Marine Policy 141 (2022) 105080

Contents lists available at ScienceDirect

Marine Policy

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

Policy options for offshore wind power in Vietnam

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ARTICLE INFO

Keywords:
Offshore wind power
Green growth
Policy
Renewable energy
Vietnam

ABSTRACT

This study assesses key barriers to offshore wind power (OWP) development in Vietnam and policy options for the development of the sector. A survey of 39 experts from government agencies, research institutions, industry, and civil society plus 22 follow-up interviews were conducted over January–September 2021, coupled with a broader analysis of key barriers and policy options. The analysis finds that an underdeveloped policy environment, incomplete procedures, and infrastructure and supply chain immaturity are key current barriers to OWP development in Vietnam. Recommended policy measures include: 1) setting a clear vision and ambitious target for OWP development, 2) adopting a renewable portfolio standard while charting the way for a move from feed-in tariffs to reverse auctions, 3) clarifying that OWP project developers are to self-connect to onshore grids, and 4) developing a streamlined leasing and licensing process within an integrated overall electricity and marine policy. If enabled by well-designed policy, OWP has the potential to play a key role in Vietnam's emission reduction and energy availability efforts.

1. Introduction

Vietnam has significant potential in offshore wind power (OWP), with 475 GW of technical potential within 200 km of the coast. This is the largest such potential in Southeast Asia [1] and equal to about six times the total size of Vietnam's installed power capacity as of 2021 [2]. The most wind-rich OWP area, with an average wind speed of over 8 m/s, lies off the southern central coast, proximate to major demand centers including Ho Chi Minh City (Fig. 1) [3]. There are also sizeable offshore wind resources in the north. A rapid decrease in technology costs is making OWP an increasingly promising energy source [4].

OWP projects in Vietnam were first eligible for a feed-in tariff (FIT) in 2011, with the rate revised in 2018. As of the start of 2021, Vietnam had one existing 99 MW OWP plant, in Bac Lieu Province. During 2021, 20 new OWP projects with a total capacity of 779 MW commenced commercial operations, with Vietnam being the third largest market for OWP capacity installations for the year behind only China and the UK [5]. All are bottom-fixed nearshore OWP farms in the Mekong delta provinces, with "nearshore" defined as being within several nautical miles (nm) of the coast. Another 50 or so projects are in the preparation or construction phase (Fig. 2) [6], including the large-scale La Gan (3.5 GW) and Thang Long (3.4 GW) projects. Vietnam's installation take-off in 2021 was closely linked to the need to beat the expiry date of Vietnam's FIT for OWP of 30 October 2021, with projects commencing after this date not being able to access the FIT [5]. However, at less than 1 GW of installed total capacity, it is fair to say that the OWP sector is still in its infancy.

There have been relatively few studies on Vietnam's OWP policies, despite the country's sizeable potential to lead the way in this sector in Southeast Asia. Several studies [7–9] have reviewed potentials, policies, and barriers to the development of wind power in Vietnam, both onshore and offshore, but their findings are relatively outdated. In a recent study, Ha-Duong et al. [10] assessed scenarios for OWP development in Vietnam by 2030. The Vietnam Initiative for Energy Transition (VIET) [11,12] reviewed international experiences and made some high-level policy recommendations. Son and Gam [13] provided an overview of key environmental regulations. A roadmap for OWP development in Vietnam has been presented by the World Bank [14], while the Global Wind Energy Council has reviewed recent OWP developments in Vietnam [5]. However, studies are yet to provide detailed

Abbreviations: EIA, (environmental impact assessment); EVN, (Electricity Vietnam); FIT, (feed-in tariff); LEP, (Law on Environmental Protection); MOIT, (Ministry of Industry and Trade); MONRE, Ministry of Natural Resources and Environment; nm, (nautical mile); OWP, (offshore wind power); PDP, (Power Development Plan); PPA, (power purchase agreement); PPC, (Provincial People's Committee); PV, (photovoltaic); RPS, (renewable portfolio standard).

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https://doi.org/10.1016/j.marpol.2022.105080
Received 30 November 2021; Received in revised form 11 April 2022; Accepted 21 April 2022
Available online 20 May 2022

insights into the policy choices for Vietnam's OWP sector based on expert views. In addition, although several barriers to rapid OWP uptake in Vietnam have been identified [14], it is unclear which are the most important.

This paper contributes to the literature on policies for OWP in a developing country context, seeking to answer two questions:

1. What are the key barriers to Vietnam's OWP uptake?
2. What are the most suitable policies for the uptake and utilization of OWP in Vietnam?

Toward this purpose, a survey of 39 experts from government agencies, research institutions, civil society, and industry was carried out and 22 follow-up interviews were conducted during January–September 2021. In this paper suitable policy options are analyzed based on the experts' perspectives, complemented by a desk-based literature review. The analysis includes economic incentives such as appropriate FIT rates and other key issues such as investment in transmission connections to the national electricity grid.

The paper is structured as follows. Section 2 discusses Vietnam's current OWP policies and regulations. Section 3 introduces the methods. Section 4 provides results on the key current barriers to Vietnam's OWP development. Section 5 analyzes suitable policies for Vietnam's OWP uptake. Section 6 concludes.

2. Vietnam's OWP policies and regulations

In 2018 OWP was prioritized for the first time in the guiding policy of the ruling Communist Party of Vietnam (hereafter referred to as the Party), the highest political unit in Vietnam. Specifically, Resolution 36/NQ-TU on "Strategy for Sustainable Development of Marine Economy to 2030, Vision to 2045" considers OWP as a potential economic sector [15]. Resolution 55/NQ-TU in 2020 on "Strategic Orientation for National Energy Development to 2030, vision to 2045" also highlights the

