Ministerie van Economische Zaken
en Klimaat

Offshore Wind Energy Market Study – Implications for Tenders IJmuiden Ver Gamma and Nederwiek I

Report

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AFRY

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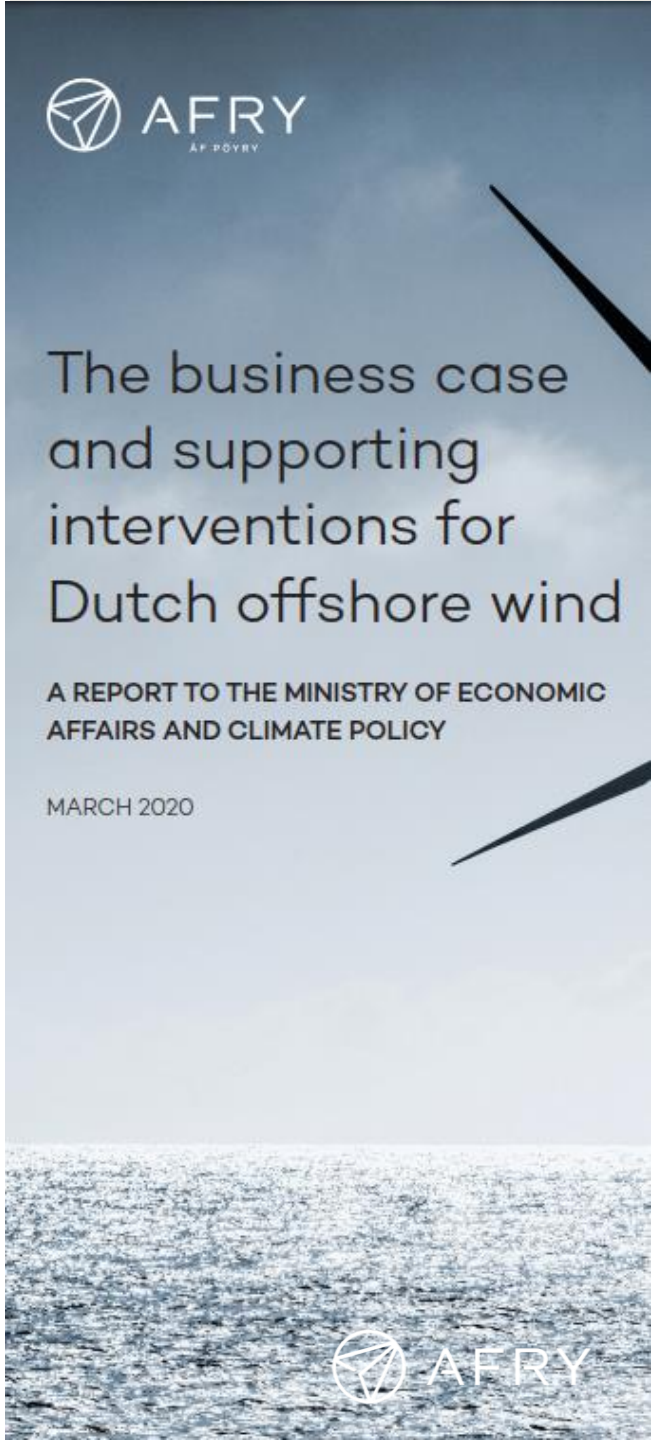
INTRODUCTION (1/3)

Building on AFRY's 2020 study, AFRY has been invited to investigate the market conditions for IJV Gamma & Nederwiek I and advise on tender procedure selection

- Offshore wind is envisaged to play a major role in decarbonising the Dutch economy: initially reaching 11GW by 2030 as set out in the Offshore Wind Energy Roadmap 2030[1], elevated to a total of approximately 21GW in the Additional Offshore Wind Energy Roadmap 2030[2]; with further targets of 50GW by 2040 and 70GW by 2050[3]. In 2024, current installed capacity of offshore wind stands at approximately 4.7GW[4].
- Offshore wind farms in the Netherlands have been built subsidy-free since Hollandse Kust (zuid) I&II (2018). This has included Hollandse Kust (zuid) III & IV, Hollandse Kust (noord) and Hollandse Kust (west). The most recent tender round for IJmuiden Ver Alpha and Beta (ca. 4GW) closed in March 2024 and attracted multiple subsidy-free bids.
- Due to government concerns about the offshore wind business case when fully exposed to power market risk, AFRY conducted a study in 2020[4]. This identified various interventions, including aligning demand growth and offshore wind development, incentivising time-shifting flexibility and improving the allocation of financing risk.
- Recent global events have significantly impacted the business case for offshore wind since 2020: amongst others, the Covid-19 pandemic, the Russian invasion of Ukraine and associated supply chain shocks and inflation increases.
- The current Offshore Wind Energy Act provides the choice of four different tender procedures under Article 14a: Procedure with subsidy, Comparative assessment, Comparative assessment with financial bid, and Auction.
- The Ministry of Economic Affairs and Climate Policy currently needs to decide on the procedural choice and tender design for the next licensing round of IJmuiden Ver (Gamma; 2GW) and Nederwiek (site I; 2GW) in 2025. The Energy Act (14A - research of market conditions) requires a review of the tendering process before every tender.



1. Routekaart windenergie op zee 2030, originally released 27/03/2018. 2. Aanvullende routekaart windenergie op zee 2030, originally released 10/06/22 and updated on 25/04/2024. 3. Windenergie op zee 2030-2050, originally released 16/09/2022. 4. The business case and supporting interventions for Dutch offshore wind, AFRY 2020.

This study considers the main challenges currently faced by Dutch offshore wind developers and considers learnings from tender processes in other North Sea countries

AIM OF THIS STUDY AND REPORT

- To aid the decision-making process for the upcoming permitting round (IJmuiden Ver Gamma and Nederwiek I), the aim of this study is to provide:
  - Market update on the uncertainties and risks in the offshore wind energy market in the Netherlands (including market revenues such as electricity prices and project costs such as supply chain constraints) and the consequences for the Dutch offshore wind business case. Specifically evaluating eleven sensitivities to assess the impact on the levelised cost of electricity (LCOE) for offshore wind without any subsidy support. The analysis has been conducted utilising AFRY's extensive international commercial and technical offshore wind expertise including having advised on every offshore wind asset in the Netherlands together with interviews with key players in the Dutch offshore wind industry.
  - Comparison of the Dutch offshore wind tender processes with those in Denmark, Germany and Great Britain. Identifying the key similarities and differences between these and the Dutch tenders, to identify benefits and risks of various tender set-ups, including understanding the risk distribution between the wind farm operator and government, and the risk of project cancellation.
  - Conclusions on the main challenges for offshore wind in the Netherlands with a focus on the business case and high-level recommendations based on the analysis.

STUDY LIMITATIONS

- The years used in this study are 2020 and 2025. This is to reflect the changes occurring since the previous study (2020), and the market conditions affecting IJV Gamma and Nederwiek I, considering that financial investment decisions and turbine orders, etc. will need to be put in place before the anticipated online date of dates of Q4 2030 and Q2 2031.
- This study is not intended to be exhaustive, hence it is not seeking to be a policy evaluation of the North Sea programme nor does it consider tender design options outside the existing legal framework. There is potential for a range of different views on LCOE/captured price analysis and the level of detail analysed here has its limitations.
- This study takes into account the views of a number of players in the Dutch offshore wind industry. Interviewed parties (listed alphabetically) have included: BP, Eneco, Orsted, RWE, SSE, Vattenfall, and Vestas.

