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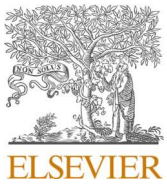

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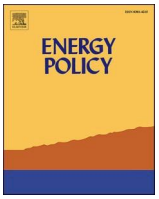

Policy implications for offshore renewable energy in Australia: An MSP approach supporting the energy transition

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ABSTRACT

In response to the 'climate crisis', countries around the world are implementing policy, administrative, and structural changes to transition towards a decarbonised economy. A key aspect of this shift is the development of offshore wind. In many countries, integrated ocean management approaches including Marine Spatial Planning (MSP) have been used to manage offshore wind development. However, in Australia – a country new to offshore wind - a traditional sector-specific approach has been adopted. Given the need for relatively rapid development of Australia's offshore renewable energy industry, and the urgency of the decarbonisation agenda, implementing a comprehensive MSP approach within the required timeframe would be challenging. This article therefore aims to identify elements of the MSP process that can be rapidly deployed to support offshore wind development. Drawing on lessons learnt internationally, we examine how three key elements of MSP—governance integration, participation, and building the evidence-base —might be employed in advance (or in lieu) of a formal MSP process. We provide recommendations to support the rollout of offshore wind that would provide coordinated pathways for integrated governance, build knowledge and provide greater social and environmental acceptability, which is relevant for other countries developing their offshore energy capacity in the absence of MSP.

1. Introduction

Global carbon neutrality is required by 2050 to limit the mean global temperature increase to 1.5 °C (°C), and thus achieve the target set in the United Nations Paris Agreement. Renewable energy and energy efficiency, combined with electrification of end-uses, account for 94 % of the proposed mechanisms to deliver emission reductions (Gielen et al., 2019). A three-fold increase in renewable energy production worldwide needs to occur by 2050 to meet this target (IRENA, 2023). While diversification of renewable energy technologies is important, offshore wind is widely favoured as the technology that will deliver the largest base loads when compared to onshore wind and other low carbon energy alternatives (Betti et al., 2022; Díaz and Guedes Soares, 2020). For example, offshore wind turbines generate 20% – 40% more energy than onshore wind turbines due to their larger size (Li et al., 2020; Zhixin et al., 2009). Offshore wind also has stronger and more consistent wind velocities resulting in consistently higher capacity factors compared to solar and land-based wind (Hormaza Mejia et al., 2023; Junginger et al., 2019). Further, offshore wind tends to be closer to population centres, allowing electricity to be transmitted to end-users more efficiently than many solar and onshore wind farms. Wind turbines that are fixed to the ocean floor have traditionally been used. However, technologies and supply chains surrounding floating turbines are now accelerating, enabling access to deeper waters (>80 m) and allowing a scaling up of energy production over large areas (Bento and Fontes, 2019; Soares-Ramos et al., 2020).

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Ambitious regional and national targets for offshore wind have been set for 2030 to meet decarbonisation goals, and growth in the installation of offshore wind has been rapid—from 7 gigawatts (GW) of offshore wind capacity in 2013 globally, to 75.2 GW by the end of 2023 (Lee and Zhao, 2024). This trend is set to increase exponentially, with expected average global installations of 40 GW annually by 2029 and 60 GW by 2032 (Lee and Zhao, 2024). Specific targets for offshore wind include 60 GW for the European Union (EU; European Commission, 2020), 50 GW for the United Kingdom (UK; British energy security strategy, 2022), and a 30 GW federal target for the United States (US; The White House, 2021). Recent research suggests that EU members may even exceed their target by around 10.5 GW (Janipour, 2023). The Asia-Pacific region is also experiencing growth in the offshore wind sector, with China hosting half the current capacity of offshore wind installed globally (38 GW of a total 75.2 GW as at 2023; Lee and Zhao, 2024), and countries including Vietnam, Japan, the Philippines, South Korea and India all committing to significant targets (Díaz and Guedes Soares, 2020; Doan and Tran, 2022; Lee and Zhao, 2024).

The development of offshore wind routinely gives rise to a range of regulatory and policy challenges that can impede countries' progress toward meeting their renewable energy goals. These challenges encompass issues such as contested ideas on the use of ocean space, permitting processes, Environmental Impact Assessments (EIA), social licence, grid connectivity, and seabed ownership (Guerra, 2018; Hughes et al., 2024). Legal uncertainty, policy instability and complex, time-consuming approval processes can further hinder offshore wind development (Hughes et al., 2024). As global offshore wind developments continue to expand it is important to reflect on the lessons learned in relation to policies and regulation, from around the world.

1.1. *International policy landscape for offshore wind*

The international policy landscape for offshore wind is highly complex, situated at the intersection of various key areas including global energy, ocean and climate change governance. Guerra (2018) argues that 'since offshore renewable energy's regulation is dispersed across various areas of international (and national law) and a plethora of institutional arrangements, potentially representing multiple centres of decision-making authority', we might be facing a polycentric, multi-level system of governance with overlapping issue areas. Similarly, Spijkerboer et al. (2020) argue that many countries have a 'patchwork of existing sectoral policies' which can reduce the transparency of decision-making, overlook the interconnections between different maritime activities and fail to account for the potential cumulative impacts of these activities. The polycentric and often fragmented systems for governing offshore wind, and the introduction of offshore wind into increasingly crowded ocean systems, has highlighted the need for integrated approaches to managing ocean uses. For example, the International Renewable Energy Agency (IRENA) argues that going forward, policy frameworks must adopt a systems approach, incorporating more fully integrated policies across different sectors (IRENA et al., 2018).

Integrated ocean management aims to consider multiple uses, objectives and outcomes in a coordinated and consistent manner, and seeks to reconcile competing interests to deliver sustainable ocean management outcomes (Voyer et al., 2021; Winther et al., 2020). Integrated ocean management is defined as an approach that links (integrates) planning, decision-making and management arrangements across sectors in a unified framework, to enable a more comprehensive view of sustainability and the consideration of cumulative effects and trade-offs (Stephenson et al., 2019).

Marine Spatial Planning (MSP) is one of the principle integrated ocean management tools currently employed around the world to manage conflict and support sustainable blue growth. For example, all EU countries were mandated to establish MSP processes to manage their marine estate under the EU MSP Directive (2014/89/EU; Ehler, 2021). MSP clarifies who can operate or what activity can take place within spatial areas and uses scientific data, decision support tools and integrated processes to develop an understanding of compatibility between users and social and environmental values and attempts to understand the impacts from all activities and sectors (cumulative impacts). Such integrated approaches now extend outside of the EU, and MSP has become the most endorsed management regime for sustainable development in the marine environment globally (McAteer et al., 2022) with more than 300 MSP initiatives identified from 102 countries/territories (IOC-UNESCO, 2022). The need to apply MSP-like approach to the offshore wind sector is echoed elsewhere globally (Young, 2015) and in Australia (Taylor, 2022, 2023).

Six foundational principles that define MSP include (adapted from Ehler, 2018).

