D2.2-seabed, April 2022

Impacts of Competitive Seabed Allocation for Offshore Wind Energy

A cash flow analysis of implemented allocation scheme designs, results, and impacts

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Executive Summary

Offshore wind is an important part of the accelerating transition to green energy sources in many maritime countries. To develop offshore wind projects, private developers require access to and tenure over the seabed, which is a scarce and valuable resource controlled and managed by governments. In this report we describe the currently implemented seabed allocation schemes for offshore wind around the world and analyse the economic effects of the fees embedded in the seabed lease agreements. We describe the allocation schemes for seabed including pre-qualification, fees, and method of competition for the examples of UK (England, Wales, and Northern Ireland), UK (Scotland), the United States and the Netherlands. Then, we use a discounted cash flow analysis to assess and compare the timeline and magnitude of the fees.

We show that the costs embedded in the seabed lease agreements can be extensive and have been trending upward over time.

1 Introduction

Renewable energy capture and transformation into usable energy carriers such as electricity is an important aspect of combatting climate change and providing energy security (IPCC, 2022). Electricity production from offshore wind has made great strides towards becoming economically viable, in some instances even when including the offshore infrastructure into the wind project scope. The most recent Danish offshore wind energy auction even resulted in a considerable sum paid to the government by the winner of the auction for the right to construct the wind farm on an otherwise purely commercial basis, i.e. without support (Energistyrelsen, 2021).

There are also other instances in which offshore wind projects must pay certain amounts to government institutions or state authorities – in the form of seabed lease agreements. On the one hand, it can be seen as an opportunity that this once subsidised technology can now become a source of income for the state. One argument for such payment may be related to that offshore wind energy and many other industries rely on access to seabed for operation. Seabed is a scarce and valuable resource and, therefore, needs to be allocated efficiently. On the other hand, it can be argued that extracting excessive fees from an industry characterised by high positive externalities for climate change mitigation may be counterproductive, especially if it could distort wind farm design and operation in way as to make projects less productive. As the cost of offshore wind technology is decreasing, thereby expanding the area of seabed that could be economically developed, the fixed (and limited) area of available seabed may become a constraint for further development. This necessitates a re-conceptualisation of the seabed as a potential point of competition with a potentially increasing impact for the offshore wind industry.

The topic of increasing cost of access to seabed lease options has been discussed in several reports from NREL (Musial et al., 2019, 2021). The topic of sea bed leases came into public focus in 2021 when a seabed lease auction in the UK resulted in unprecedentedly high bids (The Crown Estate, 2019, 2021) and, thereby, high costs of seabed. However, less has been written on the design of the seabed leases and different allocation mechanisms. One notable exception is (Ausubel & Cramton, 2011), whose study set out to identify the best method of selecting a winner in a seabed lease auction. Since then, some first publications have emerged that include considerations on auction design for seabed leases, and their interactions with auctions for the allocation of support rights, as well as the arising incentive structures for design and operation of wind farms (Baringa, 2021; Fitch-Roy, 2021; Laido & Kitzing, 2021, 2022; Timmons, 2021). The objective of this report is to present a comparative overview of the different competitive seabed lease schemes used to-date and make their results comparable by calculating the total value of fees. The report is the result of work undertaken as part of the AURES II project, and consisted of desktop research as well as a public expert dialogue during a sector conference in November 2021 in Copenhagen.

2 Implemented seabed allocation schemes for offshore wind around the world

As the global offshore wind industry enters a new phase of accelerating growth, providing developers with access to the publically owned seabed is a crucial challenge. Ensuring that the right sites are made available to the right projects, at the right time is essential for a viable, sustainable project pipeline. And the stakes are high; as the first major regulatory hurdle in the development process, the outcome will define the operational fleet for decades to come.

A variety of allocation models have been used in different countries, depending on institutional responsibilities and the wider policy environment. But, until recently, sites were generally awarded on the basis of qualitative criteria designed to guarantee project deliverability and alignment with the government's policy commitments. In some places, these 'beauty contests' have required the payment of a fee on award to retain the exclusive development rights to a site, but the allocation itself is not based on price.

However, growing confidence in the quality of available projects has seen some policymakers seek to foster competition between qualified developers, with site tenure awarded on the basis of an auction in which the highest bidder wins the site. In the UK, for example, the recent Round 4 auction for sites in England and Wales saw exclusive rights to enough offshore real estate for 8 GW of offshore wind achieve approximately €1bn in option fees, payable annually for up to ten years until a lease is taken up once relevant permits are awarded. In the US, the Federal government has been selling offshore wind leases by auction for almost a decade.