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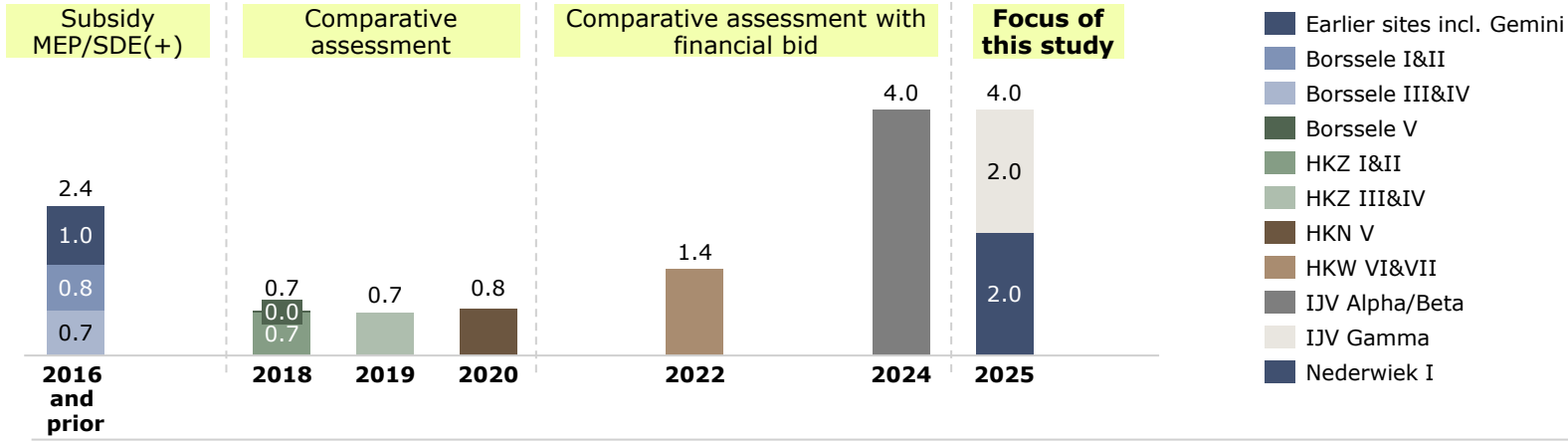
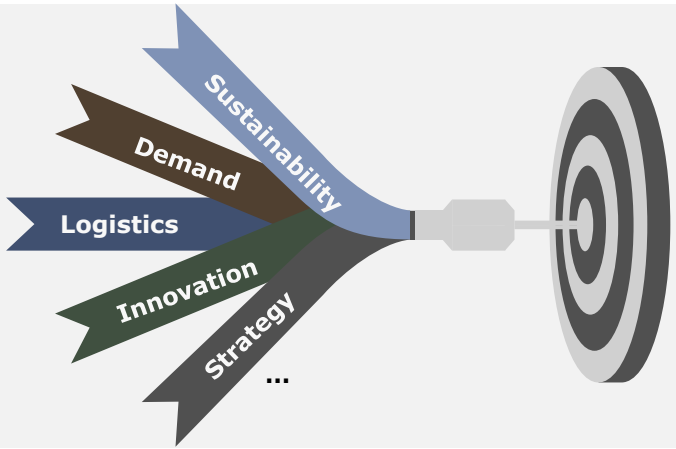
Conclusions of this study form AFRY's recommendations for the tender round of IJV Gamma and Nederwiek I

DUTCH OFFSHORE WIND SITES TENDERED/TO BE TENDERED[1] (GW)





STUDY FOCUS

- **The main focus of this study is on the business case for IJmuiden Ver Gamma and Nederwiek I** (narrower scope than AFRY's previous 2020 study) and the continued rollout of offshore wind in the Netherlands.
- Multiple perspectives could be taken when reviewing the market conditions and tender criteria to formulate recommendations for the next Dutch tender round.

1. There are further tenders anticipated beyond those shown in the chart as part of the updated Additional Offshore Wind Energy Roadmap 2030, and beyond

Contents

Although the Netherlands has continued to offer an attractive tender set-up, challenges exist which are impacting the business case for offshore wind

KEY FINDINGS

1 **How has the business case for Dutch offshore wind in 2025 changed compared to 2020 and what are the main challenges the industry is currently facing?**

Since 2020, the business case for new Dutch offshore wind sites has become less attractive. The main challenge areas facing the offshore wind industry in the Netherlands are **higher levelised cost of energy (LCOE)** as a result of **significantly higher costs** and increased wake losses, **uncertainty** around sufficient **revenues** to meet those costs, **competing in a global supply market** (driven by offshore wind deployment ambitions worldwide and a tightening supply chain – including vessel availability)**.** The continuous push for increasing turbine sizes results in **unrecoverable R&D costs of the supply chain**, which are then passed on to the developers.

2 **What has benefitted the business case for offshore wind in recent Dutch tenders and should be retained?**

As well as inherent excellent offshore wind fundamental conditions (mean wind speeds, water depth, soil) that make it an attractive location, the Netherlands has had a reliable tender set-up with clearly communicated plans, a turnkey project site following award (with grid connection and permits included), and accessible interaction between industry and government, along with willingness to engage/listen to feedback. Benefits for developers participating in Dutch offshore wind tenders include certainty of pipeline volumes and transparency of process which reduces risk and overall cost to the business case. As discussed in the report the Netherlands, however, is not immune to broader challenges in the market.

3 **What has impacted the business case for offshore wind in recent Dutch tenders and should be considered for re-evaluation for IJV Gamma/Nederwiek I?**

Some existing tender characteristics (construction timelines, demanding requirements and increased site size) can increase cost and risk perception for developers. Though they are not mandatory, over recent Dutch tenders the requirements have been increasingly demanding for developers with growing qualitative criteria as well as financial commitments. Increased wake effects due to increased power density in the sites and windfarms located in close proximity of each other, impact the business case; control of the factors increasing wake effects are not within Dutch tender design, however, some modifications are possible.

4 **What is currently missing from the Dutch tenders that could improve the business case for Dutch offshore wind?**

With the next round approaching relatively soon, large shifts in set-up are inadvisable; however, steps can be taken to enhance existing incentives for innovation, as well as further stimulate the demand side (both in and in parallel to Dutch offshore wind tendering), which is currently lagging: the increase in renewable capacity, according to planning, is rapidly outpacing the corresponding growth in demand.

AFRY recommends Comparative assessment for IJV Gamma / Nederwiek I together with several recommendations to help improve the business case

KEY FINDINGS

5 **Looking at surrounding European offshore wind tenders, are there any learnings that would be beneficial for the next round in the Netherlands, with regards to impact on the Dutch offshore wind business case and rollout?**

The Dutch tender system currently compares favourably with other markets. The one-stop-shop provision of permits, site and grid connection presented to the tender winner is popular with developers. In some instances, for recent rounds there are a higher numbers of bidders in other markets (such as Germany), though cancellation risk is similar or even higher than in the Netherlands (as bid bond/commitment requirements are less stringent). For Dutch offshore wind rollout it is advisable to maintain lower cancellation risk. Overall, qualitative criteria set-up in the Netherlands is found to be preferred compared to qualitative criteria in other markets examined.

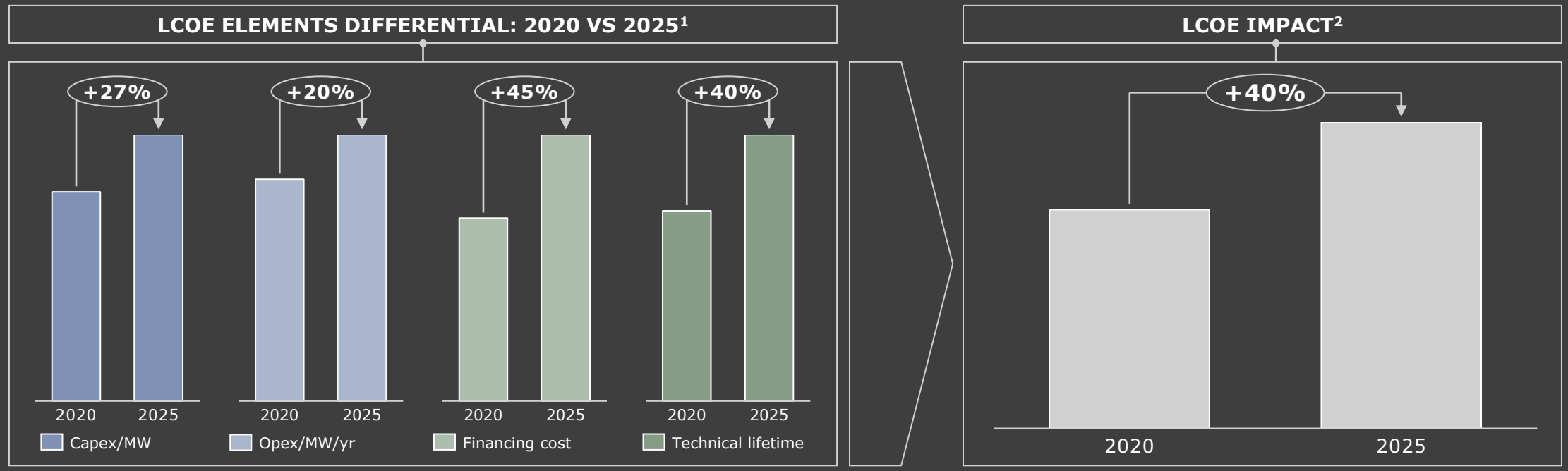
6 **What recommendations can be implemented to encourage a viable business case for IJmuiden Ver Gamma/Nederwiek I?**

AFRY makes 7 key recommendations to improve the market environment for encouraging offshore wind deployment in the Netherlands: investigate technical feasibility of allowing a longer build time for Dutch offshore wind farms following award being granted, encourage innovation from the market by using qualitative criteria and focus on a holistic approach, investigate measures (both internal and external to the tender) to stimulate growth in electricity demand to match the increase in planned offshore wind capacity, for example, producing green hydrogen, revisit the existing tender criteria to consider including targeted measures to optimise the production profile, make considerations around turbine size and encourage standardisation, investigate the feasibility of reducing site sizes to 1GW (to reduce the associated risk, allow more developers to participate and have a chance of being awarded a site), and consider introducing a targeted campaign to address personnel shortages to reduce rollout bottlenecks and associated costs.