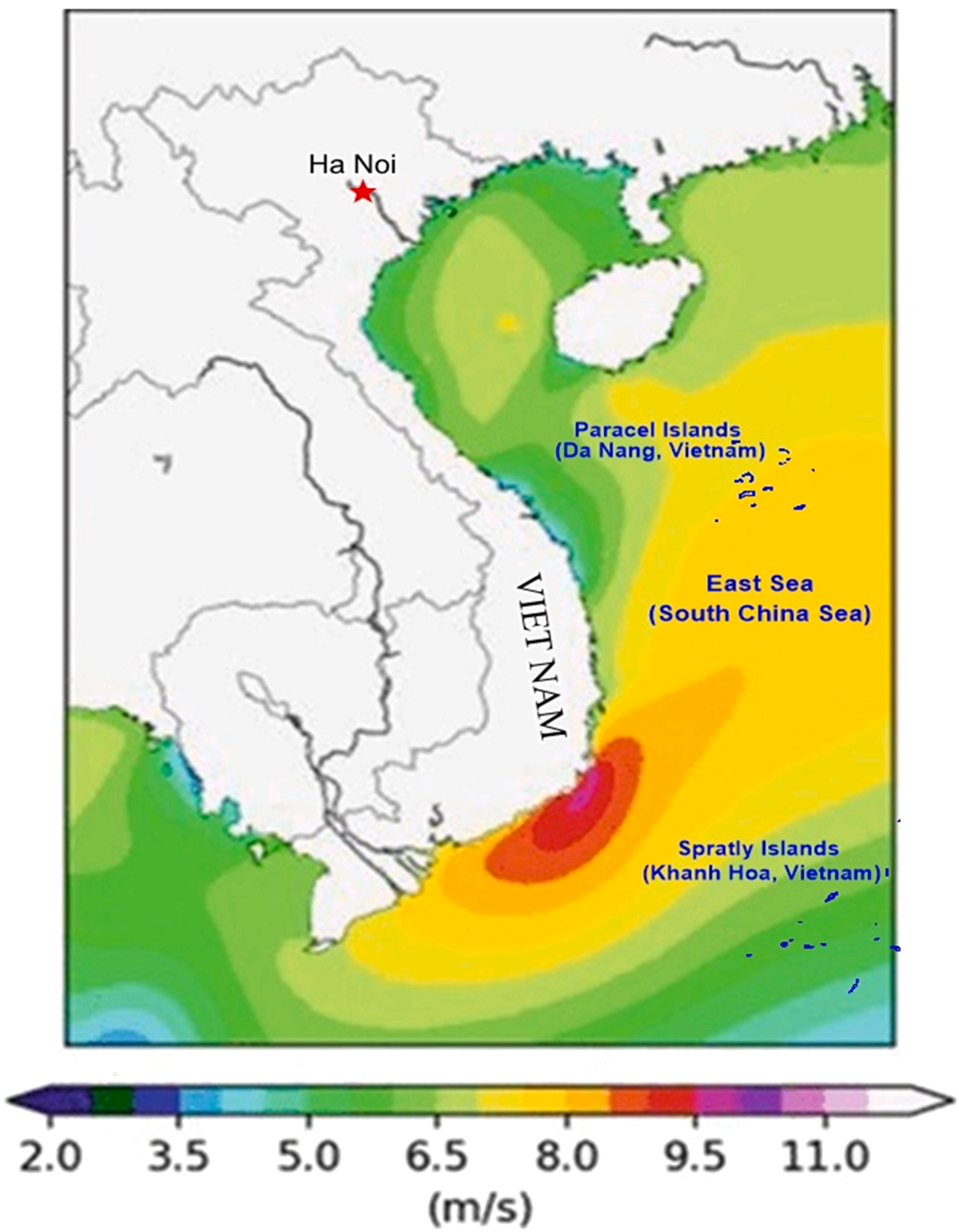

Fig. 1. Offshore wind power potential in Vietnam and nearby areas. Note: This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of any international frontiers and boundaries, or to the name of any city, area, or territory.
Source: [3].

potential importance of OWP in the energy mix [16].

OWP projects in Vietnam are currently regulated by multiple laws (Table 1). Site development and leasing are covered under the Law on Marine and Island Resources and Environment 2015 [17] and the Law on Environmental Protection (LEP) 2020 [18]. OWP planning and operation are mainly regulated by the Planning Law 2018 and the Electricity Law 2018, revised in 2022 [19,20]. OWP investment is subject to the Investment Law 2020, revised in 2022 [21]. The construction of OWP plants is regulated by the Construction Law 2020 [22]. Other indirect laws related to OWP include the Maritime Code 2015 and Fishery Law 2017 [23,24].

In terms of regulations, multiple governmental and ministerial documents are relevant. Prime Minister's Decision 37 in 2011 regulated that OWP generators could sell power at a FIT of US$78/MWh for 20 years [25]. This continued until it was replaced by Prime Minister's Decision 39 in 2018, which stipulated that OWP projects that started their operation prior to 1 November 2021 could sell electricity to Electricity Vietnam (EVN) at a more generous FIT of US$98/MWh for a period of 20 years [26]. Government Decrees 71 in 2015 and 11 in 2021 and Ministry of Natural Resources and Environment (MONRE) circulars provide general provisions on seabed leasing and permitting [27–29]. OWP permitting has been mainly subject to provisions under the Ministry of Industry and Trade (MOIT)'s Merged Document 10 and Circular 07 of 2020 [30,31].

With respect to seabed leasing, Decree 11 of 2021 replaced Decree 51 of 2014 with two key features. First, provincial people's committees' (PPCs') scope of authority to grant OWP survey permits increased from 3 to 6 nm from the coast. Second, a marine area can now be assigned to one or more organizations for individual or multiple purposes, provided there is no conflict in these purposes [13]. Environmental impact assessments (EIAs) of OWP projects have also become more stringent, switching from involving one step in the 2014 LEP to two steps in the 2020 LEP and as now regulated under Decree 08/2022/ND-CP [18].

Despite a strong overall legal framework in some dimensions, specific regulations that provide clear steps for OWP development and regulation have yet to be developed, and ambiguities exist. OWP planning, leasing, and permitting have also generally been *ad hoc*. The approval process can be broadly grouped into the following nine steps [14,27–31].

1. Developers propose a location to the PPC, which then consults with other central agencies including MOIT & MONRE.
2. Developers conduct local wind surveys for at least 12 months.
3. Developers prepare a pre-feasibility study to submit to the MOIT (<50 MW) or the Government Office (if >=50 MW) to be included in the national Power Development Plan (PDP). They also prepare a preliminary EIA to submit to the MONRE.
4. Developers prepare a feasibility study to submit to the MOIT and an EIA and a sea survey application to submit to the MONRE. MONRE seeks approval from the Prime Minister.
5. A seabed lease is issued by the PPC (if <6 nm) or MONRE (if >=6 nm) on an *ad hoc* basis, subject to the Prime Minister's approval.
6. The PPC issues an investment certificate.
7. Developers sign a power purchase agreement (PPA) and grid connection contracts with the state-owned utility EVN.
8. Developers apply for construction permits from the PPC in consultation with the Ministries of Defence, Transportation, Agriculture and Rural Development, and MONRE and start construction.
9. After construction, the PPC and MOIT approve the OWP project to start operations.