This report focusses on the economic implications of the costs incurred by developers to access publically owned seabed through tenure arrangements such as lease agreements. We consider both competitive auctions and fixed or capped price tenders but, as we will show, there is a large difference in magnitude between the costs resulting from the two types of allocation.

The allocation of seabed can be combined with subsidy schemes. However, for the purposes of this report, schemes for allocating subsidies for electricity production (e.g. Contracts-for-Difference) are excluded. Subsidy allocation is assumed to be the purpose of the scheme if tenders may result in the governments paying the developers support for electricity production. This focus results in four relevant jurisdictions/schemes.

2.1 The United Kingdom: England, Wales, and Northern Ireland. The Crown Estate

In 2021, The Crown Estate held its fourth seabed allocation auction where 2,433 km^2 of seabed was allocated to 6 projects with a total of 7,980 MW of potential capacity (The Crown Estate, 2021). The process included qualitative pre-qualification, where the most important financial requirements were m£70 in assets, m£600 in average revenue over the past 3 years and m£45 in available cash or cash equivalents (The Crown Estate, 2019). Additionally, experience from managing a project of at least m£50, from doing a full environmental impact analysis and connecting a 50 MW project to the grid, as well as compliance with exclusionary criteria was required (The Crown Estate, 2019).

The seabed leases were allocated through a competitive auction, which foresaw a minimum awarded capacity of 7 GW of projects and a maximum capacity of 8.5 GW. The auction was divided into rounds where a single project was awarded in each round to the bidder with the highest bid per MW per year (The Crown Estate, 2019). After each round, the bidders for the next round were allowed to adjust their bids. The most notable eligibility criteria were a minimum density of 3 MW/km^2, minimum capacity of 400 MW (or 600 MW in the Dogger Bank area), maximum capacity of 1,500 MW and at least 7.5 km distance to the nearest other wind farm (The Crown Estate, 2019). Only if all these requirements were met the bid was considered eligible to be ranked based on an annual option payment per MW (The Crown Estate, 2019) (henceforth, payments not officially called rent are referred to as fees). The payments will last until the wind farm starts operation (The Crown Estate, 2019).

Additional monetary obligations arising from the seabed lease agreement were the rent payable before operation and rent payable during operation. The rent payable before the option fee amounts to either the option fee or the base rent, which can be calculated as (£0.9*minimum output*consumer price index) where the minimum output can be calculated as (0.8*estimated annual production as agreed with the producer), whichever is lower (The Crown Estate, 2019). Given the resulting high option bids all the projects would pay the base rent as the lower of the two figures (The Crown Estate, 2021). Rent during operation is based on the either the base rent, 2% of revenue or minimum output*2%*average revenue over the two past years, whichever is greatest (The Crown Estate, 2019).

2.2 The United Kingdom: Scotland. Crown Estate Scotland

The Crown Estate Scotland manages the Scottish seabed. It held its first seabed allocation process named Scotwind in 2021. The process essentially featured pre-qualification as well as qualitative and quantitative criteria in the application system (Crown Estate Scotland, 2020). The applying bidders were asked to fill in a questionnaire where they had to answer questions in the categories listed below. The purpose was to first separate the applications that could probably succeed in delivering projects acting as a pre-qualification (Crown Estate Scotland, 2020). This was achieved by assigning each application to either band 1 or band 2/band 3, where if the evaluation of the bid resulted in the bid being assigned band 1 in any category it was excluded (Crown Estate Scotland, 2021). The second purpose was to provide enough information to rank the applicants in case of competing claims (Crown Estate Scotland, 2020). This was achieved through qualitative and quantitative selection criteria that resulted in a score and being assigned either band 2 or band 3 in some of the categories (Crown Estate Scotland, 2021). Achieving band 3 in all categories where that was possible would rank a bid above those that did not irrespective of the score (Crown Estate Scotland, 2021). The categories were as follows:

A - Basic information (band 1&2)
B - Project concept and density (band 1&2)
C - Project delivery plan (band 1,2&3)
D - Capability and experience (band 1,2&3)
E - Development budget (band 1&2)
F - Financial resources (band 1,2&3)
G - Commitment to the project (band 1&2)(Crown Estate Scotland, 2021)

The Scotwind seabed allocation included an option price measured per km^2 (Crown Estate Scotland, 2020). In the competition 16 out of 17 winners paid the maximum price allowed for the option, which was fixed at 100,000 £/km^2 (Crown Estate Scotland, 2020, 2022a, 2022b). It also featured a minimum payment of 2,000 £/km^2, which none of the winners bid as the lowest bid was 10,000 £/km^2. The other cost featured in the seabed lease was rent fixed at 1.07 £/MWh indexed by CPI (Crown Estate Scotland, 2020).