7 **What is the overall recommendation on the tender selection set-up for the next Dutch offshore wind round out of the four available - Procedure with subsidy, Comparative assessment, Comparative assessment with financial bid, Auction?**

AFRY recommends comparative assessment without financial bid for IJmuiden Ver Gamma / Nederwiek I in conjunction with implementing Key Finding 6. This tender approach is selected as a) this has worked well in the past, with the qualitative criteria overall well received, b) with the recommendations outlined business case improvements are anticipated, and c) our analysis indicates that removing the financial bid element is likely to encourage a wider range of participation, and enable this tender approach rather than procedure with subsidy. AFRY also recommends investigating a procedure with subsidy, and make the preparations to be able to include the option to use subsidy in future tenders in case needed if market conditions shift to further worsen the business case.

Dutch offshore wind market conditions are less attractive than in 2020; especially rises in opex and financing costs have led to an increase in LCOE



The main elements that are considered in the calculation of the Levelised Cost of Energy (LCOE) for Dutch offshore wind have changed since 2020. While capex has increased strongly since 2020, due to various factors including steel fabrication costs and rising vessel day rates, the growth is more modest when measured per MW. This is especially the case when a larger turbine is considered. Operating expenses have increased since 2020, largely due to the larger turbine sizes and labour costs. The worsening macroeconomic environment has led to higher typical financing costs faced by developers. There have been some advances over the same time period that have helped to improve the LCOE, such as longer technical lifetimes which result in a greater number of years to generate revenues (25 years to 35 years) and increases in turbine size, however, the impact of these are outweighed, resulting in an overall increase in LCOE. The effects of these individual elements do not translate in a higher LCOE one-to-one, due to the LCOE formula[2].

1. Capex and opex increases are displayed in nominal terms. The financing cost is measured using the discount rate (a percentage). The technical lifetime is measured in years. LCOE increase displayed is based on data in nominal money basis. 2. LCOE = (capex/annuity factor + opex) / annual energy yield, where the annuity factor = (1 – (1 + discount rate)$^{-lifetime}$) / discount rate. In the left chart financing cost represents the discount rate.

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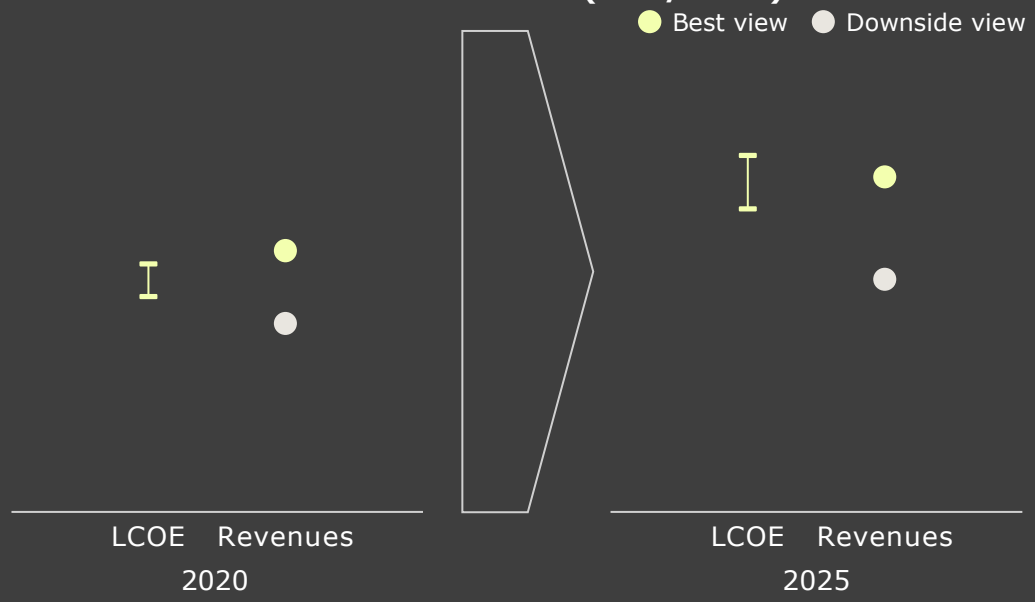
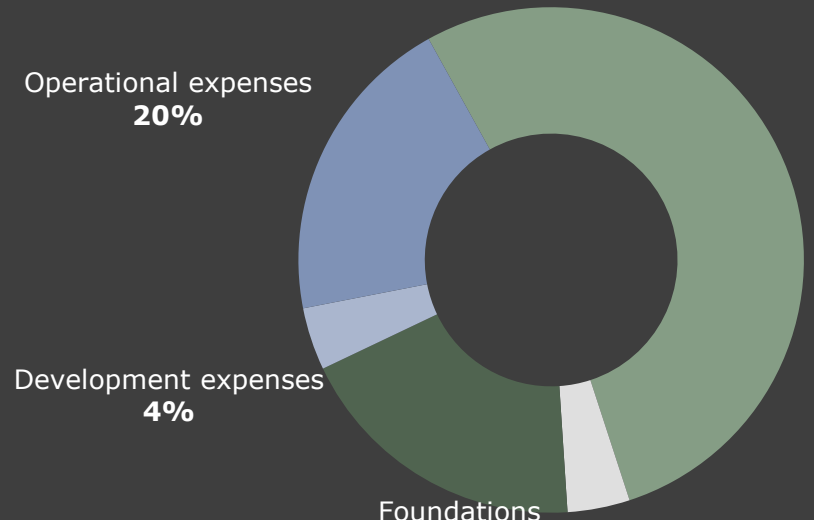
Compared to 2020, LCOE vs captured revenues projected for 2025 indicates the business case for offshore wind in NL is more challenging

LCOE[1] VS REVENUE PROJECTIONS (EUR/MWH)



BREAKDOWN OF OWF LCOE FOR 2025

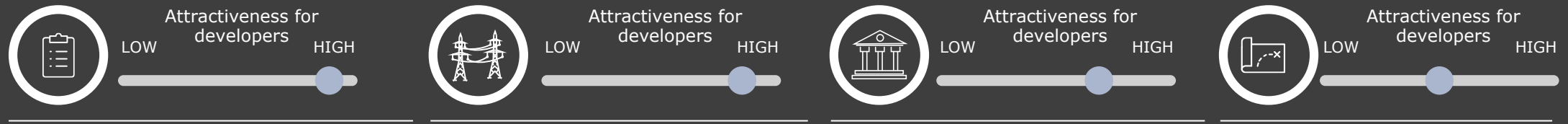


2020: During the tenders for Hollandse Kust (noord) and (early 2022) Hollandse Kust (west), the LCOE was relatively lower compared to expected average capture prices (i.e. the average power price per MWh an offshore wind farm can obtain) over a 25-year lifetime. This provided headroom for developers to invest in innovation, for instance on maritime ecology and/or system integration.

2025: Since 2020, LCOE has increased significantly and at a higher pace than the expected average capture prices. Currently, the largest components of the costs constituting LCOE are wind turbine costs, operational expenses, and wind turbine foundations. If the revenues do not cover the LCOE, extra funds or lower costs are likely to be required to close the business case (or the asset is built at a loss as part of a portfolio strategy). However, as indicated by the projected ranges above, individual developers may be able to realise a lower LCOE e.g. with access to more flexible financing cost, and still potentially set up a viable business case. If fewer parties are able to do this, it could hinder reaching the Dutch government's offshore wind capacity targets.

1. The LCOE can be defined as the aggregation of all costs divided by the power produced over the lifetime of an OWF, taking into account interest rates and economic lifetime in EUR/MWh. Revenues are based on aggregated values over the lifetime of the OWFs. Best view is our assessment of the approximate expectation of investors and is based on AFRY's Central scenario, whilst the downside view is an estimate of how investors might test a plausible adverse outcome and is based on AFRY's Low scenario.

