy system focused on energy generation and fossil fuels, instead of an integrated system including storage or conversion. Although not problematic alone, corresponding path dependencies resulted in a narrow perception of an energy transition, limited to OWE generation as a solution until 2030. Thus, institutional changes are needed to enable the prioritization of long-term technological innovations aiding a transformation of the offshore energy system. However, despite the close government-industry relations, existence of stakeholder networks and widely-shared understanding that institutional changes are

Table A3
Codebook.

Code	Description	Example from data	Theoretical dimension
Access to arenas for agenda-setting	Points of access and associated actions for actors to influence the agenda. Also code instances that depict lack of access to certain processes or arenas. Do not include here the underlying reasons for having (no) access.	*We are the member for energy in the North Sea Dialogues. I am of course involved in the spatial planning of the National Water Plan and as such the Program North Sea.*	Position
Power relations	Use this code for any reference to actors' ability to manipulate, persuade or prevent topics from being prioritized. These references may include a relation to a certain group (indebted or member), availability and mobilization of resources, actors' location in socioeconomic structure, or the perceived legitimacy of an actor.	*So we are a very small company. This morning I was talking with an English company, who have a whole department for compliance. We just say 'do what you say that you do and we will be fine'. […]. For us it is quite a challenge to map our added value and our infrastructure assets. On the other hand, our connection to large companies helps us to garner publicity for such issues in The Hague and the public sector.*	Position
Inter-organizational relations	Actors perceive their influence on agenda-setting processes to be impacted by other actors' behavior with the control over the final decision or due to the division of responsibilities.	*Well, that is a very complicated process, because we as civil servants wanted more, but the ministers did not agree. The cabinet stepped down, which did not help. Thus, this is now included as an action in the program. First, we had the proposition to appoint three or four areas, but that did not make it politically. So we now try to do that until October [2021], to make sure to, at least, take the next step.*	Position
Range of outcomes	Certain topics may be in- or excluded from agenda-setting processes at the outset due to them falling out of the scope of formal planning processes or due to not fitting with organizational routines or experiences. Do not use this code for specific perceptions of offshore storage and transport concepts.	*For the next five years it takes an advance on the spatial development. For the longer term, that is the shame of it, the Program North Sea, as far as we are concerned, does not look far enough ahead. The spatial challenge is much bigger then.*	Parameters
Information availability	Use this code for any mentions of (lacking) information.	*There are many [knowledge] gaps. A knowledge program is currently being set up for that. Those uncertainties, you should not takes those decisions, but rushing them is also unwise I believe.*	Parameters
Information networks	Use this code for any discussion on sharing of knowledge/ information among actors and the underlying reasons for sharing.	*[We] are not a lobby organization of course. In my contacts with EZK, it is mostly about informing what [we] are doing and the potential hurdles we encounter.*	Parameters
Novelty	Use this code for any reference the innovations or the novelty of certain issues and/or energy storage and transport solutions.	*Well, in the field of hydrogen, it is a relatively new problem, because hydrogen has only since a few years been in the picture. It is somewhat a new issue, because we over time start to use more and more electrons. In the beginning it was obvious that our houses would be connected to the gas grid for heating. That is changing.*	Perception
Urgency	Use this code for any mentions of urgency surrounding particular issues. Common phrases to search for include: *urgent* (urgent), *onmiddellijk* (immediately)	*What is most urgent? I believe the ecology, that is legally the strictest boundary. The others are a matter of finances.*	Perception
Scope	Use this code when discussing the scope of a certain issue and the range of effects it produces.	*But you can never [combine OWE and hydrogen] in isolation. You need to include it into the planning of your offshore windfarms, the planning of your infrastructure et cetera.*	Perception
Solubility	Use this code when the availability, acceptability and affordability of solutions are discussed.	*The cost issue also plays a role. We can also locate it at the Dogger Bank so to speak, but that automatically presents a very expensive solution. So you need to look for a balance of construction costs and mitigating measures.*	Perception

needed, debates on governance matters are largely avoided. This institutional inertia is of particular relevance for offshore energy storage and interconnectors, which lack explicit support from incumbents – such as the O&G industry or OWE sector – serving as influential resistors of change (Almpanopoulou et al., 2019; Kuzemko et al., 2016; Lockwood et al., 2019). Simultaneously, incumbents from the O&G sector utilize their position in the regime to advance the role of hydrogen in the future energy system, confirming earlier research identifying enabling roles of incumbents (Altunay et al., 2021; Ampe et al., 2021; Mäkitie et al., 2018). Although this implies that the identified institutional inertia is, at least partly, due to powerful incumbents protecting their interests (Flynn, 2016; Spijkerboer, 2021), we again recognize a connection to the governmental risk-averse and adaptive approach to long-term governance. The latter deserves elaboration.