2.3 The United States: The United States Bureau of Ocean Energy Management (BOEM)

The United States has been competitively allocating seabed leases through auctions since 2013 (BOEM, n.d.-c). The notable pre-qualification requirements are related financial and technical evaluations, which are proposed specifically for each project (BOEM, 2020). BOEM evaluates related experience, personnel, bank statements and a financing plan (BOEM, 2020).

Different auction designs have been employed by BOEM so far. For example, Atlantic Wind Lease Sale 2 was allocated using a multi-factor auction format with two lease sales taking place simultaneously (Beaudreau, 2012) while Atlantic Wind Lease Sale 7 was allocated using a single site ascending auction (Cruickshank, 2017). The sole selection criterion is the option price, which is a single upfront cash payment (BOEM, 2019).

Lessees are also required to pay rent and an operating fee. The rent is fixed at 3 $/acre rent per annum, and it lasts until the wind farm is fully constructed. The rent is reduced based on the proportion of the wind farm that is in operation (BOEM, 2019). The operating fee is an additional fee that is levied during operation and amounts to 2% of revenue except for the first year of operation, where the capacity factor is assumed to be 40% (BOEM, 2019).

2.4 The Netherlands: Netherlands Enterprise Agency

The allocation of seabed in the Netherlands is coordinated by the Netherlands Enterprise Agency. As the first step, the applications are evaluated based on the first set of qualitative criteria of technical, economic and financial feasibility, as well as on whether the project proposed by the developer fits within the criteria set out for the project, including entering operation within 4 years (Netherlands Enterprise Agency, 2020a). In the next stage, the bidders were historically ranked based on their subsidy requirement (Netherlands Enterprise Agency, 2016), but it has not been necessary since the sites Hollandse Kust I&II were leased in 2018 without a subsidy (Netherlands Enterprise Agency, 2019b). Instead, in the second stage, the bidders are ranked based on qualitative criteria wherein a committee would assign points to each of the bidders based on the following categories:

- "The knowledge and experience of the parties involved
- The quality of the design of the wind farm
- The capacity of the wind farm
- The social costs
- The quality of the inventory and analysis of the risks
- The quality of the measures to assure Cost Efficiency" (Netherlands Enterprise Agency, 2020a)

The weighting of the different categories has changed over time (Netherlands Enterprise Agency, 2020a, 2020b) and the current indication for the future policy is that there will be a new category, which would incorporate a single cash payment to the system (Netherlands Enterprise Agency, 2022).

The cost of the seabed lease has historically been fixed by the state with no way for the developers to change their design to lower these costs. The fees are based on the percentage of seabed lease that is within the 12 nautical mile zone from the Dutch coastline, with a fee of 650 € per expected MW per year indexed to inflation for the duration of the seabed lease when the wind farm is not in operation (both before and after operation) and 0.98 € per expected MWh (4000 h per year) for the duration of operation (Netherlands Enterprise Agency, 2020a). An additional fee of 3.17 €/m^2 (Netherlands Enterprise Agency, 2020b) and 3.29 €/m^2 (Netherlands Enterprise Agency, 2020a) for the cable corridor has been charged historically.

3 Quantitative analysis of seabed payment structures

3.1 Methodology and assumptions

We use discounted cash flow analysis using data on seabed lease allocations from the above described jurisdictions. We undertake the analysis from the perspective of the offshore wind project developer, i.e. only costs to businesses arising from the seabed leases are included. In only one of our investigated cases there was historically a benefit arising from seabed lease agreements in addition to costs. This was the subsidy scheme in the Netherlands, which was last relevant in 2016 and has not been in use since (Netherlands Enterprise Agency, 2019a).