Dutch offshore wind developers see the benefits of having qualitative criteria, grid connection provision, a one-stop-shop approach and a clear roadmap

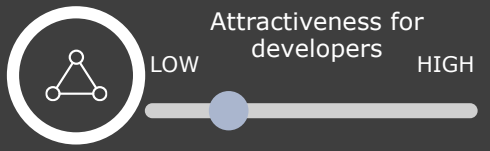


	QUALITATIVE CRITERIA	GRID CONNECTION	ONE-STOP-SHOP	GOVERNMENT TARGETS
SUCCESSES	– The Dutch offshore wind market is seen as an attractive one to bid in. Most offshore wind developers in the Netherlands are supportive of the qualitative criteria set for Dutch tenders. These criteria can give a strong motivation for innovation, not just within individual site operations but for the wider supply chain. Innovation gained in the Netherlands can then be exported to other countries, although initial development can be costly.	– Given that the Dutch TSO, TenneT, is responsible for the provision of the offshore grid connections for the sites, the Netherlands is an attractive market. It transfers the risks and costs for developers to a third party and can significantly improve the business case of offshore wind projects.	– The current one-stop-shop approach is considered helpful for reducing overall risk for the business case and provides clarity on responsibilities of all parties involved. Compared to other markets it makes the Netherlands attractive, as permits, connections, and site decisions are all handled in one go. Moreover, the current approach enables developers to spot and discuss issues in a timely manner.	– The Netherlands has a clear roadmap of the buildout of offshore wind capacity, which is considered helpful for planning by offshore wind developers.
GOV'T OPTIONS	– Suggested improvements are to employ the same set of qualitative criteria across all sites to streamline preparations and stimulate innovation; and consider setting some criteria on e.g. circularity as pre-qualification.	– AFRY recommends looking into the (technical) feasibility of delinking the offshore wind roadmap from TenneT's grid expansion. Currently, timelines are strict, which affects the negotiations of supply contracts and hence the business case.	– Given the strong support for this approach, it is recommended to maintain the use of the one-stop-shop for future tenders.	– Uncertainty exists between increase in electricity demand and offshore wind targets. Clearer signals between these two items is likely to improve the business case for offshore wind.

Some of the tender criteria used in the most recent tenders are creating challenges for some developers

	DEVELOPMENT TIMELINE	TURBINE SIZE	SITE SIZE	CRITERIA FLEXIBILITY
ISSUES	– The current offshore wind road map overlaps with timelines in other markets. This will create scarcity around 2030 for installation vessel and foundation production. Given that projects need to be finalised in 60 months, this is challenging for developers, who carry the cost of missing TenneT's timelines and face increased prices in the supply chain, who can exploit the strict timelines. This raises project costs and negatively impacts the business case.	– Across the offshore wind industry there is speak of a 'turbine size arms race' with a drive towards increasingly large turbines. Theoretically larger turbines could result in economies of scale benefits, but concerns exist about the supply chain: few vessels can transport 20MW turbines, few ports can handle turbines of this size, and installing (the foundations of) such a size are likely to be challenging.	– 2GW sites pose some challenges for developers and may be more appropriate for a market with different risk sharing, such as Great Britain. Problems with the 2GW site size include that this can increase the risk perception as a greater scale of investment is required, and for the volumes of equipment only Eemshaven is currently large enough as a marshalling harbour in the Netherlands.	– Although the use of qualitative criteria is warmly received by most developers, changes to the point scoring system used in each tender hinders spending time on demonstration or research projects. Also, some developers point at the lack of subjectivity as an innovation enabler in the tender criteria provided by the latest tender (IJV).
GOV'T OPTIONS	– Although decoupling with TenneT's grid infrastructure timeline could delay the offshore wind roadmap, investigating the possibility of extending the timeline as a measure would help to lower the supply chain bottleneck during the construction phase.	– Market opinion varies, but a possible solution is standardising turbine requirements, e.g. requiring a 15MW turbine, may improve rollout. Some argue this could reduce innovation, but some standardisation is needed to reduce LCOE.	– Though it would come with some financial risks, reducing the size of sites to 1GW could offer various benefits: reducing development risk, increasing competitiveness, more winners and more manageable development scope.	– Speeding up the development of innovations as part of wind farm projects would likely help to advance the pace of the knowledge accumulation required to support the offshore wind business case.

Outside existing tender criteria, issues impacting the Dutch offshore wind business case include lagging demand growth and personnel shortages

	DEMAND STIMULI	INNOVATION STIMULI	PERSONNEL SHORTAGE	STANDARDISATION
				
ISSUES	– Concerns exist between the progress in growth in electricity demand, new electrolyser developments and the Dutch offshore wind roadmap. OWF developers face challenges finding viable and sufficient PPA offtake for their output. Although the use of system integration criteria has secured some demand-increasing bids, overall demand is lagging. Demand stimulation is also needed outside of the OWF tenders.	– To advance the development of cutting-edge technology solutions and expertise crucial for the Dutch offshore wind rollout and energy transition, prioritising investment in innovation over financial bids is preferred. Opinions differ on the need for extra criteria and the benefits of a strict scoring system versus a more subjective interpretation of criteria.	– The job market in the wind industry has been relatively stable over the past years, but as European wind ambitions increase towards 2030, shortages in the workforce are envisaged. Especially with 'made in Europe' requirements the workforce should almost double in size by 2030 to meet targets. This could significantly increase offshore wind farm costs.	– Improving offshore wind farm economics with larger turbines and incentivising bigger turbines through tender setups leads to ever-larger turbines. This creates challenges in the supply chain and in construction: R&D, larger factories and vessels are required, while only few ports can facilitate transporting the components. Higher costs for developers shift the economic attractiveness of larger versus smaller wind turbines.
GOV'T OPTIONS	– A possible solution for boosting H_2 is having separate tenders for onshore electrolysers and offshore wind projects, although additional complementary steps for demand stimulation outside of OWF tenders is also recommended.	– Consider stimulating innovation by enhancing existing criteria with a more holistic approach, or rescoring/redefining existing criteria (e.g. on generation).	– This issue will largely have to be solved by the market itself, though the government could try to stimulate the size of the workforce through a campaign or experimental qualitative criteria, as Germany has done.	– Limiting turbine sizes at the EU level for a fixed time could facilitate the standardisation of main components, as it would spark proactive effort and collaboration amongst stakeholders.

In comparison to Denmark, Germany and Great Britain, the Netherlands has an accessible tender set-up and a slightly lower cancellation risk, but should not ignore that these other markets are also attractive to developers

	DENMARK	GERMANY	GREAT BRITAIN	THE NETHERLANDS
TENDER SET-UP	– Due to EU competition law conflicts, no tenders are currently taking place. The most recent tender, Thor, was a lottery as several €0.01/MWh subsidy bids were submitted. Future tenders will be less favourable and, unlike the Netherlands, will use concession fees, except for feed-in premiums expected for the Bornholm energy island.	– Tenders are split between sites that are pre-investigated and sites that are not. Non pre-investigated bids include qualitative criteria, whereas the non pre-investigated sites are based on a bidding procedure. Unlike the Netherlands, multiple permitting processes need to be completed after the tender is won.	– The British set-up is less straightforward than the Dutch, with tender procedures split between a tender for the site and a separate tender for a Contract for Differences (CfD). In between the two tenders, developers are required to organise the permits and the connection agreement with National Grid.	The Dutch set-up is comparatively attractive. The one-stop-shop permit provision, site and grid connection is popular with market participants.
BALANCE OF RISK	– Unlike the Dutch set-up, developers cover the grid connection and projects need to be viable on merchant basis. There is a single state entity for OWF development and mature public stakeholders, which are positives for developers. Allocation so far has been based on financial bids and modest payment guarantees.	– Pre-investigated site bids go up to 2M€/MW and securities deposits for both site types are 100-200k€/MW. Recent sites were subsidy-free with financial bids, even if support is available. Benefits are public stakeholder maturity, open-door entry (unlike the Netherlands), and the TSO providing much of the grid infrastructure.	– Like the Dutch case open door entry is not possible. Unlike the Netherlands developers are responsible for grid connection and need to pay site fees and securities for option fees. On the other hand, a 15-year two-way CfD allows for hedging, stakeholders are mature, and financial bids are the only tender criterion.	Other markets have a similar balance of risk to the Netherlands. Though Great Britain has the benefit of a two-sided CfD, it does not provide the grid infrastructure.
CANCELLATION	– Cancellation risk is similar to the Netherlands; no projects have been cancelled and there are no set procedures for tender project cancellations. This is to be defined per tender.	– As in the Netherlands, no projects have been cancelled so far. The risk is higher, however, as there is cancellation penalty aside from losing the security deposits (200k k€/MW non pre-investigated sites and 100 k€/MW for the type). Projects can also be sold or transferred to another party after the construction permit is obtained.	– Unlike the Netherlands, a project was recently cancelled. There are no monetary penalties for cancelling but it does lead to disqualification in the next round. Developers also face the risk of large sunk costs when cancelling an offshore wind development, for instance for the option fee payments as part of the seabed lease.	Dutch projects have higher cancellation costs than other markets. This lowers risks relative to other markets like Great Britain which recently saw a cancellation.