While a formal processing timeframe is unavailable, it is estimated that a typical OWP project needs about five years for project development and about another two for installation [32]. The development of onshore wind projects involves fewer administrative procedures and

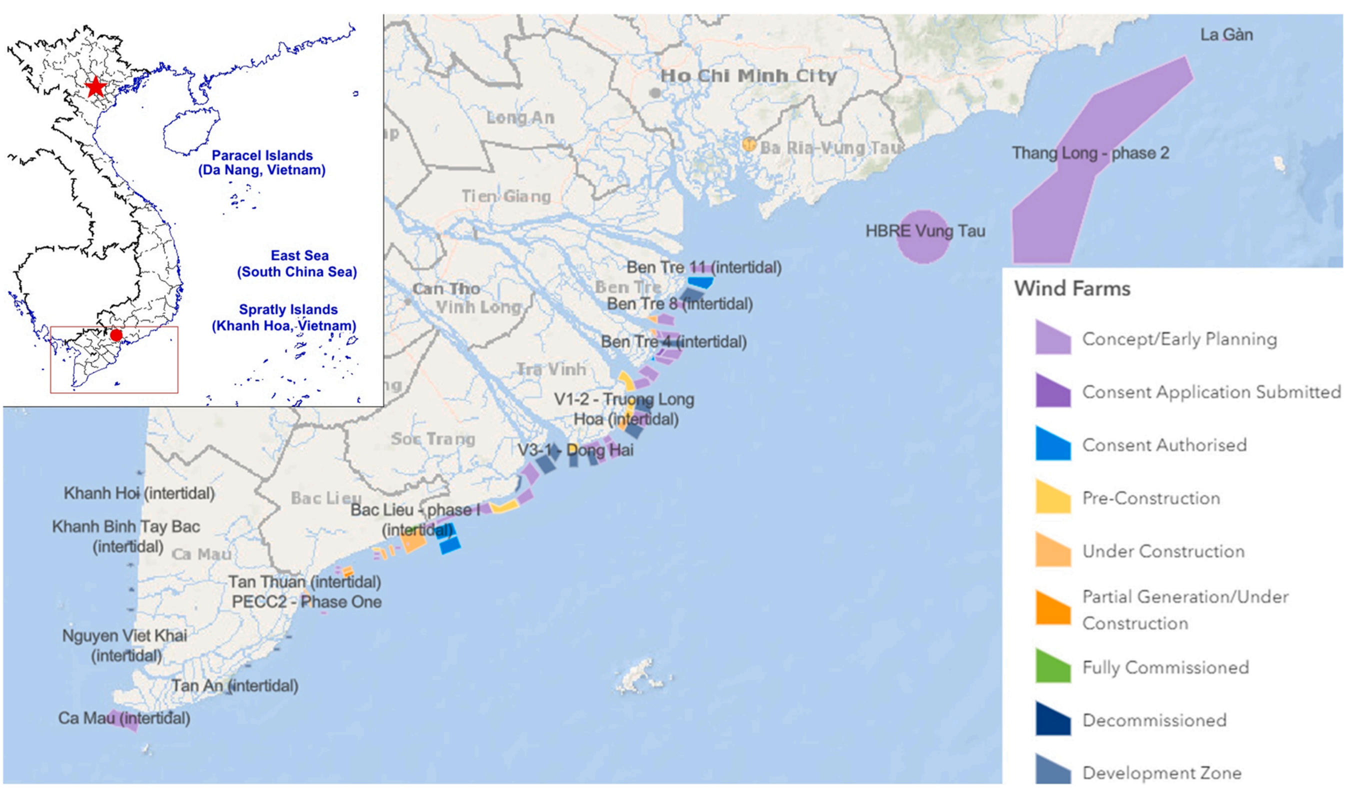

Fig. 2. Vietnam's OWP projects, southern zone. Note: This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of any international frontiers and boundaries, or to the name of any city, area, or territory.
Source: [6].

Table 1
List of offshore wind power direct policies and regulations.

Type	Year	Name	Issued by	Contents
Party documents	2018	Resolution 36/NQ-TU	Central Party's Executive Committee	Strategy for Sustainable Development of Sea-based Economy to 2030, vision by 2045
	2020	Resolution 55/NQ-TW	Political Bureau	Strategic orientation for national energy development to 2030, vision to 2045
Laws	2015	Law on Marine and Island Resources and Environment	National Assembly	Regulating fundamental surveys on marine natural resources
	2018	Planning Law	National Assembly	Regulating national and sectoral planning, including power development planning
	2018, revised in 2022	Electricity Law	National Assembly	Regulating electricity sector, including power development planning, investment, markets, and transmission and distribution
	2020, revised in 2022	Investment Law	National Assembly	Regulating investment in OWP
	2020	Law on Environmental Protection	National Assembly	Regulating OWP environmental impact assessment
	2020	Construction Law	National Assembly	Regulating construction of OWP projects
Government decrees and Prime Minister decisions	2011	Decision 37/2011/QĐ-TTg	Prime Minster	The mechanism supporting the development of wind power projects in Vietnam
	2014	Decree No. 51/2014/ND-CP	Government	Assignment of rights over seabed leasing
	2015	Decree 75/2015/ND-CP	Government	Management of activities of people and transport means in maritime boundary areas of the Socialist Republic of Vietnam
	2015	Decision 2068/ND-CP	Prime Minister	Issuing National Strategy on Renewable Energy by 2030, with a vision to 2050
	2018	Decision 39/2018/QĐ-TTg	Prime Minister	Amendment and supplementation of some articles of Decision 37/2011/QĐ-TTg
	2020	Resolution 26/2020/NQ-CP	Government	An overall plan and five-year plan to implement Resolution 36/NQ-TU
	2021	Decree 11/2021/ND-CP	Government	Assignment of rights over seabed leasing
	2021	Decree 15/2021/ND-CP	Government	Management of construction projects
	2021	Decree 31/2021/ND-CP	Government	Guidance on implementation of Investment Law
	2022	Decree 08/2022/ND-CP	Government	Guidance on implementation of Law on Environmental Protection
Ministerial circulars	2012	Circular 32/2012/TT-BCT	MOIT	Regulation on the implementation of wind power project development and the standardized power purchase agreement for wind power projects
	2012	Circular 96/2012/TT-BTC	MOIT	Guidelines for the financial mechanism to support the electric price for wind power projects
	2013	Circular 06/2013/TT-BCT	MOIT	Regulation on the content, process and procedures for the preparation, validation, and approval of wind power development planning
	2019	Circular 02/2019/TT-BCT	MOIT	Regulation on wind power project development and power purchase agreements (to replace Circular 32/2012/TT-BCT and Circular 06/2013/TT-BCT)
	2020	Merged Document 10/VBHN-BCT	MOIT	Guidance on implementation of Electricity Law
	2020	Circular 07/VBHN-BCT	MOIT	Regulation on wind power project development and power purchase agreements (to replace Circular 02/2019/TT-BCT)
	2021	Circular 18/TT-BTNMT	MONRE	Regulation on fees for using marine areas under the jurisdictions of Prime Minister and MONRE

Source: Compiled by the authors from Vietnamese government documents.

often takes about three years. Solar photovoltaic (PV) projects can be much quicker [33].