We derive the net present values of costs arising from seabed lease agreements using the assumptions set out in Table 1, country specific seabed lease costs and the standard approach for discounted cash flow analysis, described by the following formula for net present value (Brealey et al., 2008):

$$NPV = CF_0 + \sum_{t=1}^{T} \frac{CF_t}{(1+r)^t}$$

The analysis of the timeline as well as the cash flow analysis rely on assumptions for the general characteristics of the stylised wind farm that serves as the basis for comparison of the different schemes. For the sake of comparison, all of our assumptions have to share a common baseline. The assumptions for the calculations are presented in Table 1.

Table 1: Assumptions used for the cash flow analysis (Bank of England, n.d.; BOEM, 2019; Crown Estate Scotland, 2022a; Dalla-Longa et al., 2018; eia; U.S. Energy Information Administration, 2022; Entso-e, 2020; European Central Bank, 2021; Mills et al., 2018; Netherlands Enterprise Agency, 2020a; Noonan, M., T. Stehly, D. Mora, L. Kitzing, G. Smart, V. Berkhout, 2018; OECD, 2022b, 2022a; The Crown Estate, 2019; The Federal Reserve, 2012)

Baseline project (based on averages of country specific assumptions)	Value
Capacity	1,500 MW
Area	500 km^2
Capacity factor	47.6%
WACC (nominal pre-tax)	7.24%
Market value factor	100%
Expected market price (2021 EUR) (includes assumptions on historical exchange rates and inflation rates)	51.37 €
Average wind revenue (2021 EUR)	51.37 €
Real price increase of wind energy	0%
Inflation	2%
Hours in a year	8760
Lease to COD	4 years
Operation	25 years
Decommissioning	2 years

We constructed the expected market price using simple yearly average real MWh price for the years 2017 to 2021 for the four jurisdictions, and then calculating the average based on those. Due to missing data for the two UK jurisdictions the whole year 2021 was excluded from the average price calculation. For the capacity factor and WACC the average for the 4 jurisdictions was used. For the country specific costs, we use data from the latest rounds of seabed allocation and averages of those latest rounds if there were multiple projects. For the market value factor we assume that the offshore wind will earn the average value on the market. Currently, for offshore wind, only US data is available showing a range of 95%-105% for the East Coast (Mills et al., 2018), while for Europe the discussion is ongoing with estimates for Germany being 89% for 2019 (Ederer, 2015), though the results are still subject to discussion (Brown & Reichenberg, 2021). For the cable cost in the Netherlands, we assumed that the cost per m^2 rises with the Consumer Price Index based on the slight increase in costs for the two latest projects (Netherlands Enterprise Agency, 2020a, 2020b).

3.2 Project level impacts

The quantitative comparative cash flow analysis shows that the price for seabed access has been trending upward over time, as shown in Figure 1. With the US starting to conduct competitive auctions in 2013, the price per km2 remained relatively stable until 2017, when Statoil Wind US LLC paid m$42 for lease OCS-A 0512 now called Empire Wind (BOEM, 2017). The next round saw higher bid prices, though the release of new seabed in the US became more intermittent.