Adaptive governance plays an inherent part of governing for energy transitions, with scholars calling for sufficient adaptive and absorptive capacity to allow for institutional change (Andrews-Speed, 2016; Armitage and Plummer, 2010). However, an adaptive approach also enabled Dutch policymakers to remain ambivalent in their long-term visions for a future offshore energy system. This ambiguity may be adaptive in theory, but risks a resisting regime and overlooking innovation in practice. As such, the institutional regime hinders short-term agenda-setting of niche developments and long-term energy system change. Nevertheless, we recognize the value of an adaptive approach in addressing the structural sources of instability and uncertainty confronting transitions. Rather than aiming for total stability in policy, we must strive for "stabilizing the overarching orientation of [..] policy" (Rosenbloom et al., 2019,

Table B1
Responsibilities of government actors for North Sea and offshore energy policy (based on (Rijksoverheid, n.d.).

Organization (abbreviation)	Responsibility
Ministry of infrastructure and water management (IenW)	- Coordinating actor for all North Sea policy. - Develop policy on shipping (safety) and sand extraction.
Ministry of economic affairs and climate (EZK)	- Energy policy – from OWE to oil and gas extraction – and telecom cabling. - Together with BZK responsible for spatial integration of large energy projects, such as OWE.
Ministry of agriculture, nature and food quality (LNV)	- Policy on nature conservation and fisheries - Deals with ecological impacts in permitting procedures
Ministry of interior and kingdom relations (BZK)	Spatial planning of North Sea (through National Water Plan) Together with EZK responsible for spatial integration of large energy projects, such as OWE.
Ministry of defense	Manages military training areas offshore Monitors the offshore area through the Coast Guard
Ministry of foreign affairs (BZ)	- Together with EZK works on trade promotion (such as for OWE) for Dutch companies wanting to do business abroad or foreign companies doing business in the Netherlands.
Netherlands enterprise agency (RvO)	Executive branch of EZK and LNV: - Administers tender processes for OWE development - Coordinates preparatory site surveys for OWE - Facilitates information sessions for OWE sector and manages contacts with business and branch organizations - Supports EZK in communication, stakeholder management and trade promotion. - Coordinates permitting processes of large energy projects (supporting EZK)
***Rijkswaterstaat* (RWS)**	Executive branch of IenW: - Coordinator of North Sea - Manages permits, surveillance and enforcement for activities offshore - Executes research program into ecological impact of OWE - Coordinates stakeholder management and communication

Table B2
Categorization of the most prominent challenges for the offshore energy system mentioned throughout the interviews (in alphabetical order). A total of 65 challenges were mentioned in 22 interviews, of which 60 are included in the categorization below.

Themes (# times mentioned)	Examples
Ecological impact (4)	Lack of knowledge on ecological impacts, strict ecological boundaries stipulated in (EU) law.
Economic feasibility (4)	Fair distribution of risks and profits, lacking clarity in conditions for offshore energy projects, high costs for infrastructure (particularly for electricity transport) .
Infrastructure (4)	Too little capacity in existing physical infrastructure, narrow focus on connecting OWE with electricity cable to shore, current transport limitations for distribution system operators.
Integration of the offshore energy system (5)	System integration, undecided on the interplay of various energy carriers and sources, integration of large-scale RE generation in the energy system.
International coordination (2)	Creating international connections between offshore windfarms, international collaboration.
Mismatch supply and demand (8)	Intermittent energy supply of RE, creating a reliable supply of energy using OWE as a source, lack of energy storage to address intermittency, balance the supply of electricity to the demand of hydrogen, uncertainty surrounding demand development of electricity.
Owe rollout (7)	Sustaining business case of OWE, accomplish OWE ambitions, support for spatial claim of OWE.
Regulatory barriers (2)	Current legal framework does not allow integration of various energy carriers offshore.
Reuse of infrastructure (4)	Using existing pipelines and platforms in the transition to a carbon-neutral energy system, mismatch of decommissioning timelines of platforms and timeline of potential reuse options.
Societal impact (2)	Support for the energy transition, impact of landing of cables onshore on local citizens.
Space (9)	Spatial integration of various sea uses, spatial competition offshore, spatial claim of cable landing onshore, enormous amount of space needed offshore to execute all ambitions.
Stakeholder management (2)	Great amount of stakeholders offshore and onshore, dealing with competing stakeholder interests.
Technical feasibility (4)	Hydrogen production offshore is not technically sound yet, the harsh offshore environment complicates technical design of offshore projects.
Vision (3)	No clear vision for spatial integration of various sea uses, no choices made for vision or timeline on the transition of the offshore energy system.