3. Materials and methods

To identify key barriers to OWP uptake in Vietnam, a survey and follow-up semi-structured interviews with experts were carried out between January and September 2021 [34–36]. Similar approaches have been used in studies of other energy and climate policy issues in Vietnam [33,35–38]. A combination of stratified purposive sampling and snowball sampling was employed [34,39], with an invitation to participate in the survey being sent to a total of 81 energy and marine stakeholders, of whom 39 agreed to participate. Of those, 11 were from government agencies, nine from academia and civil society, and 19 from industry (15 domestic and four international) (Fig. 3). The respondents were given three weeks to complete the survey questionnaire (Appendix 1).

In addition, 22 face-to-face and virtual follow-up interviews (with seven government officials, eight academia and civil society representatives, and seven industry stakeholders) were subsequently conducted to gain further insights. While there is no rigid rule on the number of interviews required for qualitative research, a typical threshold is a minimum of 20 [39]. The number of interviewees from each stakeholder group was determined based on respondents' availability and willingness to participate, with the aim of having a balanced representation of stakeholders. Clarifying points for discussion were sent before the interviews so that interviewees had sufficient time to think through the issues [40]. The interviews typically lasted about one hour.

Responses were transcribed and coded in Excel for analysis. Interviewees were coded G for government official, A for academic or civil society representative, and I for industry participant. Discussion points mentioned by more than 10% of respondents, and those mentioned by less than 10% but supported by secondary data, were brought forward for further analysis [38]. Personal and institutional details of the respondents remain confidential, and this was made clear in advance. Anonymized quotes from selected interviews are included in the paper.

The expert perspectives were complemented by a desk-based review of international experiences in OWP development [41–45]. China, the UK, and Germany – the top three countries in terms of cumulative installed capacity – were the focus of this review [43]. Relevant experiences from other countries were also considered.

To identify suitable policies for Vietnam, options were analyzed against five specific policy criteria [36,38]. The initial criteria presented to the respondents were cost-effectiveness, effectiveness, equity, timeliness, and feasibility [36], from which the respondents were asked to choose the most important three. During the interview process the effectiveness criterion was subsequently revised to "quantity certainty" to clarify the term and reflect the priority of the respondents with respect to this criterion. Timeliness (how quickly the intended objectives can be met) and equity (the extent to which the proposed policy affects stakeholders in a fair manner) were ranked lowest by the survey respondents and hence not included for further analysis. In order of importance, the three most important policy evaluation criteria identified from the survey and hence receiving focus in this study are thus feasibility, cost-effectiveness, and quantity certainty. These are defined as follows:

- Feasibility: The extent to which the proposed policy can be implemented, on institutional and political accounts.
- Cost-effectiveness: The extent to which outcomes are achieved at the least cost.
- Quantity certainty: The likelihood that the expected quantity is achieved.

4. Vietnam's OWP barriers

Key barriers to Vietnam's OWP ranked in the order of importance by respondents are shown in Table 2. They can be grouped into institutional, technical, and economic barriers.

Table 2
Ranking key barriers to OWP in Vietnam.

Barrier	Rank (% of survey responses)	Type of barrier
Limited foreseeable policy and incomplete administrative procedures	1st (100%)	Institutional
Immature supply chain and infrastructure, including grid connections	2nd (79%)	Technical
High off-take risks	3rd (36%)	Economic
Lack of technology transfer	4th (23%)	Technical
Limited capacity building of government agencies	5th (18%)	Institutional

Note: 1st is the most important. Survey respondents were asked to choose the three most important barriers among nine presented. They could also volunteer new ideas. Those selected by 10% or more of the respondents were reported as key drivers.

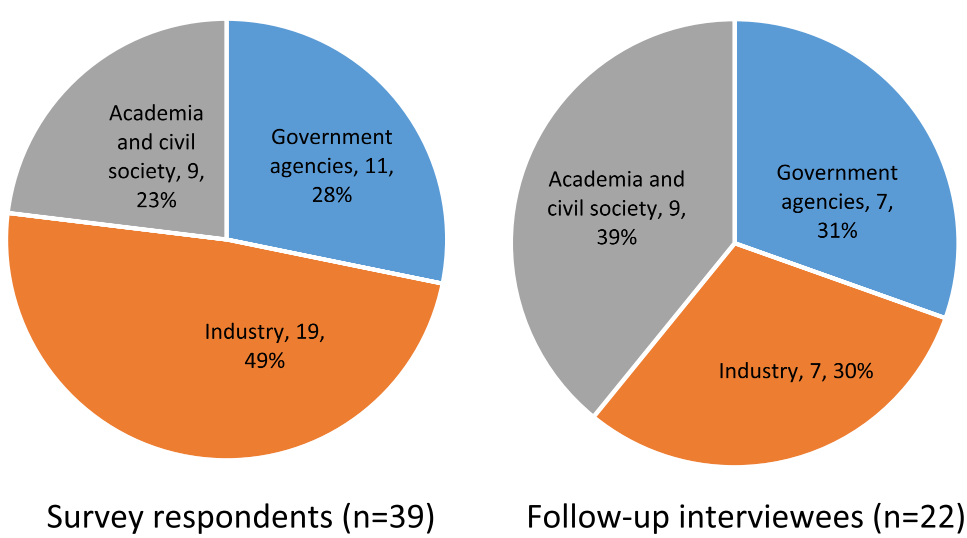

Fig. 3. Composition of survey respondents and follow-up interviewees, (number and %).
Source: Survey.

4.1. Institutional barriers

An underdeveloped policy environment and incomplete administrative procedures were identified as a key institutional barrier by all survey respondents (Table 2). Before 2020, no OWP adoption target was specified in Vietnam, creating a vacuum in terms of specific vision for the sector. In 2020, the tentative total capacity target fluctuated several times during the drafting of the PDP 2021–2030 (PDP8). It even tumbled from around 2 GW by 2030 to zero GW in the 4th draft in September 2021 [46]. This added to the uncertainty facing the sector.

In addition, 44% of survey respondents held that the FIT eligibility window of 3 years was too short (Fig. 4). Further, no incentive instruments were established after the FIT ended in the end of October 2021. This uncertainty increases the difficulty for investors and developers to plan. The interviewees stressed that the overall policy and administrative context is crucial and that attractive FITs alone would not necessarily boost OWP uptake (A2, A5, I3, I5). One said that “Higher FITs would obviously be welcome by the industry, but what matters more is a foreseeable and enabling policy framework” (I5). Short timeframes for project eligibility and uncertainty over future FITs have also been found to stall OWP development in other countries such as Denmark [45].

Administrative procedures for the OWP sector in Vietnam are also lengthy and complex. As shown in Table 1, the development of an OWP project is subject to at least six laws and over 20 regulations. There are nine central agencies involved: the Government Office, MOIT, MONRE, Ministry of Defense, Ministry of Public Security, Ministry of Transport, Ministry of Construction, Ministry of Planning and Investment, and Ministry of Agriculture and Rural Development. At the provincial level, administrative procedures involve the PPC and various provincial departments. One interviewee said that “Dealing with multiple agencies requires good local knowledge and networks that are often beyond many foreign developers’ familiarity” (A9).