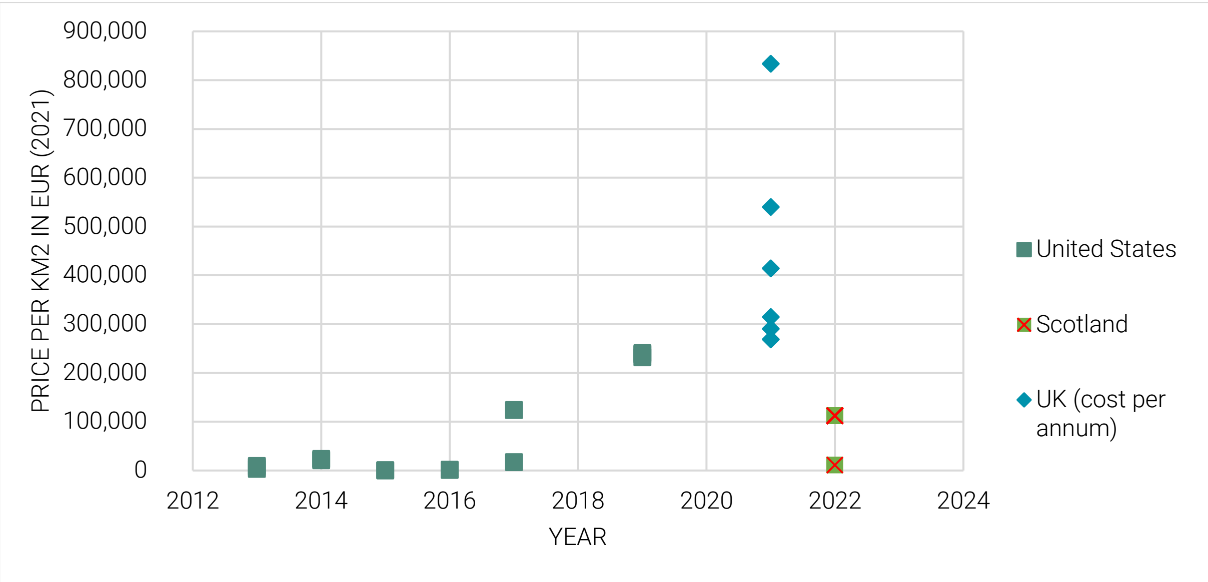

Figure 1: Seabed lease agreement bid price evolution (note that UK cost is per annum). The latest US data is yet to be fully analysed.

The UK (England, Wales and Northern Ireland) seabed lease round 4 in 2021 reached the highest prices yet, especially considering that the option price is to be paid annually (The Crown Estate, 2021). It also featured a very large range of bids per km^2. It was shortly followed by Scotwind in Scotland, which featured a maximum allowed payment cap which 16 out of the 17 winning bid reached (Crown Estate Scotland, 2020). It also saw 10 floating and 1 mixed foundation project proposed showing that even deeper seabed can be considered highly valuable by the offshore wind industry (Crown Estate Scotland, 2020). Overall, the rising cost of seabed leases could slow the transition to renewable energy, as more capital is diverted to paying for these fees, raising the LCOE of offshore wind and making it less competitive.

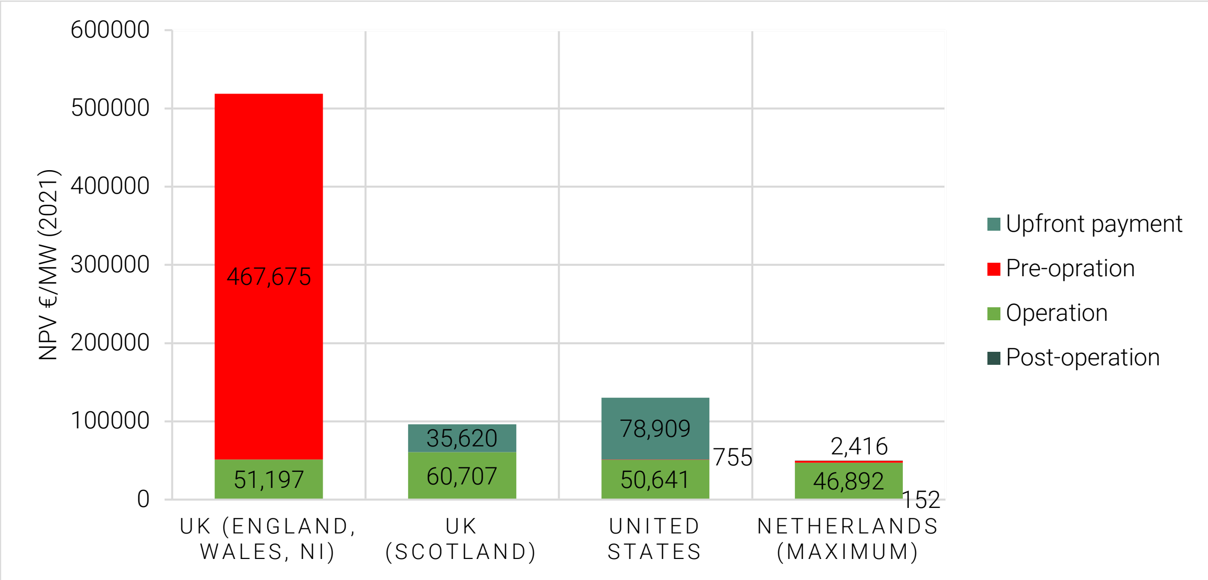

Figure 2: Total estimated seabed lease fees and their time of occurrence in the investigated jurisdictions. The latest US data is yet to be fully analysed.