1. **Integrated governance**: across and among sectors and governmental agencies, and among different levels of government;
2. **Strategic and future-oriented**: focused on long term planning and future changes;
3. **Participatory**: engaging stakeholders actively and meaningfully throughout the entire process;
4. **Adaptive**: capable of learning by doing, adapting with changing needs and understandings;
5. **Ecosystem-based approach**: a strategy for integrated management balancing ecological, economic, social, and cultural goals and objectives toward sustainable development and the maintenance of ecosystem services, it is based on the application of the evidence-base (data and knowledge) to inform planning; and
6. **Place- or area-based**: focused on marine spaces that people can understand, relate to, and care about.

These principles characterise MSP and are considered critical to a genuine spatial planning process (Reimer et al., 2023).

While MSP is often considered the ideal model for managing conflict and ensuring environmental, social and economic feasibility of blue economy industries in the long-term, there are two inherent, and interrelated challenges with MSP that limit its short-term suitability as a tool to assist countries who are just starting out in the process of developing an offshore wind sector.

The first is that, despite the broad use of MSP globally to facilitate the development of the offshore wind industry (Quero García et al., 2019), it needs to be acknowledged that MSP requires significant resources and policy changes to support the process (Frazão Santos et al., 2021). For example, Rhode Island's MSP process, (Ocean Special Area Management Plan), driven by the need to identify suitable sites for anticipated offshore wind farms, was prepared over a 3-year period of information generation, analysis, consultation, planning and policy making (Ehler, 2021). However, it took another five years before construction of the turbines began. The Seychelles MSP initiative, driven in part by growth in the blue economy, began in 2014 and despite making significant progress on areas of policy development and planning tools, a data atlas, and broad scale zoning plans, implementation of the marine areas has yet to begin[1] (Ehler, 2021). Thus, the time taken to implement a full MSP process may not align with the urgency required to establish the offshore wind industry to meet decarbonisation goals.

The second challenge is that whilst MSP has assisted nations to manage the complexities of multiple use ocean spaces, the emergence of offshore wind has also necessitated the alignment of ocean governance with previously disparate energy policy frameworks. Historically, energy policy has largely focused on land-based energy production and distribution and has frequently been siloed by energy source (Guerra,

[1] However, the scale of the planning area is likely to be the cause of the longer time frame (the process is running for 13 marine areas concurrently, over an area of 1.37 million km^2; Ehler, 2021).

2018). Inclusion of offshore wind within MSP has necessitated an expanded planning scope, introducing a range of new challenges, uses, jurisdictions and actors associated with land-based planning systems, grid and transmission connections as well as broader emissions reduction policy mandates. This makes an already complex MSP landscape decidedly more complex, which is likely to further exacerbate the time scales involved in completing an MSP exercise.

For these two reasons it is unlikely that MSP will be able to be deployed in sufficient time to assist countries to meet their 2030—and potentially 2035—commitments for emissions reduction if they have not already commenced these planning processes. Despite this, there remains an opportunity to reflect on elements of the MSP process that could support a more integrated, holistic and sustainable approach to the required rapid rollout of offshore wind. This article aims to explore whether there are opportunities for core elements of MSP to be deployed rapidly to assist in the development of offshore wind and provide a pathway towards future MSP. This article explores this idea using an Australian case study – a country which is rapidly developing an offshore wind industry in the absence of MSP. It examines how three key strengths of MSP – governance integration, stakeholder engagement and evidence-based decision making – might be employed in advance (or in lieu) of formal MSP processes.

1.2. The policy landscape for offshore wind in Australia

The Australian government has committed to reducing carbon emissions by 43 % by 2030 and achieving net zero by 2050 (*Climate Change Act, 2022*). However, there are currently no national offshore wind targets. Despite this, significant progress has been made in offshore wind energy development, in recognition of Australia's high offshore wind potential (Coppin et al., 2003; Briggs et al., 2021). Offshore wind is estimated to have the potential to generate 4,963 GW, far surpassing the National Electricity Market's current capacity of less than 60 GW (Australian Energy Regulator, 2023). In June 2022, the Federal Parliament passed the *Offshore Electricity Infrastructure Act 2021* (OEI Act), enabling the declaration and development of offshore renewable energy areas in Commonwealth waters, which extend from three to 200 nautical miles offshore (see Appendix 1 for more detailed information on the OEI Act and its framework). However, offshore wind will require cables to transmit the electricity generated offshore to the electricity grid onshore, and these will have to pass through state waters within three nautical miles of the coast. Therefore, additional state and territory legislation will need to be developed to enable the establishment of offshore wind. While the primary focus of the OEI Act and its regulations (Offshore Renewable Energy Infrastructure Regulations 2022 (Cth); OEI Regulations) is currently on the development of an offshore wind industry, the OEI framework has a broad application that could underpin the conduct of a wide range of offshore energy activities into the future.

Under the OEI Act, the Minister for Energy identifies and declares areas for offshore renewable energy, considering various factors such as defence, navigation, international obligations, public consultation, and the potential impacts on existing marine uses. Once an area is declared, developers can submit applications for licences to conduct offshore renewable energy activities in that area in accordance with the licensing scheme prescribed in the OEI Regulations. The Act establishes four types of licences: a 'Feasibility Licence' for undertaking scoping activities to assess the feasibility of an offshore energy project; a 'Commercial Licence', which must be preceded by a feasibility licence, and authorizes the exploitation of offshore renewable energy resources; a 'Research and Demonstration Licence', which enables the conduct of research or the demonstration of technologies; and a 'Transmission and Infrastructure Licence', which is required if a commercial project includes associated offshore electricity transmission infrastructure (such as an export cable) that extends beyond the boundary of the commercial licence area.

Applicants for a license must meet the "merit criteria," which include demonstrating technical and financial capabilities, as well as considering the national interest, such as economic contributions, job creation, and the resolution of conflicts with other marine activities. The feasibility license holder is required to develop a management plan for the project, seek necessary environmental approvals, and eventually apply for a commercial license. This process necessitates engagement with relevant stakeholders, including First Nations and other rightsholders, and requires public consultations and reporting of consultation outcomes, and the preparation of a stakeholder engagement strategy (see Fig. 1) (DCCEEW, 2024d).

Under the OEI Act six priority areas were selected and proposed for declaration, with all six now officially Declared Areas (see Fig. 2). These areas were selected by government based on wind conditions, environmental constraints, proximity to energy demand, and existing infrastructure (ports and transmission). Developers have either submitted or have been granted a feasibility license. Award of a feasibility license is the first step to obtain a commercial license to start construction of an offshore wind project.

One of the challenges for the development of offshore renewable energy in Australia's Commonwealth waters is the lack of an integrated and holistic process, such as MSP, to establish the industry. Australia's exclusive economic zone (EEZ) is the third largest in the world, covering 11.38 million square km, yet 43.5 % of it is occupied by petroleum lease areas, 42 % by commercial fisheries, and over 50 % by marine parks (some of these areas intersect), much of which overlaps with areas ideal for offshore wind development (Coppin et al., 2003). Currently, Australia lacks a comprehensive mechanism to integrate policies, stakeholders, and data to manage conflicts in the majority of its marine estate. The country has historically relied on sector-specific management approaches to develop blue economy activities, a tradition that continues with the OEI Act, which offers limited mechanisms for integrated policy-making across sectors (Vince, 2018).