More importantly, the procedures are incomplete, resulting in case-by-case leasing and licensing decisions and processes (A1, A4, A9, I5). Multiple rounds of consultation are needed for each step in the project development process, both horizontally between national agencies and vertically between national and local authorities. With nine steps in total, the overall consultation process can involve hundreds of rounds.

The surveys and interviews indicated that a key reform priority is for detailed guidance to be provided for all stages of OWP development. A national marine spatial planning guidance was believed to be the most urgent, as pointed out by 69% of respondents (Fig. 5). One interviewee observed that “The current *ad hoc* and uncoordinated allocation of project sites could result in wake effects in which downstream projects receive less wind” (I1). Detailed guidance for environmental and social impact assessments for OWP was also identified as being needed, as mentioned by 56% of the experts.

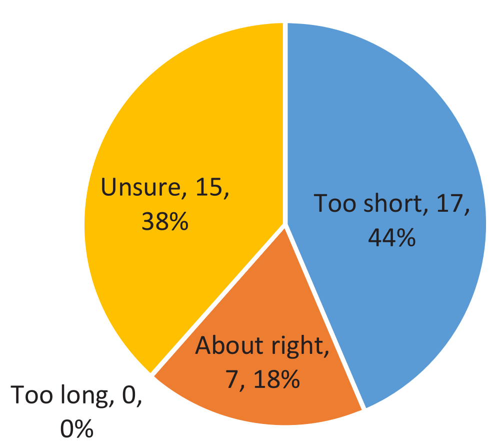

Fig. 4. Survey perspectives about the three-year OWP FIT eligibility window. The number of respondents selecting the options in the absolute and % terms, n = 39.
Source: Survey.

Another barrier is an unclear division of tasks among government agencies, for example in linking the emission reduction targets and OWP targets or in harmonizing the interests of fishers and OWP developers (A1, A5, G9). Uncoordinated efforts among related authorities are seen as having hindered efficiency and effectiveness (A1, A2, G1, G3, G10, I11, I12).

Other regulations identified as needing clarification include those for processing procedures and timeframes (Fig. 5). Among the procedures, responsibility for transmission connections from OWP sites to onshore grids is seen as a key issue, as noted by about two-thirds of the interviewees. For deep-water OWP sites, who will be responsible for transmission connections has been left undecided.[1] This poses a major barrier for investors who would need to enter overly lengthy negotiations to clarify the way forward. Although foreign investment is allowed, no follow-up guidance has been provided on particulars relating to Decree 31/2021/ND-CP regarding the participation of foreign investors in OWP projects (A6, A9, I4).

The cause of administrative and regulatory shortcomings has been attributed to limited government capacity and the nascency and complexity of this sector. Policymakers have faced policy questions such as over the setting of suitable OWP targets, proper FIT rates and duration, and operational procedures (G6, G9, G10, G11). Limited data on wind and seabed conditions and the maritime environment have further impeded OWP development (A1, A2, A4, A7, I12, I19).

In addition, the benefits of OWP have yet to receive broad acceptance and recognition. Awareness of OWP among the public and policymakers is assessed as being only modest (A4, G1, G4). Some policymakers believed that with current Vietnam’s electricity grid management capacity, it would be impossible to deal with the OWP intermittency issue, causing risks to power system stability (A1, A3, A4, A6). On the other hand, one interviewee pointed out that “There has been a public misconception that the need for upgrading transmission grids is because of OWP. That is incorrect. Upgrading the grid will be needed for any forms of new electricity investment” (I5).

4.2. Technical barriers

Limited infrastructure has been another key barrier, with grid undercapacity being the most significant concern. The concern has heightened, particularly among policymakers, given recent experiences with the curtailment of solar PV and onshore wind power [33,36]. Like solar PV and onshore wind, Vietnam’s OWP potential is particularly concentrated in the south. This poses high risks of curtailment due to limited grid capacity in the local area (A1, A2, G3, G6, G9, I5). Upgrading the grid – particularly the north to south system – may take years to complete due to a lack of capital and complex negotiations about land compensation for local communities (A1, A5, A9, G6). Grid limitations have caused OWP output curtailment issues in countries such as Germany and China [11].

Another concern when considering OWP is Vietnam’s limited energy storage capacity to help to manage the intermittency of output. Although OWP can be less variable than solar PV and onshore wind power, some energy storage capacity may still be required to help to balance the power system (A3, A4, G10). A handful of utility-scale battery and pumped hydro energy storage projects are at only the planning stage in Vietnam.

The current port systems also remain inadequate for OWP development (A1, A3, A4, I1, I4, G9). Some deep-water ports such as Cam Ranh,

[1] For nearshore projects, developers are responsible for connecting to the grid [31].

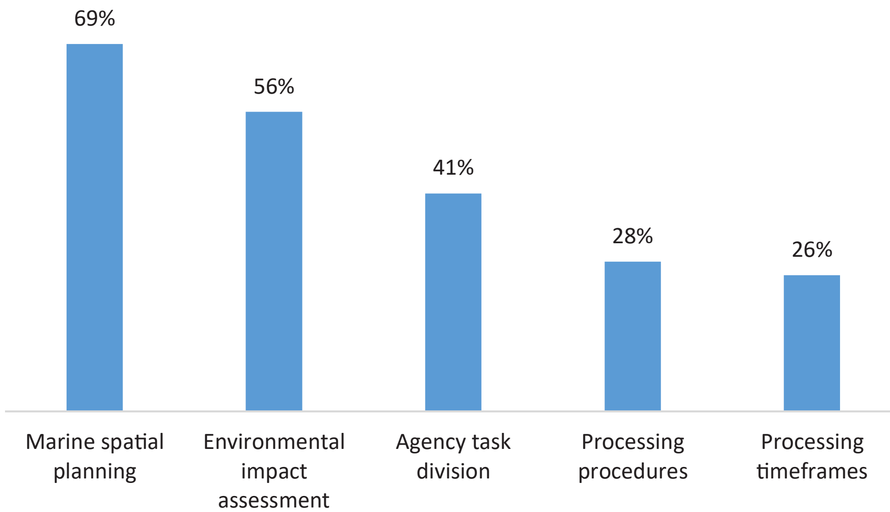

Fig. 5. Areas that need to be revised or added to regulations (% of respondents). Respondents were given various options. They could more than one as well as volunteer new ideas. Those selected by 10% or more of the respondents were reported as key benefits.
Source: Survey.

Van Phong, and Phu My in the south-central region and Tan Cang and Sai Gon in the south would need upgrades [12]. Some shallow-water ports may also need upgrades to facilitate shipping for OWP maintenance services. Improper roads and inland waterway systems have already impeded the transport of wind turbines and towers for intertidal projects to the Mekong Delta, where deep-water ports are unavailable (A2, I11), [33].