Figure 2 shows the total costs for the four jurisdictions, with the Dutch case assuming 100% of the wind farm is within the 12 nautical mile zone. Given the assumptions for a generic wind farm, it is clear that the seabed lease costs in the UK (England, Wales and Northern Ireland) region are by far the highest. Most of the lease cost occurs before the wind farm generates income. The concentration of the payments in the pre-operation period has some implications. It may incentivise early completion of the project, which is beneficial for an accelerated deployment of renewable energy. However, it also increases the capital intensity in the phase of the project where projects still have no revenues, which may have implications on risk and financing cost.

This may lead to increased financing costs as the developers need to commit more capital to the project. In case financing capacity of some companies is constrained, this may impact the level of competition in the seabed auction. Nevertheless, the concentration of payments in the pre-operation period also translates into an incentive to reach the commercial operation date as fast as possible, as longer development periods can translate into significantly higher costs. This may speed up offshore wind deployment as it could manifest itself in e.g. staggering of processes, shortening of negotiations, the use of multiple installation vessels. However, it may also lead to additional risks and costs in areas unrelated to the seabed lease itself.

Where the pre-operation costs are relatively low, it can be argued that the cost of holding the 'option to develop' remains affordable. Offshore wind technology has seen continuously declining costs (Beiter et al., 2021). If the cost of holding onto the seabed lease is less than the rate at which the business case improves over time, there may be an incentive to extend the pre-construction phase. It may slow down the deployment of offshore wind if the option period is long. Notably, none of the competitively allocated seabed lease areas have been developed in the US as of 2021 (BOEM, n.d.-e), while extensions have been awarded (BOEM, n.d.).

The Netherlands has a seabed lease scheme that concentrates payments mostly during the operation phase. This likely reduces financing costs relative to the other jurisdictions, as there is less need for raising capital upfront. There seems to also be broad alignment on the level of fees during the operating phase, with the UK (Scotland) being an outlier.

4 Expert/stakeholder dialogue and discussion of findings

An overview of the above presented implemented seabed allocation schemes as well as the results of the quantitative analysis of their payment structures were presented at a stakeholder workshop in Copenhagen in November 2021, which was organised as a side event to the 'Electric City' event by WindEurope. The workshop programme can be found in Appendix 1. The workshop attracted approximately 30 participants, comprising developers, policy makers and academic representatives. Over the course of 3.5 hours, the present and future of seabed allocation were discussed, and a breadth of ideas and opinions on the issue were voiced during a lively interaction.

Overall, participants agreed that site allocation may become the key policy task determining offshore wind build-out in the future. In relation to that, the allocation of grid connection could become equally important, as also grid connection can be seen as 'scarce resource'. For both cases, a policy task is to prevent 'land-grabbing' situations, in which the strategic occupation of sea would prevent a timely build out of projects. One participant voiced that the first priority for policy should be to first ensure that projects are coming to realisation, and only after that focus on incentivising innovation, system integration and ecological development. This was met by agreement across participants, and, in addition, societal issues were mentioned as important secondary policy objectives.

One participant was for the first time voicing some new thoughts on the benefits of moving away from price-only criteria in auctions and towards more diverse selection criteria, and how this could support the future need for flexibility and adaptability of the technology. This could then even be done outside of rigid auction systems and on individual initiative.

The following open issues were seen as important to tackle in relation to seabed allocation:

1. Should seabed allocation and support schemes be integrated or separated? What are their interactions?
2. How can/shall the original seabed holder (the state) determine the value of the seabed and thus the correct pricing of the area for lease?
3. Will competitive seabed allocation become an opportunity to enforce secondary policy goals, such as environmental and social?

The stakeholder workshop demonstrated a breadth of ideas and opinions on the issue. This emphasises the newness of the area, especially also as research field. For example, it proved impossible for us to recruit an economist to speak at the workshop about the economic rationale for eliciting payments from offshore wind energy for the occupation of seabed and about how large payments may be justified – this simply seems to not have been investigated in a scientifically rigorous manner until now. This issue was addressed at the workshop, where it was lamented that policy makers are basically 'left alone' in designing seabed auctions due to the lack of research in the area. The fact that the schemes implemented in different jurisdictions vary very much across the globe (despite the fact that only a few jurisdictions have implemented them) is a witness to that.