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Overall, AFRY's recommendations are focused on IJV Gamma/Nederwiek I, but also highlight future considerations and the need to focus on demand in parallel

RECOMMENDATION OVERVIEW: DUTCH OFFSHORE WIND TENDER SET-UP

RECOMMENDATIONS FOR IJV GAMMA / NEDERWIEK I

With AFRY's tender procedure selection recommendations, the overall aim is to support Dutch offshore wind rollout by encouraging participation in tender rounds in an effective and competitive manner.

When determining whether to participate in Dutch offshore wind tender rounds, for most developers **a sound business case is crucial**, along with strategic fit, as well as other considerations such as accessibility of tender, perceived likelihood of award and whether attractive on a technical level.

Overall, AFRY's recommendations for IJV Gamma / Nederwiek I can be summarised as:

7 key recommendations to reduce LCOE and encourage a viable business case

+

Tender with comparative assessment

FUTURE CONSIDERATIONS

Explore tender with subsidy procedure in case market conditions shift further

Assessment of participation levels in IJV Gamma / Nederwiek I tender round along with monitoring/re-evaluation of market conditions recommended to inform the need for invoking this option.

IN PARALLEL WITH DUTCH OFFSHORE WIND TENDERING[1]

In addition to the measures recommended that can be taken within the offshore wind tendering set-up, additional measures are likely to be required beyond this and also for future offshore wind tendering in the Netherlands.

Additional measures to stimulate demand growth to match the increase in planned offshore wind capacity, such as those linked to electrification of industry and demand for green hydrogen

1. In this vein, at present, the Dutch government is in the process of investigating decoupling offshore wind from electrolysers with the aim of reducing risk for both markets, while still maintaining an offtake interaction between OW and electrolysers via a PPA, yet also allowing for the provision of subsidy for electrolysers.

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AFRY makes 7 key recommendations to reduce LCOE and encourage a viable business case for offshore wind in the Netherlands for the next tender round

1 **Investigate technical feasibility of allowing a longer build time for Dutch offshore wind farms following award being granted**

Allowing additional time or flexibility around installation dates could be a potential solution to provide flexibility in the supply timeline and keep down costs in supply contracts. Though it could have a negative effect on developing the DC connection, it would be worth exploring de-linking site development deadlines of the TenneT rollout to allow a longer build time.

2 **Encourage innovation from the market by using qualitative criteria to focus on a holistic approach**

A key learning from previous offshore wind tenders is that having too many strict qualitative criteria can distract from innovation. Opinions differ, but some parties argue that less prescriptive (incl. technology neutral) criteria foster innovation by encouraging bidders to propose the best available solutions, including new concepts. Subjective criteria could also support further differentiation amongst bids without a financial bid, but there is a risk bidders would have less clarity on how to fulfil those criteria. We recommend the qualitative criteria points award aims to be well differentiated within an area, with a clear scoring methodology, but take into account the holistic view.

Qualitative criteria need to be not too demanding or overly stringent individually, such that the minimum 'pass' level does not require excessive devex to encourage participation, but provides scope for differentiating and extra spend through the points system[1]. Qualitative criteria are recommended to be consistent and holistic. This facilitates shifting the focus from simply aiming for maximum point scoring to one that enables the best solution for system integration, ecology, and sustainability for Dutch offshore wind. For example, this could be transitioning from a narrow focus on protected species to a broader, holistic ecosystem approach, which allows initiatives onshore or nearshore. Findings in this study indicate it would be preferable to prioritise focussing on innovation over financial expenditure requirements in the tender set-up, as this encourages learning throughout the supply chain on important issues critical for success in Dutch offshore wind (as well as the overall decarbonisation of the energy system).

3 **Investigate measures to stimulate growth in electricity demand to match the increase in planned offshore wind capacity**

This is crucial for the success of Dutch offshore wind development; however, potential changes within the tender itself are viewed as limited, and much more work is required on this topic in the wider Dutch energy system additional to the offshore wind tender set-up.

Although some previous Dutch OWF tender rounds included a component which has successfully secured some demand-increasing bids, site focus/system integration has not been sufficient to address the overall demand side lag. This is affecting the offshore wind business case as industry fears locking in relatively high prices and therefore may hesitate to enter into PPAs.

Recommended solutions to explore within the tender include consider having separate tenders for green hydrogen. The details of this would require further investigation and are recommended to take into account RFNBO criteria.

Recommended solutions to consider alongside, but not contained within the tender include: working on a clear matched demand roadmap; have further discussions with industry to address the high costs of green hydrogen vs grey against the backdrop of blue hydrogen bespoke agreements; and continued collaboration on an EU level to support momentum on this.

1. Note, AFRY did not consider (as this is out of scope of the report) the feasibility or complexity to implement on the one hand subjective criteria that foster innovation and on the other hand criteria that provide clarity on how to fulfil and that are not too demanding or overly stringent.

AFRY makes 7 key recommendations to reduce LCOE and encourage a viable business case for offshore wind in the Netherlands for the next tender round

4 Targeted measures to optimise the production profile

Reducing wake effect is imperative as this has a significant impact on yields and the business case. This can best be achieved by reducing turbine density requirements for the Dutch sites offered for tendering. Additionally, it's suggested to investigate replacing the current production criteria, which favor maximum total production, with criteria focusing on reducing wake effects. Although both options would offer advantages to a developer and potentially render the need for criteria redundant, leading to increased production, the former encourages larger turbines, while the latter fosters innovation to minimise wake losses through methods like wake control mechanisms and optimised blade design.

5 Considerations around turbine size and encourage standardisation

Ensuring no minimum turbine size is directly or indirectly in place in tender requirements to allow freedom of choice and encourages innovation from both developers and supply chain. The continuous strive for larger turbine sizes has implications for the recovery of R&D costs by the supply chain, vessel shortages, suitable harbours, developers ordering multiple turbines to be used across European sites, LCOE, wake effects, birds/ecology considerations, availability of materials, etc.

As turbines capacities and sizes have been increasing significantly in plans over recent years, there is a struggle for the logistics to keep up and for cost-savings to be realised. It also reduces the flexibility of turbine stock orders placed by developers to be used across multiple countries/markets and allow cost savings that way. Therefore, encouraging some standardisation at the EU level is recommended to achieve some stability and reductions in LCOE to improve the business case for Dutch offshore wind.

6 Investigate feasibility of reducing site sizes

Having 1GW as the site size is comparable to previous tenders prior to IJV Alpha/Beta (each 2GW). Though reducing the size of sites would come with interface risks due to the DC connection, which requires the entire 2GW capacity to be operational at once, smaller sites could also reduce developmental risk perception, lowering the LCOE and encouraging more developers to participate in tenders. Having the same focus for each OWF site in the same tender round also encourages cost-savings if bidding for multiple sites.

7 Targeted campaign in the Dutch offshore wind industry to address personnel shortages

This is likely to be critical both for the Dutch offshore wind industry, but also the wider energy transition. Having sufficient personnel and a skilled workforce equipped for the Dutch offshore wind industry requirements can lower LCOE for developers, as scarcity is less likely to be priced into supply contracts and facilitates a smoother rollout of offshore wind.

To overcome the shortage in workforce, the government may seek to establish a general policy to enable job traineeship programs and/or dedicated MBO programs for offshore wind that covers all phases of a project. Some elements of setting up a longer term training and targeted recruitment campaign may be challenging to implement in time for IJV Gamma / Nederwiek I. However, it is recommended to examine whether in the short term this could be boosted by supporting those transitioning from another career, particularly if relevant skill-sets, and evaluating the accessibility and option of using available skilled/trained personnel resource external to NL in addition to those available within the Netherlands.

In combination with the proposed 7 changes outlined previously, AFRY recommends to proceed with a comparative assessment tender procedure

PROCEDURE WITH COMPARATIVE ASSESSMENT

- **Overview:** In combination with the 7 changes highlighted previously, **AFRY recommends to proceed with comparative assessment without financial bid** for IJV Gamma / Nederwiek I tender.
  - From research, interviews and analysis in this study, AFRY's findings indicate that the business case for offshore wind in the Netherlands has worsened overall since 2020, although the range of impact is highly dependent on assumptions able to be taken by individual developers, e.g. accessibility of financing lower hurdle rates.
  - Considering the challenges faced by the offshore wind industry in the Netherlands, there is a risk that some developers may decide not to participate in the IJV Gamma / Nederwiek I tender - which may reduce competition in the process and worsen outcomes - if the tender set-up remains unchanged from that used for IJV Alpha/Beta. This has additional adverse consequences since lower participation would reduce pressure on remaining developers to (a) innovate (through qualitative criteria); or (b) compete through financial bids (further lowering expected foregone revenue).
  - AFRY recommends to encourage and enable wide participation from bidders to ensure effective and competitive tendering along with robust and reliable rollout of Dutch offshore wind.
  - To facilitate sufficient and diverse participation in Dutch tender rounds, AFRY recommends to implement the proposed 7 measures to improve the offshore wind business case.
  - In conjunction with this, the comparative assessment tender set-up is selected as a) this has worked well in the past, with the qualitative criteria overall well received, b) with the recommendations outlined business case improvements are anticipated, and c) our analysis indicates that removing the financial bid element is likely to encourage a wider range of participation, and enable this tender approach rather than procedure with subsidy.