A lack of technology transfer and supply chains was also highlighted as a barrier by local industry stakeholders (I11, I12, I19). Currently there is a reliance on international experts' knowledge and on offshore OWP equipment manufacturers. COVID-19 has worsened the situation for reasons including that foreign experts could not travel to Vietnam to work on advanced technical processes (A2, A4, A9). Equipment imports have also been delayed during the pandemic. Many registered projects have struggled to meet the FIT deadline.

4.3. Economic barriers

Given the underdeveloped nature of Vietnam's wholesale electricity market, it is necessary for OWP projects to have PPAs with the utility – as is common in many markets. Yet high off-take risks associated with Vietnam's PPAs have hindered investment in OWP in the country [47]. EVN has yet to include take-or-pay obligations in the PPAs given its concerns about its capacity to take variable energy supplies from OWP. While some investors have accepted off-take risks for solar PV projects [36], investors appear more cautious when it comes to OWP given the large-scale investments and long-time horizons involved (A1, A9, I5). The termination, arbitration, and curtailment clauses of the PPAs have also created bankability issues that have put off some foreign investors [32].

5. Strategies for OWP development

5.1. Vision and target

A clear vision and ambitious target were identified by respondents as important required enablers for Vietnam's OWP development. Ambitious targets are a common feature of successful countries in OWP adoption such as the UK (40 GW by 2030), Germany (20 G W), and China (50 GW) – although these countries differ in other OWP policy dimensions (Table 3). When asked to select different options, 87% of the survey respondents believed that Vietnam should set a target of 11–25 GW (about 5–12% of power capacity) by 2035, as suggested by the World Bank [14], instead of 9–11 GW by 2035 as in the current draft PDP8 [2]. The idea that "Vietnam should give priority to developing OWP" was supported by 85% of the experts. It was broadly thought that now is the time to set the target and vision (A1, A2, A3, A4, A5, A9, G3, G6, G10, I1, I4, I5).

The rationale for an ambitious OWP vision is supported by assessments that OWP would deliver multiple benefits. 92% of respondents believed that OWP could meet increasing energy demand at a large scale (Fig. 6), particularly at a time when financing sources for fossil fuels

Table 3
International experience in OWP policy in some key markets.

	UK	Germany	China
2030 target	40 GW	20 GW	50 GW
Economic incentives	- Renewable Obligation Certificates during 2002–2017 - Contracts for differences since 2017	- FIT during 2000–2017 - Tariff-based auctions since 2017	- Two parallel systems: tariff-based auctions and FIT for some non-tendering projects - Since 2014, separate nearshore and deep-water offshore FITs - From 2022: no more central government FITs
Site identification	- Zones are identified by the State, investor proposes the site within these zones	- Open door procedure: Investor proposes sites; first come, first served	- Developers conduct surveys after winning a bid and before beginning of the project construction
Streamlined process/ One-stop shop	- Offshore Renewable Consent Unit is in charge, although multiple clearances are required	- Regional state agencies approve if less than 12 nautical miles. Federal agencies approve otherwise	- In the process to centralize
Grid connectivity	- OWP Project developer, then switched to allowing other developers	- Transmission system operator	- OWP project developers

Source: [42–44,51,55].

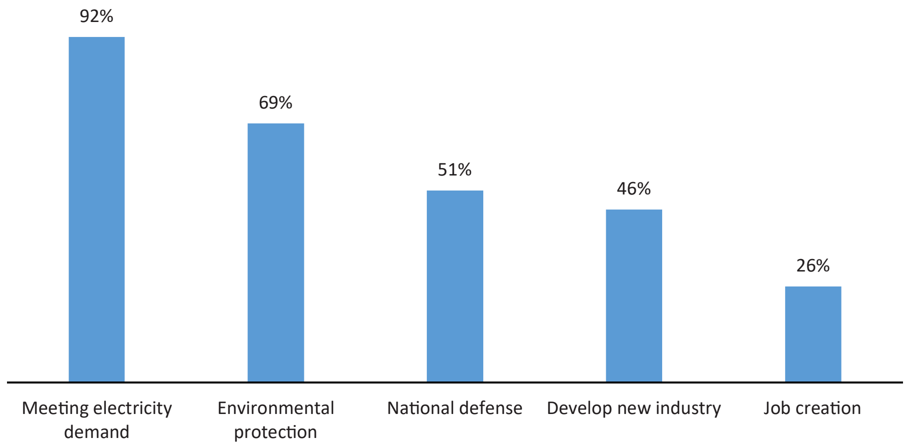

Fig. 6. Key OWP benefits (% of respondents). Respondents were given various options from which to select the most important three. They could volunteer new ideas. Those selected by 10% or more of the respondents were reported as key benefits.
Source: Survey.

have reduced (A3, A4, G3, G8, G9, I1, I5). OWP typically has a higher capacity factor, predictability, and stability than solar PV and onshore wind (A3, A7, I4, I5), [12]. It can complement these sources and, if coupled with energy storage such as pumped hydro, can provide a reliable alternative to thermal power [48]. Consistent with this, Lu et al. [48] reported that Vietnam has the potential to achieve over 90% penetration of solar PV, onshore and offshore wind, and pumped hydro storage in its electricity mix with a competitive LCOE of US $63–85/MWh based on 2020 technology. Land limitations can also be addressed (A3, I3, G3).

In addition, 69% of the experts highlighted the environmental benefits of OWP, including that it could help to significantly reduce greenhouse gas and other atmospheric emissions (A1, A2, A3, A4, A5, A6, G3, G6, G10, I1, I4, I5). It has been estimated that by replacing coal power with 25 GW of OWP by 2035, Vietnam could avoid over 200 million tons of CO_2 emissions cumulatively – about 60% of the country's annual energy sector emissions in 2020 [14,49]. Another benefit pointed out by 51% of survey respondents is contributing to sustaining the country's seas and islands sovereignty. OWP development could also bring about economic benefits by forming a new green industry, creating jobs, and exporting power to other countries (A3, A4, A5, A6, G3, G6, I3, I4). The cumulative benefits of achieving 25 GW by 2035 have been estimated at over US$50 billion [14].

5.2. Incentive instruments

Experts rated incentive mechanisms as important for OWP development in Vietnam. A total of 61% recommended that a new incentive instrument should be issued after the end of the FIT under Prime Minister's Decision 39 (2nd FIT) to provide continuity in policy. One possibility would be to extend the now-expired 2nd FIT for already-registered projects (A1, A3, I11, I19). This would help to provide certainty and reduce the need for negotiations with EVN over PPA terms, and would also be fair in that project developers faced many obstacles during the pandemic, delaying their projects. 44% of the survey respondents believed that the FIT rate of US$98/MWh seems about right for nearshore projects for the time being. The LCOE for a typical nearshore wind site was about US$81/MWh while that for deep-water offshore wind was about US$174/MWh as of 2021 [14]. Therefore, the FIT understandably induced investment in nearshore rather than deep-water OWP projects.