5 Conclusions

We reviewed four jurisdictions with regard to the costs created by their different seabed lease agreement setups. We found that there are large payments embedded in the seabed lease agreements and that they have increased substantially in recent years. Since these fees lower the competitiveness of offshore wind, a renewable energy source, it could also potentially slow the transition to renewable energy overall. But it can also be argued that (some) payments are justified given the scarcity of available seabed and the competition on its utilisation.

The scarcity of the seabed and the value of the opportunity seabed leasing rounds present is illustrated by the very high prices bidders are willing to offer in auction-style tenders where bid price is the determining factor. The economic rationale for such high up-front costs to develop offshore wind does not appear strong since it is an inefficient means of raising public revenue as well as a distorting incentive on a vitally important part of the clean energy transition. The reliance on a broader range of 'qualitative criteria' associated with various industrial, environmental or innovation policy goals in recent tenders such as Scotwind in the UK and the upcoming Hollandse Kust West tenders (2022) in the Netherlands may be indicative of a recognition that purely economic allocation in the context of such rapid industrial change is not always appropriate. That said, however, the design of qualitative so-called 'beauty parades' is no less challenging with the potential for inefficient or even arbitrary outcomes presenting policymakers with a no less complex challenge and researchers with a fruitful avenue for future enquiry.

The topic of seabed allocation for offshore wind is high on the agenda for policy makers and developers, but has until now been only sparsely been looked at by academia. There are a number of open questions, especially regarding the allocation mechanisms, the pricing and the allocation criteria and incentivisation structures, which are all important to address, as sea bed allocation is expected to be a key policy task in the deployment of offshore wind in the future.

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Appendix 1

The workshop

As the global offshore wind industry enters a new phase of accelerating growth, access to publicly owned seabed is a crucial challenge. A variety of allocation models have been used in different countries. Until recently, sites were generally awarded on the basis of qualitative criteria designed to guarantee project deliverability and alignment with policy commitments. In some places, these ‘beauty contests’ include a fee to retain exclusive development rights, without the allocation itself being based on price. There is a growing number of site allocations based on price-competitive auctions in which the highest bidder wins the site. In the UK, for example, the recent Round 4 auction resulted in approximately €1bn in option fees, payable annually for up to ten years until a lease is taken up. In the US, the Federal government has been selling offshore wind leases by auction for almost a decade. Enthusiasm for competitive allocation is not universal, however. Unlike in England and Wales, Crown Estate Scotland implemented a tight cap on bids in a recent allocation.

The objective of this workshop is to consider several questions around price-based auctions for seabed leases and to asses if they are here to stay and to become the norm. What can recent auctions tell us about the offshore wind market? How does competitive lease allocation affect project economics? Is there an optimal auction design? How do seabed lease auctions interact with other policy processes, such as revenue support auctions?

The workshop will contain a first part, in which we present facts & figures around seabed auctions, and a second part in which industry experts, researchers and policymakers enter into a dialogue to discuss the above mentioned questions. We will end the workshop with a light lunch.

List of speakers:

– Oscar Fitch-Roy, Researcher at University of Exeter and AURES II project (download the presentation)

– Philipp Beiter, U.S. offshore wind expert, National Renewable Energy Laboratory NREL

– Mark Stuurman, Netherlands Ministry of Economic Affairs and Climate (EZK)

– Mark Timmons, senior wind bid manager, SSE (download the presentation)

– Øyvind Vessia, head of regulatory affairs and market development, Ørsted

– Lena Kitzing, Head of Section Society, Market and Policy, DTU Wind Energy and AURES II project

– Ahti Simo Laido, DTU Wind Energy (download the presentation)

AGENDA

09:00-10:15: Part one: analysis

- Oscar Fitch-Roy , University of Exeter - Price or Beauty
- Ahti Simo Laido, DTU – preliminary economic analysis of existing approaches
- Philipp Beiter, NREL – experience from the US

10:15-10:30: Coffee

10:30-12:00: Part two: stakeholder experience and discussion

- Mark Stuurman, Netherlands Economic and Climate Ministry
- Mark Timmons, senior wind bid manager, SSE
- Øyvind Vessia, head of regulatory affairs and market development, Ørsted

AURES II is a European research project on auction designs for renewable energy support (RES) in the EU Member States.

The general objective of the project is to promote an effective use and efficient implementation of auctions for RES to improve the performance of electricity from renewable energy sources in Europe.

www.aures2project.eu

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