Financial bid and additional payments:

- AFRY recommends to retain a bid bond to help secure project commitment to construction and reduce cancellation risk.
- Outside of this, having a financial bid element and other payments prior to operation are likely to negatively impact the project's business case and are recommended to be removed or reduced to a minimum.
- There are costs and benefits with removing a financial bid component. The main benefit is supporting wider participation of developers in the process, ensuring competitiveness and maximising the innovation inherent in designs in response to the qualitative criteria. The main cost is foregoing the direct revenue to the government and consumers in the Netherlands from the bid.
- (cont. overleaf)

In combination with the proposed 7 changes outlined previously, AFRY recommends to proceed with a comparative assessment tender procedure

- **Financial bid and additional payments (cont.):**
  - On the basis of the evidence collected through this study, we believe the benefits of removing the financial bid outweigh the cost. Most developers have indicated that the business case has deteriorated since previous auctions, reducing expected revenue generation through financial bids. This study's findings and LCOE / revenue analysis indicate that although some developers will have a positive business case, for others this may be more marginal or negative, which suggests financial bids may be low if at all.
  - The absence of a financial bid could also help support innovation by allowing developers to invest more in those areas which could be more clearly linked to alignment with e.g. sustainability goals of participating companies or further improvements that could benefit Dutch offshore wind roll-out directly. However, it is important not to overlook that adhering to qualitative criteria will also likely require associated expenditure (devex[1]).
  - A key consideration of tender set-up is how to adjudicate the tender winner clearly if points allocated results in a tie.
    - Any well-designed process should have a means of resolving a tie, regardless of the initial scoring process.
    - To reduce the likelihood of tie occurrence, it is recommended to use qualitative criteria that can be awarded as a range of points (some could be pass/fail, but ideally not all).
    - The presence of a financial bid could bring more scoring variation, but it can also have other unintended consequences, such as lower innovation overall.
  - It is recognised that the importance of some of our observations depend on the final structure agreed for the qualitative criteria and scoring such as the height and the weighing of a possible financial bid compared to the qualitative criteria.
- In coming to this conclusion we note that:
  - We have not undertaken a detailed assessment of bidding strategies and the potential level of innovation or financial bids that may emerge.
  - We have made no judgement on the relative importance to the Dutch consumer of wind-sector innovation over direct revenue receipts.

1. The development costs (devex) consists of preparation of the bid and the execution of the qualitative tender criteria.

Comparative assessment brings benefits including encouraging innovation, but criteria set-up requires consideration to enable a range of responses

PROCEDURE WITH COMPARATIVE ASSESSMENT

- **Qualitative criteria:**
  - Key considerations around these and the tender requirements are that they are recommended to be a) simplified where possible (reducing devex for participants) and not contradictory, b) accessible to all who wish to attempt to fulfil the criteria (to encourage participation from parties both in and outside of the Netherlands), and c) effective, designed with the overall aim involved.
  - Encouraging innovation is recommended, as outlined, but combined with clear evaluation criteria.
    - With more subjective criteria there is a risk evaluation criteria may not be clear to all, and could lead to objections/appeals in court from market parties about expert committee/RVO assessments, which could ultimately delay the offshore wind roll-out. This study has not assessed this risk in depth.
  - Measures supporting ecology and circular economy were strongly supported by developers in the past, and system integration was well received by most.
  - For some sustainability criteria such as circularity, it is recommended to consider making these pass/fail entry requirements to encourage improvements across the industry and supply chain.
  - In general, avoid changing criteria late in the bid process to reduce unnecessary additional costs for bidders.
  - The exact definition of the individual qualitative criteria is beyond the scope of this study. It is noted that there are further considerations and complexities around designing qualitative criteria.
- **Benefits:**
  - Implementing the aforementioned recommendations in combination with this tender procedure aims to improve the financial viability.
  - Enables multiple developers to participate in Dutch tenders, which encourages and enables:
    - Innovation and cost competitiveness via a diversity of competition.
    - Resilience rather than reliance on a small number of parties, (which is favourable as those parties may unexpectedly be unable to bid in a future Dutch round or choose to focus their investments on another market).
  - Compared to procedure with subsidy, comparative assessment reduces the need for subsidy for Dutch offshore wind, which, if invoked too soon could result in reduced confidence in the stability of Dutch tender process, and potentially add complexity for the existing offshore wind fleet. A procedure without subsidy could improve the socio-economic welfare associated with Dutch offshore wind rollout if progress can still be maintained.

Comparative assessment has many benefits, but still may risk in future tenders having a lower number of bidding parties than tender with subsidy

PROCEDURE WITH COMPARATIVE ASSESSMENT

- **Risks:**
  - Even with these recommendations to improve the business case for Dutch offshore wind combined with removal of financial bid, there may be multiple developers unable to achieve a viable business case and so number of parties bidding could still be low.
    - At the extreme, this could result in a no-bid tender situation and delays to the Dutch offshore wind rollout/targets not met. However, given the findings of this study, this is viewed as unlikely if the measures recommended are implemented.
  - Submitted bids could result in same total points scored, (although this is also possible if financial bid is included). To reduce the likelihood of tie occurrence, it is recommended to use qualitative criteria that can be awarded as a range of points.
  - In the absence of a procedure with subsidy, developers are likely to require the option of agreeing viable (c)PPAs with offtakers. Currently growth in electricity demand to match the increase in planned offshore wind capacity is lagging. In addition to the recommendations proposed for the Dutch offshore wind tender set-up and any relevant qualitative criteria, AFRY recommends that the Dutch government investigates measures to help stimulate growth in demand, such as, those linked to electrification of industry and demand for green hydrogen outside of the tender set-up.
- **Outcome:** Overall, gauging market conditions, choosing comparative assessment is likely to result in continued rollout of offshore wind in the Netherlands and likely to be able to adhere to Roadmap plans.

SUPPLEMENTARY DETAIL

- If the number of parties bidding is (too) low for IJV Gamma / Nederwiek I tender, it is recommended that procedure with subsidy be considered for future rounds.
- Having a viable business case affects not only developers, but Dutch offshore wind as a whole. With the right incentives, e.g. qualitative criteria, this could also enable investment across Dutch offshore wind potentially leading to increased sustainability across the industry, greater availability of personnel and more robust industry set-up.

If the trend of decreasing profitability continues, the option of procedure with subsidy should be explored to ensure effective and competitive future tenders

PROCEDURE WITH SUBSIDY

- **Overview:** The desired outcome is to have a wide participation of potential developers to enable Dutch offshore wind growth, and if this is not occurring, AFRY recommends to consider having an option for subsidy in the future tenders, potentially beyond IJV Gamma / Nederwiek I, depending on how market conditions evolve.
- **Benefits:**
  - Supports the rollout of offshore wind in the Netherlands and likely to be able to adhere to Roadmap plans.
  - Reduces risk for developers and therefore improves the financial viability.
  - Enables multiple developers to participate in Dutch tenders, which encourages and enables:
    - Innovation and cost competitiveness via a diversity of competition.
    - Reduces reliance on a small number of parties and may encourage resilience.
- **Risks:**
  - Providing subsidy when potentially a small number of parties may still be able to make their business plan work without subsidy.
  - If subsidy invoked when not needed, it could result in stranded assets and negative public opinion if not viewed as necessary.
- **Outcome:** Enable stable and sustainable Dutch offshore wind growth.

SUPPLEMENTARY DETAIL

- **Suggested setup:**
  - AFRY recommend to explore and make the preparations to be able to include the option to use subsidy in future in case needed.
  - There are various subsidy types available, e.g. 1- or 2-way Contract for Difference (CfD) for offshore wind on revenues, a CfD or direct grant to stimulate the demand side for offtake, capex grant or loan, tax relief or reclaim, etc.
  - There are benefits and drawbacks of the different subsidy types available, however, AFRY recommends to explore a **2-way CfD for offshore wind in case needed**.
    - This is likely to be the most impactful, rather than e.g. having a diluted effect via a trickle down. In the design, indexation is also a consideration to investigate.
  - With the way the tender procedures are set out in the Energy Act, it is **possible to run two in parallel for the same site**. However, there are cost considerations to this and there would still need to be a way of selecting the award overall.
    - Therefore, if moving beyond comparative assessment alone, AFRY recommends exploring running either a procedure with subsidy or both a procedure with subsidy and comparative assessment in tandem.
    - In order to improve the interaction, this could include e.g. a EUR/MWh advantage on the CfD if the bidder performs well on the qualitative criteria.
    - To reduce overall subsidy costs, the CfD cap/strike price should also be set at a reasonable level.