One approach would be for FITs to continue until a relatively sizable cumulative volume of OWP has been signed up (A2, A7, I1, I5, I11, I12). This could be similar to the approach used in Taiwan in 2018, where a selection process for a fixed FIT was initially used before the transition to competitive bidding over the feed-in price [47]. A new FIT could also be specifically designed to decrease annually to reflect declining technology costs and disincentivize project delays (A1, A2, A5), an approach used in Germany [42]. Under this approach, later-starting projects would receive a lower FIT (but projects would receive a FIT that is constant in nominal terms over a set time horizon). To meet overall system planning and other objectives, limits could be imposed on eligibility and different FIT rates could potentially be applied for different zones. FITs are often employed in the early stages of a country's renewables development [44], such as in Germany and China (Table 3).

A generous FIT is unlikely to be suitable in the long term due to costs (A2, A6, A9). Such FITs could also have adverse effects on electricity users, especially low-income households, if the incremental costs were to be passed through via electricity tariffs [50,51]. Policymakers in Vietnam also appear reserved about FITs given that the solar FITs have faced criticism of being prone to rent seeking [52,53]. In the long term, either a low FIT and/or competitive reverse auctions to determine PPA feed-in terms would be desirable.

Reverse auctions are currently indeed being considered in Vietnam. This instrument has become a popular approach to drive down renewable project costs [54], including in the major OWP markets of Germany and China (Table 3) [55]. However, institutional preparation such as revising the Electricity Law and the Asset Auction Law would be needed (A1, A2, A3, G3, G8, I5), [47]. One interviewee noted that "Introducing reverse auctions when the industry is immature may stall development momentum" (I5), as in Denmark and France [47]. It is likely that reverse auctions would however be a good option in Vietnam's context over the medium to long term.

Depending on the maturity of the OWP industry and the wholesale electricity market, other mechanisms such as contracts for differences and feed-in premiums have been used in some markets such as the UK and Germany, respectively [1,43]. The suitability of these mechanisms depends on the local institutional context [54–57]. Given the nascent state of Vietnam's wholesale electricity market, these instruments are not yet suitable for Vietnam (A9, G3, G8). While the development of a competitive wholesale electricity market is an ongoing initiative [58], the use of PPAs (with terms determined by a FIT or a reverse auction and not linked to the wholesale price) is likely to be the dominant model for new electricity projects in Vietnam in the foreseeable future.

Another potential instrument is a renewable portfolio standard (RPS) – a requirement that a certain level or share of renewables be achieved each year (A1, A3, A7, A9). Obligations could be met using tradable renewable energy certificates (RECs) [54], with a well-managed RPS being a direct and efficient mechanism for achieving renewable adoption targets. An advantage of an RPS is that it helps to ensure a minimum quantity of renewables and ensure that EVN has an incentive to promote renewables adoption and utilization. It is a less politically sensitive approach than FITs [59].

RPSs have been adopted in over 100 countries [60] as a complementing mechanism to FITs and reverse auctions [41,59–62]. For example, an RPS has been used in combination with a FIT in the US and China [51,56] and in combination with reverse auctions in the UK [63]. The Renewable Energy Target (RET) in Australia is an RPS that has been a key policy instrument for successful solar PV and wind uptake [64].

An RPS would have legal grounds to be developed as a policy instrument in Vietnam. One interviewee shared that "An RPS was mentioned in the National Strategy for Renewable Energy 2016 and hence could roll out without much regulatory hurdle" (A1). Indeed, an RPS and tradeable REC system could build upon the existing spontaneous small REC market in Vietnam under the International REC and Tradeable Instrument for Global Renewables mechanisms [68], although the overall process to establish a formal system may take several years [36]. By reducing off-take risks, an RPS could improve the bankability of PPAs and attract more financing for OWP.

The various incentive instruments each have advantages and disadvantages, as summarized in Table 4. It is also relevant to note that the appropriate design and implementation of incentive instruments is generally more important than their type [59,65].

5.3. Leasing and licensing

With respect to responsibilities for site identification, different opinions exist among the respondents. Academic experts believed that a government-led option would enable a focus on the national interest, including defence, environmental protection, and energy demand and supply (A1, A3, A4, A5) and that this would help to deliver high volumes of prospective sites [14]. However, this approach creates financial and administrative burdens for the government.

Industry representatives indicated a preference to identify suitable sites by themselves as in the current open-door approach, provided that their incurred costs and rights to project development are considered later in the leasing and licensing processes (I1, I5, I11). They did note that in either case, better coordination and rules on siting would enhance project outcomes. These findings are similar to those reported in a previous study by the World Bank [14].

Opinions about licensing also tended to diverge between the industry respondents and those from academia and civil society. Many industry respondents indicated a preference for the status quo, as they were concerned that changes would make processes more stringent and time consuming (I1, I3, I5). Particularly, local developers indicated they preferred dealing with multiple agencies over working with a single agency (I4, I11, I12). They generally wished to keep the current level of scrutiny of applications for inclusion into the national and provincial PDPs although they also had complained about the complexity and strictness of the process.

Academic and civil society representatives believed that a more streamlined licensing process including a one-stop-shop mechanism – as in the UK and Demark [47] – and clear procedures would improve efficiency and effectiveness (A1, A3, A4, A5). A one-stop-shop would be possible in Vietnam, with the likely focal point being the National Steering Committee on Marine Economic Development established in 2020, chaired by the Prime Minister [12]. This type of approach is being considered in Japan [66]. More stringent leasing and licensing procedures may also be needed to improve the quality of OWP projects (A3, A4, A9).

Government agency respondents tended to be more neutral among the different options. They indicated that more consideration would be needed because the various options have advantages and disadvantages. For example, while more streamlined licensing may save time, it would receive less participation and support of stakeholders including the local authorities (G1, G8, G10). On the other hand, mandating the provincial government with more authority would require significant technical capacity building (G1, G8, G9). That can present a big challenge as in the case of China [67].

Transparent procedures are an important common enabler of OWP, although countries' approaches differ. Germany has applied a decentralized process while the UK and China have tended to follow more centralized approaches (Table 3). Transparency and certainty of capacity targets have been a key driver for OWP success such as in the Netherlands [47]. Clear timeframes for each stage of the licensing process would provide good visibility and confidence of project progression for developers [34].