A fully integrated MSP process is complex, costly and timely, and even when those challenges are overcome through a well-resourced budget, limitations remain. For example, experience from management of the Great Barrier Reef, which is one of the first examples of marine spatial planning in the world and is a designated World Heritage Area, shows the limits of an MSP approach, including: 1) the practical constraints of implementing plans—particularly in terms of integrating land and marine-based management (Great Barrier Reef Marine Park Authority, 2024), 2) the ongoing challenges of ensuring strong community engagement and adequate levels of stakeholder knowledge and empowerment, particularly that of First Nations peoples (Great Barrier Reef Marine Park Authority, 2024), and 3) the risk that even in a framework where information sharing is prioritised, information gaps can affect the effectiveness of management, particularly in terms of addressing human use patterns and impacts (Kenchington and Day, 2011).

1.3. Analytical framework – key components of MSP as a process

We identified three critical components of MSP, which emerged from three principles of MSP identified by Ehler (2018) (see Section 1.1), as priority areas of analysis (Fig. 3). These principles include governance integration, participation and evidence-based decision making. Whilst none of these three elements are unique to MSP, they are commonly enabled through MSP to inform the learning of lessons from MSP approaches. We therefore argue that a better understanding of these three elements at regional or country level will benefit the offshore wind industry across the development, construction and operations phases, without the need of a full MSP implementation process.

1.3.1. Governance integration

MSP requires active consideration of diverse, polycentric and sometimes incoherent policy domains and aims to develop mechanisms which support cross-institutional and cross-sector integration. Integration is required in order to build a common understanding of the long-

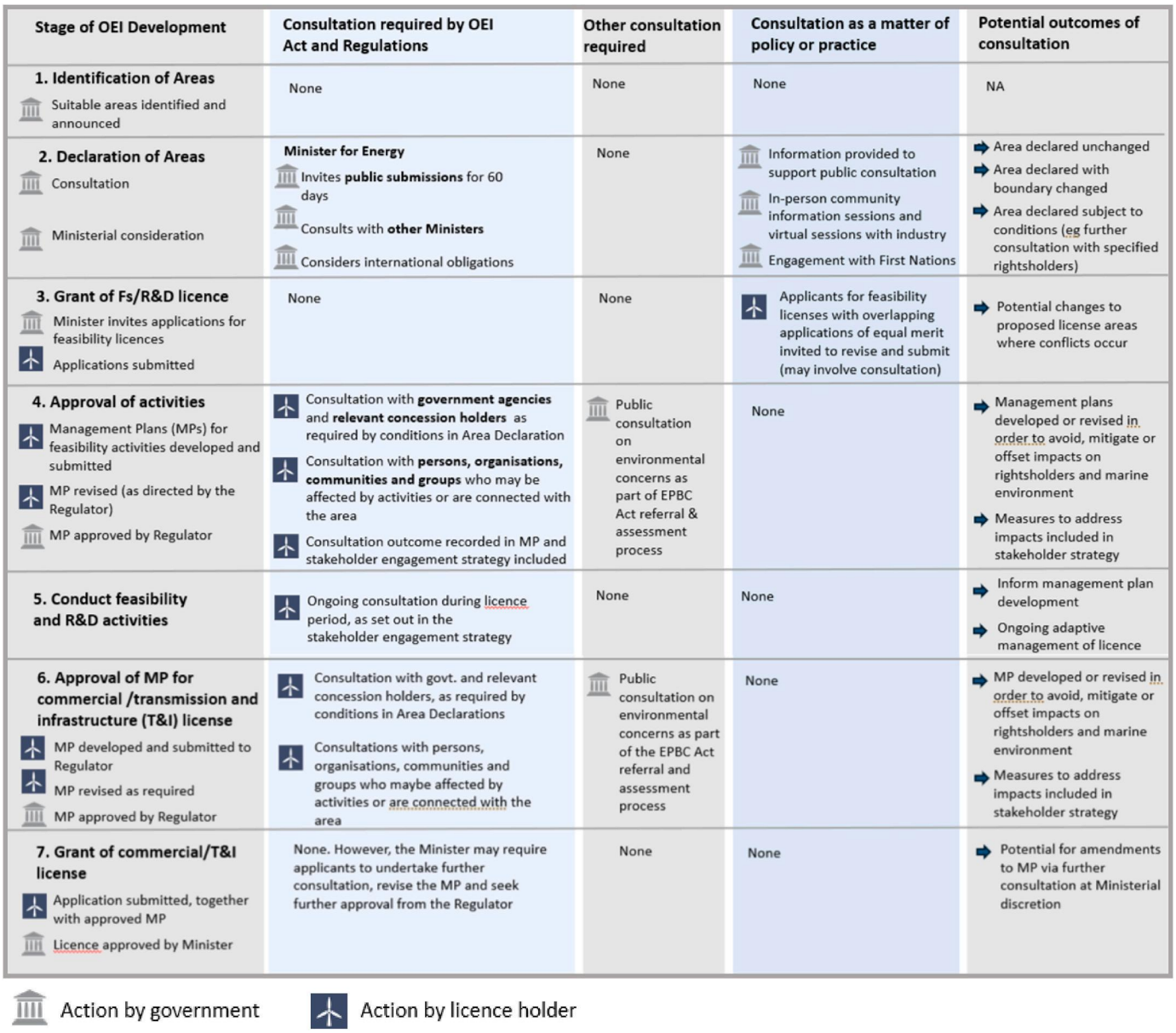

Fig. 1. The Commonwealth framework for consultation for offshore renewable energy developers seeking a licence under the OEI Act 2021

term vision that MSP is seeking to achieve, and to ensure mechanisms are in place to support participatory and adaptive processes. Cross-institutional and cross-sector integration provides a pathway to coordinate and streamline processes across multiple governing bodies, agencies, and economic sectors and across scales of governance, from local to national. Therefore, governance considerations will also be influential in defining the scope and scale of ecosystem-based objectives and place-based considerations, as highlighted by the expanding scope of MSP in response to the inclusion of energy policy considerations.

1.3.2. Participation

Understanding community aspirations, values and uses of ocean spaces intersect with all aspects of MSP. The MSP process is inherently a participatory process in which stakeholders play a fundamental role (Ehler, 2021). The inclusion of a participatory approach to stakeholder engagement can ensure that all relevant stakeholders are identified, and their values and aspirations are included in the information that informs decision-making. This approach can help to garner support for the process and provide a platform to consider divergent values and manage conflict (Yates and Bradshaw, 2018).

1.3.3. Ecosystem-based approach-supporting evidence-base decision-making

Throughout the MSP process there is a heavy reliance on available data and knowledge to support an ecosystem-based approach to decision-making. An ecosystem-based approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (UNEP, 2004). Scientific and other forms of data provide the critical evidence-base about the human and non-human dimensions upon which MSP depends, underpinning goal setting monitoring, and evaluation frameworks which support adaptive management approaches (Zuercher et al., 2022). Evidence-base decision-making is best supported through a mechanism or process that can draw knowledge from multiple sources and disciplines into one consistent organisational network.