p. 168) and embed adaptive capacity through "a supportive ecosystem of institutions" (Rosenbloom et al., 2019, p. 175) enabling technological innovation and learning for long-term decision-making. More concretely, this transitions management approach calls for a future-oriented MSP process with a long-term vision, room for experimentation and clearly-defined responsibilities to accelerate a transformation of the North Sea energy system. Considering the highly political and contingent nature of governing for innovations and energy transition (Kuzemko et al., 2016), further research is needed before specific implications can be drawn internationally. Yet, for similar neoliberal, highly political contexts in which regime actors hold great power over the speed and pathways of a transition, such implications should at least consider (1) how deliberate attempts to either confine or broaden the scope for niche innovations to be considered in policy may result in path dependencies or, adversely, (2) allow incumbent actors to accept and accelerate such innovations and related actors to enter the policy agenda.

6. Conclusion

The identified opportunities and barriers for agenda-setting of offshore energy innovations demonstrate that technological innovations remain largely guided by the existing status quo and that institutional changes are needed to stimulate niches to emerge. Current adaptive governance approaches in MSP processes are however insufficient to set in motion long-term institutional changes required for energy transition. Although we acknowledge that agenda-setting is an inherently dynamic process, this paper is limited in providing solely the state of affairs from 2019 to 2021. If future research adopts a longitudinal approach, it may provide additional insights on the emergence and uptake of novel technologies in energy transitions, particularly on how institutions co-evolve with the contents of the agenda. Though transition literature offers appealing alternatives for such longitudinal research of socio-technical transitions (e.g. the multi-level perspective, Geels, 2002), we assert that the present (institutional) analysis forms a fundamental part of transition research, for it shifts the center of attention from technologies and artifacts to the wider mechanisms shaping both technological and institutional innovations. The approach taken holds similarities with work by Fuenfschilling and Truffer (2016) and Almpanopoulou et al. (2019) by assessing the interplay of institutions, technologies and actors, but the adopted agenda-setting triangle offers an original approach by zooming in on the agenda-setting processes influencing innovation emergence and niche-regime interactions. Specifically, the interconnector case illustrates that even when regime actors endorse certain niche developments, it requires truly *supportive* institutions to become prioritized and penetrate the regime, rather than purely an absence of prohibiting rules and regulations. Accordingly, future research may explore the role of institutionalized structures (i.e., culture, regulations, resources) and practices in niche-regime interactions through a socio-institutional approach to transitions (see Fuenfschilling and Truffer, 2014; Loorbach et al., 2016). Also, MSP scholars may equally explore niche-regime interactions influencing innovations in other policy domains, e.g. in relation to innovations for sustainable fisheries and aquaculture towards a food transition at sea (see Koning et al., 2021).

To conclude, the coming decade will be critical for ensuring an efficient integration of the significant growth of OWE in the energy system beyond 2030. The 2021 court ruling that O&G producer Shell must curb its carbon emissions (The Hague District Court, 2021) and the publication of the EU Strategy to harness the potential of offshore renewable energy (European Commission, 2020) may open a window of opportunity for initiating changes in governance arrangements to stimulate the uptake of innovative offshore energy solutions. Concretely, a first step involves establishing clear ownership of the transformation of the offshore energy system and related incentive structures beyond 2030. Therein, policymakers must be aware of the influence of incumbents and may stimulate them in developing out-of-the-box solutions. Regardless of technological predilection, scholars, policymakers and the political authority must at minimum start considering supportive institutions and desirable locations for large-scale demonstration projects, given the long lead times of offshore infrastructure and great uncertainties surrounding the offshore environment.

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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

The data that has been used is confidential.

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Appendix A

See Tables A1–A3.

Appendix B

See Tables B1 and B2.

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