Overall, a more centralized licensing and procurement process with integrated electricity and marine policy via a one-stop-shop mechanism emerges as a preferable option, supported by 43% of the experts. In a more streamlined approach, the government would need to allocate resources for siting and also for surveys on for example metocean conditions, marine ecology, and seabed habitats. However, control over the pace and volume of OWP development and over EIAs and sea management could be better addressed (Table 5). Any change in regulations should minimize impacts on early-mover projects and minimize -disruption to the sector, as recommended by the World Bank [14]. It would also be important for government to maintain ambition in the roll-out of OWP.

5.4. Grid connectivity

International experience shows there are three main models for transmission connections from OWP farms to onshore grids. In the first, the transmission system operator is mandated to be responsible. This model is employed by Germany, the Netherlands, and Belgium [43]. In the second, used in the US, Denmark, China, and Taiwan, the responsibilities belong to the OWP generators themselves. The UK employs a third model in which generation and transmission are unbundled so that other developers can invest in transmission connections [42]

Table 4
Key advantages and disadvantages of incentive instruments in Vietnam's context.

	FIT	Auction	RPS	Contracts for differences and feed-in premium
Advantages	Low risks for developers	Cost effective	- Politically feasible- More certainty in uptake quantity- Potential to improve PPAs' bankability	Flexible and cost effective
Disadvantages	- Potential financial burden for government or electricity consumers (unless FIT is set at a low level)- Less certainty in uptake quantity- Politically less popular in Vietnam at the current time	Institutional preparation required	Requires establishing and overseeing markets for REC	Not yet suitable given Vietnam's underdeveloped wholesale electricity market

Source: Interviews.

Table 5
Advantages and disadvantages of leasing and licensing options.

	Site identification (pre-leasing)		Leasing and licensing	
	Developer-led (Status quo)	Government-led	Status quo (multiple contact points)	More streamlined (one-stop shop)
Advantages	Can be more cost-effective, as developers are incentivized to find the best locations	More control, including over the pace and volume development	Possibility for more stakeholder consultation	More cost-effective, saving time for developers Better coordination among stakeholders to maximize national interest
Disadvantages	Less certainty about quantity uptake Potential cost duplication	Financial burdens for the government	Risks of fragmented and uncoordinated efforts	Risks of less consultation and less support by local stakeholders

Source: Interviews.

(Table 3).

The survey respondents generally believed that mandating OWP developers to connect from OWP farms to the national onshore grid would suit the local context, with 46% of respondents selecting this option. This would incentivize OWP developers to carefully prepare for a project proposal and would help to contribute to only projects that make overall financial sense going ahead (A2, A5, G10, I1). More importantly, with this approach the overall financial burden for electricity transmission could be shared between the government and the private sector (A3, A5, G10), with the government focusing on the national onshore grid (G3, G8, G11). This change would also mean that the government could review OWP development and grid connections in one application package (A6, A7, G6), which would improve efficiency.

The approach of requiring projects to cover transmission connections to the main grid currently applies for nearshore project models and could be expanded to include offshore ones. This approach has also been applied in China and Taiwan. The amendment of the Electricity Law in early 2022 allowing the private sector to invest, construct, operate, and maintain transmission grids provides a basis for such implementation [69]. The caveat is that only large deep-water projects would be likely to have capacity to join the market if transmission connections need to be covered by the project proponent (Table 6). On the basis that this reflects higher relative costs for smaller projects, this seemed acceptable to the interviewees, including the industry respondents (I1, I11, I19). Good planning and coordination would still be needed to optimize the overall transmission and distribution systems (I5, I11, I19).

Table 6
Advantages and disadvantages of approaches for responsibility for grid connections.

	EVN	OWP developers (status quo)	Other developers/ investors
Advantages	More government control over the entire system	Overall financial burdens are shared between the public and private sectors	Opportunities for investors other than OWP developers
Disadvantages	Financial burden on public funding	Small OWP projects would be less likely to proceed	More complex processes

Source: Interviews.

6. Conclusions

Based on expert surveys and policy option analysis, this study has provided various insights into OWP development in Vietnam. It finds that OWP could be deployed at scale to meet increasing energy demand and contribute to achieving Vietnam's net zero emissions by 2050 target. In addition, there are opportunities for Vietnam to develop a new sea-based economy for purposes including OWP exports while enhancing national defence interests. Key barriers to realize the potential include incomplete leasing and licensing procedures and limited technical capacity in the OWP sector in Vietnam.

To overcome the barriers, clear and ambitious OWP targets in the upcoming PDP8 would help. A predictable FIT for coming years, followed by a move to reverse auctions, would also be a practical way forward. This could be complemented by an RPS to ensure EVN is incentivized to promote renewables uptake. An enabling policy framework including transparent and detailed regulations on issues such as marine spatial planning, environmental impact assessments, and task division among agencies is important. More streamlined leasing and permitting could also improve efficiency and effectiveness. The development of the industry would also benefit from close cooperation between government and the private sector. For example, the government could take more responsibility for pre-leasing site preparation and continue with its responsibility for the onshore grid, while OWP developers could take responsibility for connecting from OWP farms to onshore grids.

Other enabling strategies would be useful. Capacity building and better communication on the benefits of OWP could help to generate more political and public support. Strengthening linkages between marine, climate, and energy policymaking via mechanisms such as the national action plan for net zero emissions (currently being drafted) would create impetus for boosting OWP uptake. Developing a renewable energy law could also ensure a long-term stable regulatory and policy framework for OWP.

OWP can have a higher capacity factor, greater predictability, and involve less land interference than solar PV and onshore wind. It is thus relatively well suited to integration into Vietnam's electricity systems, particularly when combined with energy storage such as pumped hydro. Although technology costs for deep-water OWP are currently higher than those of nearshore OWP, deep-water OWP typically has fewer negative impacts on the livelihood of local fishers and on other marine economy sectors. It thus merits long-term policy development initiatives.

Vietnam's northern provinces experience relatively poor solar irradiation conditions in winter, and transmission connections across the country remain weak. Fortunately, Quang Ninh and Hai Phong provinces in the north have high potential for deep-water OWP [2,14], meaning that OWP could play an important role in powering the economy of not only the provinces in the south. This would also help to reduce the need to invest in north-south transmission connections to some extent. However, careful planning would be needed to mitigate negative environmental impacts given that the potential OWP sites in the north are close to environmentally sensitive areas [14].

Establishing a strong and conducive policy framework would mean that a conducive setting is in place for deep-water OWP projects that may start to become cost competitive in coming years. Experience gained from the initial nearshore projects may open the way for a much larger OWP sector in Vietnam in the future. Vietnam may also be able to lead the way for other developing countries in the region and beyond.

Declaration of Competing Interest

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

Acknowledgements

We are grateful for funding under the Australian National University's Zero-Carbon Energy for the Asia-Pacific Grand Challenge. We thank the Vietnam Institute of Seas and Islands Research, Hoang Xuan Huy, and other colleagues for their assistance with the survey. We also thank the respondents for their contributions and two anonymous reviewers of the paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2022.105080.

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