1.3.4. Methodology design

For the purposes of this article, we therefore draw on these three

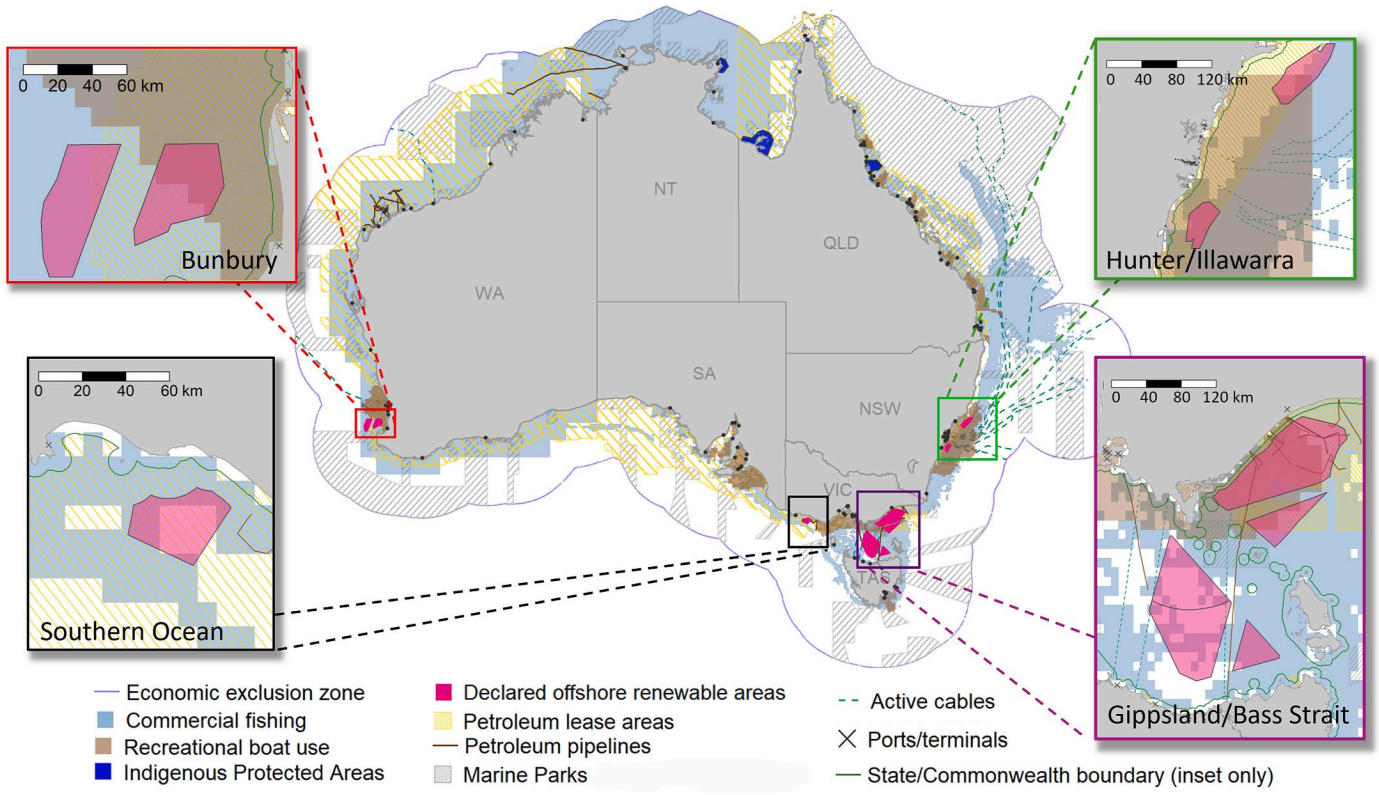

Fig. 2. Maps of the Declared Areas for offshore renewable energy, showing their location in proximity to other marine sectors in Australia's commonwealth waters (3 nm – 200 nm). Port and terminal locations are used to indicate shipping intensity. Shipping lanes are excluded for ease of visual display because they are found broadly across commonwealth waters. Sectors that are common in coastal waters such as tourism, aquaculture and recreational fishing outside of major cities are excluded due to scale. Commercial fishing for WA and NT is reported at the 1° grid scale and thus actual fishing locations occupy a smaller area than depicted in the map. Commercial fishing for other states reported at the 0.1° grid scale. Petroleum lease areas may not include the actual footprint of activity which could be smaller. Insets showcase the Declared Areas.

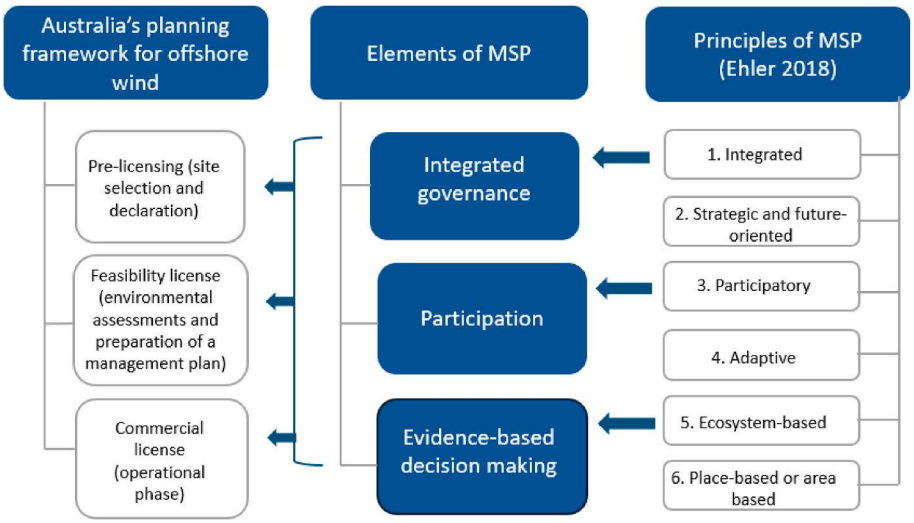

Fig. 3. The analytical framework – the key elements of MSP that can support planning for offshore wind in Australia.

critical elements, which emerge from the established principles of the MSP process. We selected these three elements because we are proposing an approach to planning for offshore wind that avoids the inevitable difficulties of a full MSP process (time, cost, complexity) and can be applied widely, efficiently, and effectively to bring some of the key benefits of MSP to bear in the short term - as opposed to some of the longer-term or more specific elements of MSP that might be applicable to a particular area (place-based) or in the future over the longer term (adaptive, future orientated). We use these three elements as the analytical framework through which to explore the ongoing development of the Australian offshore wind sector, and to highlight opportunities to strengthen these dimensions of the planning and implementation process.

In the following sections, we begin by critically analysing the

constraints of offshore wind development in the current governance landscape in Australia, using the analytical framework outlined above. We examine how these three key strengths of MSP, might be employed in advance (or in lieu) of formal MSP exercises, by drawing on multiple sources of information across published literature (using the Web of Science database) and grey literature through a narrative style of review (Green et al., 2006). Grey literature is an important resource for understanding current issues, progress and planning frameworks used by practitioners (Adams et al., 2017; Corlett, 2011) and was searched using state and commonwealth government websites (e.g., Australian Parliament House, Department of Climate Change, Energy, the Environment and Water [DCCEEW, 2024a]), reputable national news media platforms (e.g., Australian Broadcasting Corporation) and google. Examples of grey literature includes government documents, websites or reports, legislation and policies, non-governmental organization reports and industry reports. Key search terms included wind farm planning/development, blue economy development, and conflicts and offshore wind. Only references relating to Australian based issues around governance integration, participation and the evidence-base were included. Limitations about this research design are discussed in the conclusion.