Roadmap to speed up the electrification of heat and transport combined with incentivising green H_2 production will likely aid offshore wind business case

ADDITIONAL CONSIDERATIONS: TENDER VIA AUCTION

- Of the four tender procedures available for IJV Gamma / Nederwiek I, the case for using auction was also investigated. Though potentially a more efficient procedure, a tender set-up of a (straight) financial auction would likely discourage multiple developers from participating in Dutch offshore wind tenders and has been the reason given for exiting other markets, and so is not recommended as the preferred tender set-up for IJV Gamma / Nederwiek I tender round.
  - The risk of discouraging multiple developers has the likely consequence of less competition during tenders and fewer participating parties.
  - Having a smaller number of participating parties brings associated risks:
    - Higher dependency on a small number of parties, which may exit the market unexpectedly and lowers resilience.
    - At the extreme, no-bid offshore wind tender situation, and/or delays to the Dutch offshore wind roll-out or targets not met, and worse socio-economic welfare overall.
  - Less investment across Dutch offshore wind potentially leading to race to the bottom, reduced availability of personnel and less robust industry set-up.
  - Reduced innovation, potentially leading to higher LCOE.
  - Less emphasis on sustainability, ecology, system integration and so potentially reduced progress in these areas in case no requirements for these areas can be set by the government.

FUTURE CONSIDERATIONS BEYOND NEXT TENDER ROUND

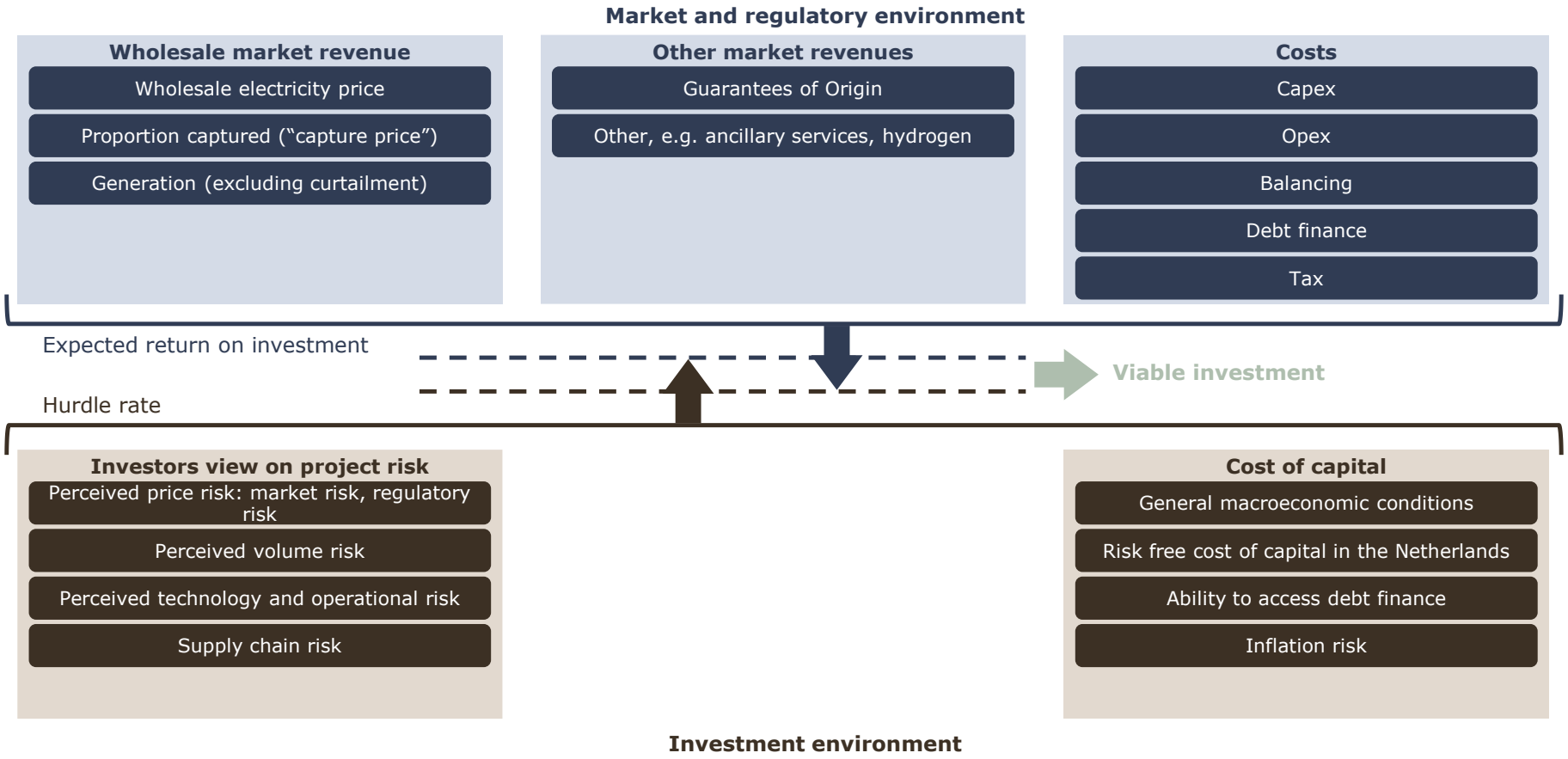
- To support the rollout of Dutch offshore wind, the corresponding growth in demand for electricity is vital.
  - Currently there is work ongoing to encourage this in the Netherlands, but it is not aligned with the planned in increase offshore wind capacity
  - This is a wider issue than only affecting the next round for IJmuiden Ver Gamma / Nederwiek I. A clearer relationship between the offshore wind build out (towards the 2030+ Roadmap, but also beyond to the envisaged 50GW and 70GW milestones) and demand for RES electricity such as that used for the production of green hydrogen is needed. (Partly this connects to a lack of clear penalties/implications if EU requirements around green hydrogen in 2030 are not met.)
    - To aid in this, we recommend that for future Dutch offshore wind market condition studies, to consider including views from industrial offtakers who are using renewable electricity both for energy demand requirements and feedstock purposes.

Contents

SITUATION

This study analyses the factors influencing an offshore wind project investment decision, including revenues, costs, and investor perspectives

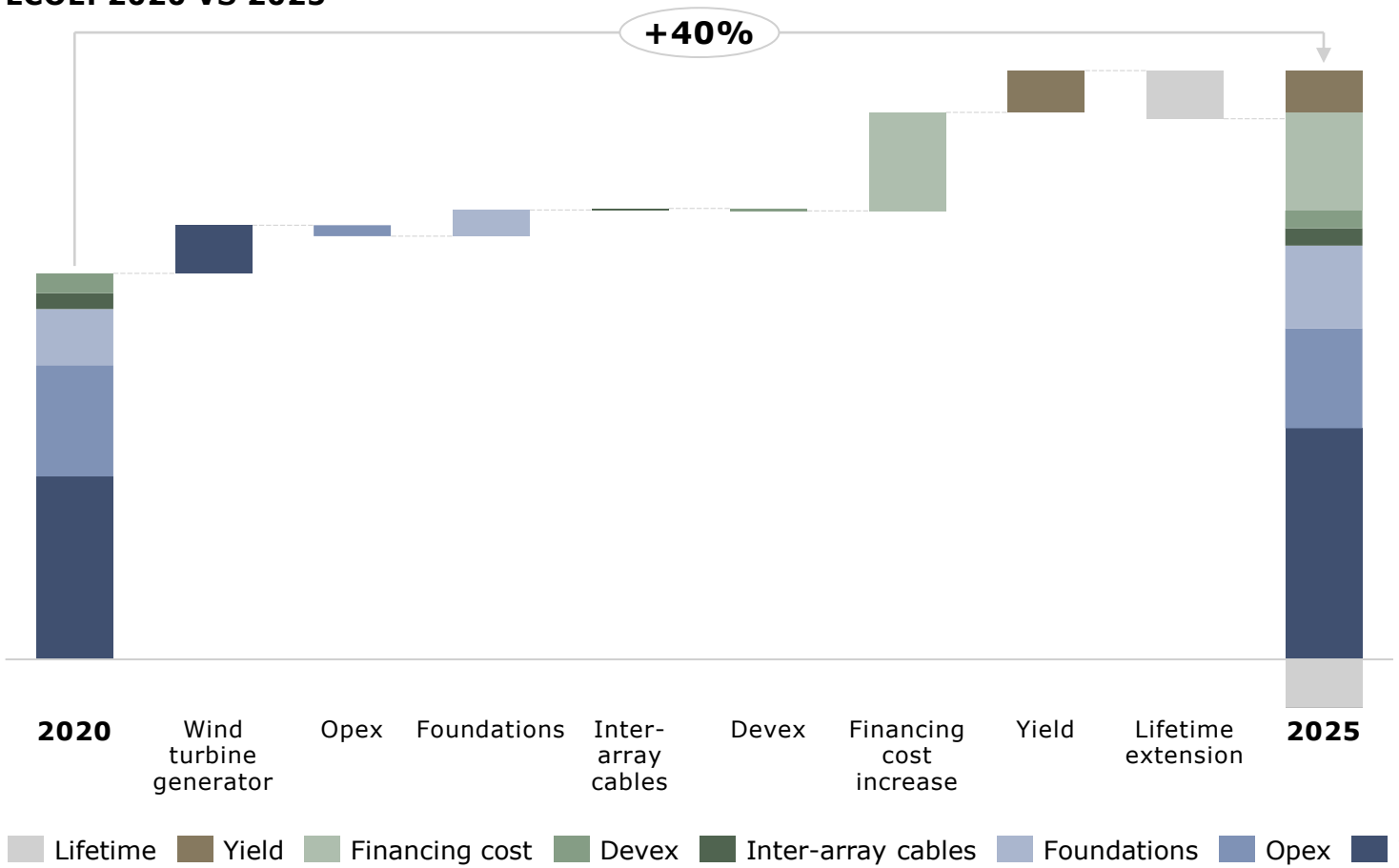
FACTORS INFLUENCING THE BUSINESS CASE OF AN INDIVIDUAL OFFSHORE WIND FARM PROJECT