We seek to identify where opportunities could provide pathways to potential change for a more integrated approach to offshore wind rollout. We conclude with four recommendations that would support a more progressive, and ultimately more rapid, approach to achieve decarbonisation goals, whilst also achieving social, environmental, and economic sustainability.

2. The constraints and opportunities for offshore wind development in Australia

In this section we outline the constraints and opportunities for offshore wind development in Australia. This analysis is based on the analytical framework in which we draw on three critical elements of MSP (governance integration, participation and building the evidence-base) to analyse the development of offshore wind. We assess how, in the absence of MSP, the current process is engaging with each element. We then explore where opportunities lie to strengthen this engagement, including through creating links with selected relevant complementary governance frameworks.

2.1. Governance integration - integration and coordination within and across institutions and sectors

2.1.1. Assessment of OEI framework when applying an integrated governance approach

The OEI framework operates within Australia's "Offshore Constitutional Settlement" (OCS), which assigns regulation of activities beyond three nautical miles to the Commonwealth. However, for offshore wind to be successful, cables will need to be laid through state/territory waters to connect offshore wind farms to the electricity grid onshore. This requires additional state and territory legislation. There is no centralised process that enables offshore wind developers to work across state/territory and Commonwealth boundaries. Instead, Australia relies on cooperative mechanisms to harmonise actions through a system of complex agreements between federal and state/territory authorities, all of which contribute to inconsistency and uncertainty around accountability and transparency (Kallies, 2021). Because existing Declared Areas for offshore wind are located in Commonwealth waters, and transmission infrastructure will also have to pass through state waters, at least two separate application and approval processes for state and Commonwealth waters, will be required. These processes are likely to require parallel application and community consultation processes.

Even where activities occur solely within Commonwealth waters, parallel processes will be required. However, coordination among offshore wind developers in Australia is constrained by legislation. There is no mechanism to coordinate the industry and enable developers to collaborate and harmonise (or synchronise) planning to optimise area usage inside the Declared Areas. For example, two or more developers could apply for a feasibility license over the same or overlapping areas because competition law requires developers to act independently and compete. In the case of the Gippsland Declared Area, for example, it was not until after companies had submitted their feasibility licence applications – and overlaps were identified - that companies were invited to collaborate or mediate appropriate resolutions to these overlapping claims (Kallies, 2021).

Cross-sectoral integration and coordination are not enabled under the existing governance arrangements. Once areas are declared, a range of approvals may need to be obtained before proponents can apply to the Minister for a licence to conduct offshore electricity infrastructure activities—including under the Environment Protection and Biodiversity Conservation Act 1999 (Cth) [EPBC Act], the Environmental Protection (Sea Dumping) Act 1981 (Cth), the Underwater Cultural Heritage Act 2018 (Cth), the Great Barrier Reef Marine Park Act 1975 (Cth), and relevant state and territory legislation. Obtaining these approvals (and securing the evidence and support to demonstrate that their application is 'meritorious') will require developers to consult with various government agencies (including the Department of Defence, the Bureau of Meteorology, the Director of National Parks, the Australian Maritime Safety Authority, and the Civil Aviation Safety Authority, and titleholders of petroleum or greenhouse gas titles) putting pressure on the resourcing of these agencies as they seek to support multiple developers and adding complexity to the process for applicants.

This approach does not directly address the interaction with other marine activities or industries nor provide any centralised or harmonised process to manage or reconcile conflicts between potential uses or users of the Commonwealth offshore area to mitigate impacts or identify who will bear the costs. Rather, the regulatory framework place this responsibility on individual licence holders as part of the process of developing and approving management plans. This means that every developer, on award of a feasibility licence, will need to liaise with the various industries, community groups, rightsholders, First Nations people and other stakeholders who use the marine environment and that all those people will have to liaise with multiple individual developers.

2.1.2. Opportunities to strengthen integrated governance

The need for a coordinated process has been advocated by the wind industry. An Australian Offshore Wind Taskforce has recently been established by the Clean Energy Council in response to industry identifying the need for a coordinated and collaborative approach towards the development of offshore wind (Clean Energy Council, 2024). Priorities identified by participants included establishing a clear structure and implementation pathway for a national coordination body, as well as exploring the role of a national offshore wind target. While the taskforce is newly established, two position papers speaking to these priorities are expected in 2025, after a year of consultation with industry participants.

The importance of coordinated decision-making across all sectors and processes at the Commonwealth and state/territory level has also been recognised. The Australian Government has made an international commitment, through the High-Level Panel for a Sustainable Ocean Economy, to sustainably manage 100 % of its ocean jurisdiction. The commitment is being delivered though the establishment of a taskforce within DCCEEW, tasked with developing a Sustainable Ocean Plan (SOP) for Australia by 2025. The plan is intended to enable Australia to grow its ocean economy while transitioning to industries that better support sustainability. The Commonwealth has been engaging with the states and territories to support the SOP. The plan has potential to bring ocean management in Australia under a single integrated governance framework, especially if it mandates for an integrated planning process using tools such as MSP.

Other examples of cross-jurisdictional management between the states/territories and Commonwealth are also emerging. Regional Plans

are being developed in partnership between the state/territory and the Commonwealth government to speed up decision making, build stakeholder trust and improve environmental protection, as part of the governments Nature Positive Plan (DCCEEW, 2022). Developing a regional plan will be through "a highly collaborative process involving the local community, governments, business, natural resource management organisations, environmental NGOs, First Nations and technical experts" (DCCEEW, 2024e). New South Wales (NSW) and Queensland are developing these plans for specific terrestrial areas. It is unclear if regional plans will extend into the coastal and marine estate, however they offer a pathway for integrated management.

The Great Barrier Reef Marine Park represents a mature cross-jurisdictional ocean management process and uses various mechanisms to coordinate actions across local, state and commonwealth jurisdictions (Morrison, 2017; Olvera-Garcia and Neil, 2020). However, given the significant government investment required, this model is unlikely to be replicated across Australia's broader marine estate.

While Australia has as strong history of sector-based management, cross-sector planning frameworks are emerging in the states. Victoria has enacted legislation to establish an MSP process for integrated coastal management, which supports the state's renewable energy targets and provides greater certainty for offshore wind energy development (Victoria State Government, 2023). NSW uses the Marine Estate Management Authority (MEMA) for integrated coastal management (Brooks and Fairfull, 2017), while South Australia has developed regional plans, such as the Spencer Gulf plan, which incorporate integrated and holistic planning processes for managing the marine environment (Stephenson et al., 2023).

2.2. Participation – including First Nations, rightsholders and stakeholders

2.2.1. Assessment of OEI framework when applying a participative approach

The assessment and approvals framework for offshore wind in Australia reflects a siloed approach to engaging with users, rightsholders, and First Nations, which prevents learnings being shared and understood, and encourages misinformation. To date, the consultation processes conducted in the proposed and declared areas have been primarily focused on establishing the spatial boundaries of the zones. This is because the details of the type, scale and nature of the offshore energy infrastructure to be included within these areas will be identified by individual developers in subsequent stages of the planning and approvals process. This has meant that communities have felt uninformed about what to expect if, and when a zone is declared. This is reflected in calls from public institutions, such as local Governments, and local communities for more information and community engagement (DCCEEW, 2024c). It has also potentially contributed to the prolific and highly successful campaigns of misinformation and disinformation as grassroots organisations and other, more bad faith, actors fill the information vacuum (Rogge, 2023).

Pursuant to the OEI framework (Fig. 1), individual developers are required to consult with other marine industries and users to identify and address potential conflicts as part of the licensing process. This means that proponents will have multiple points of contact with industries and users throughout the engagement process and similarly, industry and users will be consulted by multiple proponents (Fig. 1, Stage 4). This raises some concerns not only about consultation fatigue but also about how the Minister will be able to meaningfully consider the potential impacts of offshore renewable energy infrastructure on marine users or interests in declaring areas, when such impacts may not be understood until after those areas are declared. As with other aspects of the planning process, the OEI Act largely leaves potential conflicts amongst marine uses and users to be addressed by individual developers as part of their feasibility assessments and in the development of their management plans (OEI Regulations). However, site-specific negotiations with impacted users may not adequately take into account cumulative impacts such as spatial squeeze on users from multiple developments and other regulatory changes. In addition, the absence of structured negotiation mechanisms leaves communities vulnerable when it comes to identifying pathways through perceived and actual conflicts, including benefit sharing arrangements and compensatory mechanisms. The absence of these mechanisms may translate into an absence of transparency and accountability within the negotiation process and risks undermining trust and fairness in the process and its outcomes.

Consultation fatigue is a key concern for Australia's First Nations People, the oldest and most continuous culture on the planet (Rasmussen et al., 2011). Australia has committed to reconciliation and recognition of Aboriginal and Torres Strait Islander people as the original custodians of the land and sea. However, at present, there is no formal process or model of consultation with First Nations specific to offshore wind. In the establishment of declared areas for offshore wind development, First Nations are consulted using the same process as the public stakeholders and given the same time to make submissions about the proposed declaration area (Fig. 3, Stage 2). This process is not consistent with reconciliation, in that it fails to recognise Indigenous Peoples' long custodianship of the land and seas, their deep connection to the submerged terrestrial landscape, their status as rightsholders, and the different cultural processes needed for communities to agree a formal position on an issue. Once zones are declared, engagement and negotiation with First Nations communities becomes largely the responsibility of the individual developers (Fig. 3, Stage 4). Legislation that requires procedural consultations with traditional custodians can put a considerable burden on Land Councils and other Aboriginal Organisations, without commensurate time and resourcing support, as multiple developers are attempting to engage with and negotiate arrangements with the same communities and organisations. Lack of First Nations support can delay development applications. For example, a recent Federal Court ruling has delayed a development application for the Scarborough gas project in offshore waters due to inadequate consultation with Indigenous communities (Macdonald-Smith, 2023).

Lastly, the regulatory framework established in the OEI Act involves a wide range of consultation and approval processes. However, public consultation on the declaration of an area is both the first formal opportunity for public input and the only opportunity that exists in the "pre-licensing" stage of the process (Fig. 1, Stage 2). Discontent with this process is reflected in the significant number of submissions made to the public consultations undertaken in relation to the six priority areas. For example, the public consultation period on the declaration of the Illawarra offshore area was open for 94 days (having been extended from the original 65), and received 14,211 submissions from members of the community, First Nations groups, Commonwealth, State and local government agencies, industry, non-government organisations, community organisations, peak bodies and unions (DCCEEW, 2024c). Of these, 65 % of the submissions were in opposition to the proposed zone. High numbers of submissions were also received in relation to the other areas (DCCEEW, 2024c).

2.2.2. Opportunities to strengthen participation

Recognition of the importance of integrating community engagement processes and concerns raised through public consultation led the Australian government to commission a review in 2023 of community engagement on renewable energy infrastructure developments. The review led to the production of a guidance document ('The Guidance') which provides practical advice on effective community engagement for offshore wind developers and major stakeholders (Dyer, Australian Energy Infrastructure Commissioner, 2023). Although The Guidance is not legally binding, it aims to provide best practise advice for industry and is a considerable step forward given the limited mandatory consultation requirements under the OEI Act. The state of Tasmania has also developed its own guidelines to support the states renewable energy

sector with community engagement as well as identifying benefit sharing opportunities (Tasmanian Department of State Growth, 2024).

Progress is also being made for First Nations engagement. The Commonwealth government has recently developed a First Nations Clean Energy Strategy which is intended to give First Nations Australians a say in renewable energy policies and programs (DCCEEW, 2024b). The strategy aims to identify ways to support First Nations to participate in and benefit from the clean energy transformation, ensure their connection to Sea Country is respected and develop collaboration and consensus building. A bill – the Protecting the Spirit of Sea Country Bill (2023) (Cth) – was also introduced into Parliament by the Minister of Climate Change, Energy, Environment and Water in August 2023 to address the need to consult differently with Australia's First Nations People on offshore energy infrastructure projects. In its current form, the Bill falls short in recognising the intrinsic intangible value of Sea Country and the spiritual connections and responsibilities, but it has been referred to a Senate Committee for inquiry and report (Parliament of Australia, 2024). Despite this, the underlying intent of the bill has generally received support in submissions so changes to this bill may be unlikely. Guidelines for First Nations engagement for blue economy industries have also been developed by research collaborations (Hunter et al., 2024) and by Australia's Environment department (DCCEEW, 2023a).

2.3. Applying an ecosystem-based approach – building the evidence base

2.3.1. Assessment of OEI framework when applying an evidence-based approach

The licensing scheme places the responsibility on the licence holders/proponents to understand the data landscape across environmental impacts and values, encouraging data secrecy between proponents because there are gaps in scientific knowledge. Offshore renewable energy developments have the potential to cause environmental harm (Boehlert and Gill, 2010; Frid et al., 2012; Galparsoro et al., 2022) to species (Harnois et al., 2015; May et al., 2020), habitats (Davis et al., 2016; Hutchison et al., 2020) and ecosystems (De Mesel et al., 2015). Australia has specific thresholds of impact for its threatened species and protected places that need to be met under its key environmental legislation (the EPBC Act), in order for development projects of national significance (which offshore wind projects are assigned) to gain approval (Department of Environment, 2013). However, there is uncertainty around meeting these thresholds for some species because of a lack of information. While the feasibility license enables proponents to conduct research on environmental impact, mechanisms to coordinate shared research outputs and responsibilities are not yet established. This places considerable burden on each proponent to fund their specific research needs and encourages competition between proponents which can lead to costly duplication and delays. Further, there is no incentive or ability to understand the impacts from all proponents and activities within a spatial footprint (considered cumulative impacts). Gaps in scientific knowledge about the magnitude of ecological impacts and cumulative pressures from offshore wind is a global concern (Galparsoro et al., 2022; Willsteed et al., 2018).

Access to baseline environmental information is another limitation for emerging industries because Australia lacks a robust national spatial database that provides access across all relevant marine related information to support planning. Spatial data on ocean threats, science, climate and jurisdictional boundaries are housed on various commonwealth platforms such as Australian Ocean Data Network, National Environment Science Program, Australian Marine Spatial Information System, SEAMAP, National Map, etc. State-based data is housed in sector-based platforms such as NSW Fisheries Spatial Data Portal, Western Australia Marine Geospatial data, etc. There is also a multitude of industry data that is inaccessible due to client confidentiality or if it is accessible, the government has limited capacity to hold it or make it into a useable data product. A lack of a national database makes it difficult for consultants to access high-quality, consistent and comprehensive data, to ascertain if proposed activities fall within EPBC Act thresholds (Agardy et al., 2011). Thus, proponents are required to fill the knowledge void by commissioning surveys that may largely duplicate those commissioned by other proponents.

2.3.2. Opportunities to strengthen the evidence-base

The Australian government has recognised the issues around a lack of integrated ocean data to support the offshore wind industry, particularly the need for enhanced scientific certainty to support decision making and frameworks for data standardisation, sharing and access, and adaptive management (Marine and Coastal Hub, 2023). The importance of standardising data, improving the interoperability of existing datasets and avoiding data duplication and siloed data approaches were priorities identified through the ocean data workshops held with marine scientists, industry, NGOs and government to inform development of the SOP (DCCEEW, 2023b). The Commonwealth Government is also in the process of reviewing the EPBC Act due to concerns raised, during the most recent periodic (10 year) mandatory review, about its lack of effectiveness to address current or future environmental challenges (Samuel, 2020). There is thus potential for improved environmental data accessibility and quality, and the requirement for cumulative impacts of multiple sectors/users to be considered, in the EPBC Act reform and through the SOP. This work is in parallel with other projects underway to identify and develop a national data platform that enables access to consistent, resolved and cleaned spatial data and data products (National Environment Science Program; McLean and Ierodiaconou, 2023). There is a concerted push by the Australian Government (DCCEEW and NOPSEMA) to support offshore wind developers to collaborate and share data, particularly to support an understanding of environmental effects once feasibility licenses are granted (DCCEEW, 2022). Environmental consultants support these efforts and have already held initial discussions for a region-wide coordinated data gathering campaign for developers who opt-in.

2.4. Summary of key constraints, consequences and opportunities for the OEI framework

3. Recommendations to assist implementation

The results of our analysis (summarised in Table 1) highlight a number of challenges in the current Australian system for regulating the emerging offshore wind sector with regard to the three elements considered (governance integration, participation and building the evidence-base). These challenges point to the issues of planning for offshore wind in the absence of a coordinating, data-driven mechanism such as MSP. To reduce this risk, we outline four key recommendations for consideration within the current system and complementary policy domains, that might assist with supporting the three key elements of integrated planning, even in the absence of a formal MSP process. Whilst these recommendations draw from international and national experiences to speak specifically to the Australian context – as the subject of our analysis – the broader lessons will be useful to any country seeking to rapidly develop their offshore wind potential in the absence of MSP supports.

3.1. Novel approaches to support integration and cross-jurisdictional decision-making

To foster integrated governance at the Commonwealth and state/territory levels, the development of a dedicated governance structure is critical (Wuwung et al., 2022). In many jurisdictions, this takes the form of a national agency, independent board, or ministerial committee (Voyer et al., 2022). In Australia, NOPSEMA currently manages some

Table 1
Summary of key constraints and opportunities for the OEI framework.

	Constraints	Consequences	Opportunities
Governance integration	1. No process to work across jurisdictions.	1. Multiple approvals will be needed in each jurisdiction. Offshore wind development constrained by state and territory support.	1. The Commonwealth-led Sustainable Ocean Plan (SOP) has the potential to bring ocean management under a single integrated governance framework.
	2. No process to coordinate applications within the offshore wind industry.	2. Inefficient use of resources - expensive and time-consuming process to revisit application. Potential to harbour unhealthy competition between applicants.	2. Cross-jurisdictional mechanisms to manage across jurisdictions (Regional Plans, Great Barrier Reef Marine Park Authority).
	3. Lack of a coordinated process to seek approvals from other relevant agencies.	3. Multiple points of contact with different government agencies will be needed to gain approvals which adds complexity, time and costs to the application process.	3. State regional planning processes to integrate engagement, coordinate sectors and support whole-of-government decision-making across different sectors and users (Victoria's MSP process and NSW MEMA).
			4. Clean Energy Council is also helping to support and coordinate the offshore wind industry through the Australian Offshore Wind Taskforce.
Participation – First Nations, stakeholders and rightsholders	1. Public consultation on the declaration of an area is the only opportunity that exists in the "pre-licensing" stage of the process.	1. Public discontent experienced because they haven't been engaged early in the process which could lead to a lack of support for offshore wind.	1. A guidance document has been produced by government (Australian Energy Infrastructure Commissioner) to provide best practise advice for industry.
	2. No process to integrate engagement with rightsholders, users, First Nations People and those with an interest in the area.	2. Multiple points of engagement needed with different rightsholders, sectors and users can lead to fatigue and conflict.	2. A First Nations Clean Energy Strategy has been produced which is intended to give First Nations Australians a say in renewable energy policies and programs and respects their connection to Sea Country.
	3. First Nations People are subject to the same consultation process as other stakeholders.	3. Feelings of discontent with Indigenous communities, because their deep custodianship of the land and sea is not recognised through this process. Can lead to lack of support for offshore wind. Risk of consultation fatigue and places burden on these communities who are already underfunded and under resourced.	3. A Protecting the Spirit of Sea Country Bill was proposed in Parliament that recognises that FNP need to be consulted with differently by offshore wind developers.
	4. Responsibility for engagement falls on the licence holder.	4. Understanding of conflict could be subject to bias in recommendations to the Minister. Inability to consider cumulative impacts to users from multiple developments.	4. Non-binding guidelines for engagement with stakeholders, rightsholders and First Nations in the renewable energy sector have been developed by Commonwealth (DCCEEW) and State (Tasmanian) governments, as well as by industry-lead research collaborations such as the Blue Economy Cooperative Research Centre.
	5. Consultation based mainly on spatial boundaries.	5. Communities felt uninformed about offshore wind because essential details on type, scale and nature of the offshore energy infrastructure to be developed comes later in the planning process.	
Supporting evidence-based decision making	1. Gaps in scientific knowledge surrounding the impacts of offshore wind developments are recognised.	1. Australia's high environmental thresholds for its protected species and places means that it may be difficult to get approval for impacts lacking knowledge.	1. The SOP aims to make data more consistent and accessible across jurisdictions. There are also other projects underway to identify and develop a national data platform that enables access to consistent, resolved and cleaned spatial data and data products.
	2. Australia lacks a nationally consistent and robust spatial database to support planning at all levels of jurisdiction.	2. Data to support planning can be inconsistent across regions, resolutions and quality and can be difficult to access making it difficult for applicants to understand and weigh up the full suite of environmental and user impacts.	2. Review of the EPBC Act has potential to make recommendations for cumulative impacts of multiple sectors/users to be considered, including cumulative impacts, to better protect Australia's threatened species and places.
	3. Australia lacks a national policy to make developers consider cumulative impacts.	3. Australia's protected species and places are not given adequate protection from development and subject to further impacts and potential losses.	3. Potential for coordination of data though Commonwealth research initiatives (National Environmental Science Program (NESP); Integrated Marine Observing System (IMOS); Geosciences Australia; identifying priority protected species datasets of relevance to the Gippsland offshore renewable energy declaration areas, and others)

regulatory functions, but is focused mainly on offshore oil and gas activities and lacks the capacity to address broader ocean management needs. This leaves a vacuum around who is ultimately responsible for overseeing and supporting integration.

The development of the SOP offers an opportunity for the Australian Government to establish a policy or institutional mechanism, such as a dedicated oceans commission, to facilitate cross-sector and cross-institutional decision-making for integrated marine planning. As with MSP, however, this is unlikely to occur in the timeframe required to advance the urgent attention that is required. As an alternative, novel approaches to supporting governance integration as an interim measure may need to be considered.

A non-government-led coordinating body, such as an academic or research institute-led initiative, could help facilitate cross-sector and cross-institutional decision-making, particularly if it receives government support and funding. Non-government-led processes can still achieve many of the benefits of integrated planning, provided they are resourced and have clear goals. International examples, such as those in Canada, Israel, Greece, and South Africa, demonstrate how voluntary, academic-led MSP initiatives have prevented conflicts, boosted blue economy investment, and ensured broad stakeholder involvement (Rutherford et al., 2005; Rivers et al., 2022; Barbanti et al., 2015; Dorrington et al., 2018). In Australia, a non-governmental MSP coordinating body could be established, hosted by an NGO, consultancy, or research institute, and would need government and stakeholder support to ensure broad participation and collaboration across sectors.

3.2. Tap into complementary integrated planning processes to support offshore wind development

Policy development to support MSP is critical, but can be time and resource intensive. Interim measures which address the immediate gaps

in governance integration might be achieved by aligning with or adopting existing complementary processes. For example, Victoria's Marine Spatial Planning (MSP) framework, aligned with the state's renewable energy targets, could be adapted by other states and territories to create a coordinated pathway for offshore wind development. Similarly, existing state-level integrated planning mechanisms, such as the Marine Estate Management Authority (MEMA) in NSW and regional plans in South Australia (e.g., Spencer Gulf), could be leveraged at the national level. Collaborative tools, such as Strategic Environmental Assessments, could streamline planning across government, industry, and other stakeholders, facilitating the approval process for offshore wind projects. Other frameworks to achieve integration have also been identified (Stephenson et al., 2019).

3.3. Create consultative mechanisms for transparency and conflict resolution

Coordinating consultation with First Nations, the public, and stakeholders is essential to support the industry to understand key issues and conflicts and reduce duplication and consultation fatigue. This role could be carried out through an existing government or non-government body and needs to support the industry throughout the process. MSP requires active participation of stakeholders throughout the life of the planning process which is commonly overseen by the planning agency or department. The offshore wind industry would greatly benefit from a similar participative approach, that is supported through a coordinating body.

Transparent and inclusive consultation mechanisms, such as community forums, citizen juries, or other deliberative democracy models, can be integrated into offshore wind planning. These mechanisms, already used in international MSP processes, promote public involvement, trust-building, and benefit-sharing. For example, Denmark's strategy for offshore wind includes community benefit-sharing initiatives, such as local residents being offered shares in turbine projects (Skjaerseth et al., 2023). Australia could adopt similar approaches to ensure broader acceptance and mitigate conflicts.

In future, more strategic consultative mechanisms are needed over the long-term to support offshore wind development. For example, rather than a top-down approach to site designation for offshore wind, a more inclusive process led by government that engages First Nations, local communities, and other stakeholders in the identification of potential development areas could occur, which is likely to require legislative changes.

3.4. Develop spatial data platforms to support decision-making

The development of a comprehensive, centralised Marine Data Atlas could provide the spatial data necessary for effective planning which would support decision making in the immediate future whilst also enabling future Marine Spatial Planning. By integrating environmental, user, and value-based data, this platform would support evidence-based decision-making for offshore wind development (Bloomfield et al., 2011; DFO, 2024; Smith et al., 2023). Existing tools, such as Victoria's Coastkit (Victoria State Government, 2024), which provides an interactive mapping platform, and other spatial planning tools like MARXAN, can help assess cumulative impacts and inform long-term planning. Incorporating social and cultural data, as done in the US with First Nations territories (Diggon et al., 2021), could further enhance the planning process and foster more inclusive decision-making. While assessing cumulative impacts is challenging (Foley et al., 2017), tools like Cumulative Impact Assessment (CIA) in Sweden are guiding ecosystem-based decision-making in MSP (Hammar et al., 2020).

4. Conclusion

Finding space for growth of the offshore renewable energy sector is essential to deliver the decarbonisation targets and to stabilise global warming. However, ocean industries are faced with complex regulatory landscapes that present challenges and risks, particularly in the absence of a coordinating, integrative mechanism, such as MSP. This article uses Australia as a case study to illustrate that in the absence of a full MSP approach, there are still elements of the MSP process that can be deployed in the short-term to support development of the offshore wind sector. These include governance integration, participation, and evidenced-based approaches. We acknowledge that there are other approaches available to practitioners that could be considered to help support the development of the offshore wind industry. Such tools include integrated ecosystem assessments and community-based management, among others (Smith et al., 2021). While outside the scope of this article, we also acknowledge that there are other constraints hindering development of the offshore wind industry. For example, investment in technology and infrastructure development, diversifying supply chains, enhancing skills of the workforce and identifying appropriate funding models will be key to enable growth (Larkin et al., 2024; Seetharaman et al., 2019). Further, continued strong policy commitments from all levels of government will be important to support investor confidence to continue financing growth of the industry.

A full-scale rollout of MSP could be considered as a mechanism to support the declaration of other offshore renewable energy areas in Australia in the future. We advocate for continued research to help achieve this. This process could be undertaken concurrently, while mechanisms suggested here could advance the planning and management of offshore wind within the existing declared areas. However, it is important to recognise that in practise the fundamental principles of MSP are not always implemented as intended (Ehler, 2018). Conflicts and territorial injustices from power imbalances in participatory approaches are among some of the challenges that have been documented when implementing MSP (Flannery et al., 2018). Further research to overcome some of these challenges to support a more progressive and inclusive MSP process is needed. For example, understanding how the elements of an MSP process mentioned in this article could progress outside of a regulatory framework could provide options for industry to drive action and overcome constraints around public engagement, data sharing and funding to support the process.

CRediT authorship contribution statement

Laura L. Griffiths: Writing – original draft, Methodology, Conceptualization. **Camille Goodman:** Writing – review & editing, Investigation. **Michelle Voyer:** Writing – review & editing. **Jackson Stockbridge:** Visualization. **Anna Lewis:** Writing – review & editing, Conceptualization. **Freya Croft:** Writing – review & editing. **Chris LJ. Frid:** Writing – review & editing, Supervision, Conceptualization.

Declaration of competing interest

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Data availability

Data will be made available on request.

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