- If an offshore wind project is to go ahead, the projected return on investment, defined as the projected revenues divided by projected costs, needs to meet a pre-set value: the hurdle rate.
- This study assesses both elements.
- Findings regarding the investment environment are based on AFRY experience and interviews with key market participants.
- AFRY analysis of market and investment environment - including projected revenues and LCOE – is used to determine an indication of investment viability.

The overall LCOE offshore wind projects have increased by 40% since 2020, largely due to higher operational expenditures and turbine costs

LCOE: 2020 VS 2025



- The stacked bar on the far left shows the LCOE for an OWF developed in 2020, split by the various components. The LCOE on the far right shows the LCOE for an OWF in 2025.
- The waterfall in between shows the impact of various changes in the LCOE over this period.
  - Increasing the lifetime of an OWF lowers the LCOE as revenue is generated over a longer time period.
  - Decreased yield increases LCOE, brought about by having larger project areas with denser wind turbine layout which results in higher wake losses.
  - Other factors, e.g. the increase in capital costs and project costs, have increased the LCOE.
  - Of the various LCOE components, wind turbines remain the largest expenditure component overall.
- The combined impact of the changes in these drivers is a 40% overall increase in LCOE between 2020 and 2025.

AFRY has analysed 11 sensitivities to assess the impact on LCOE between 2020 and 2025, with expenditure and financing cost most influential drivers

	Sensitivity	Description	Effect on LCOE
Quantitative Assessment	***Overall Cost Increase***	Analysis of cost increase based on increases of main expenditure components	
	Larger Turbine Size	Assessing the effect of selecting larger turbines	
	Increased financing cost	Analysis of the effect of economic changes on LCOE	
	Increased Lifetime	Changing the technical lifetime for the same OWF zone	
	Grid Technology	How the HVAC/HVDC grid technology affects the LCOE	
Qualitative Assessment	***Material Costs***	Changes in material prices that affect the overall costs	↗
	Vessel Availability	Limitations of vessel availability which impacts installation costs	↗
	Non-price Tender Criteria	Analysis of development costs related to non-price tender criteria	↗
	External Wake Effects	Impact of external wake effects from neighbouring wind farms on production	↗
	Standardisation	Analysis of standardisation on main components	↘
	Workforce Resources	Assessment of the effect of labour shortages on OWF costs	↗

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Interviewed market participants stress that the business case has become worse due to lacking demand and increasing costs

INSIGHTS

DEMAND

- All players in the Dutch offshore wind market point at the absence of demand increases as the main issue facing developers currently.
- The Dutch offshore wind buildout timeline is clear and reliable, while a similar timeline is lacking on the demand side. This leads to an imbalance between (future) renewable generation and demand, causing low or uncertain revenues – a strong negative impact on the business case.
- The current system integration criterion is deemed insufficient for boosting the demand to the required degree.
- Instead, aligning the timeline of policy such as the OWE for H_2 is needed.

BUSINESS CASE

- The offshore wind business case has become worse since 2020. The main drivers that are mentioned are increasing commodity prices and the financing costs due to the poor macroeconomic environment.
- Few offtakers are willing to sign PPAs, as they fear locking in high prices, especially when there is a pipeline of OWF projects planned.
- Removal of the financial bid is recommended by most to reduce burden on the business case.
- Some parties advocate introduction of a CfD scheme to bring certainty of sufficient revenues they need to make a viable OWF business case.
- Some parties outline that the business case has worsened, but they have so far been able to cope.

TENDER SET-UP

- Interviewees point at the constraints posed by the offshore wind development timeline of 60 months as negatively impacting the business case. It increases competition for installation vessels and foundation production with other markets. The supply chain is aware of these tight timelines and is viewed as raising prices. Not meeting TenneT's timeline also leads to compensation payments.
- The 2GW size of projects creates challenges for some developers, who say that four sites of 1GW would have the advantages of increased competitiveness, easier supply chains, and a reduction of the risk of non-realisation.
- One interviewee recommended a simple auction as an alternative, but no others supported this.

QUALITATIVE CRITERIA

- Market participants are generally supportive of the current use of qualitative criteria. These are seen as a stimulus for innovation, driving sustainability and help develop expertise that can be exported to other markets.
- Opinion differs on the current implementation of the criteria. Previous tenders (e.g. Hollandse Kust (west)) left room for interpretation to developers, allowing them to come up with various solutions to the challenge. This is perceived in opposite ways: either as a stimulus to innovation, or as creating unnecessary uncertainty about the scoring method.

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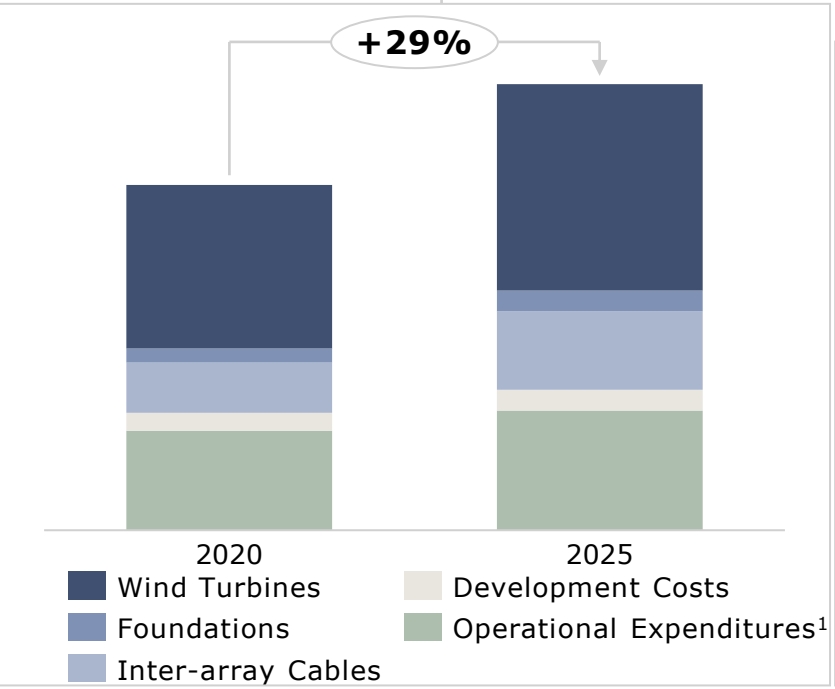
Capital and operational expenditures have increased significantly between 2020 and 2025, resulting in a 29% increase in LCOE

LCOE IMPACT



PROJECT AREA	ASSESSED PARAMETERS
750MW offshore wind farm	Cost estimates per main components

- The sensitivity analysis focuses on the impact of increases in capital and operational expenditures on the LCOE, while keeping other factors - financial costs and lifetime assumptions – constant. AFRY revisited the cost assumptions for the main components of a 750MW site keeping all the technical parameters the same.
- Between 2020 and 2025, capital and operational expenses both increased. The rise in vessel day rates and steel fabrication costs resulted in higher capital expenditures. Increase in turbine sizes and labour costs increased the operational expenditures. This has caused a 29% increase in the LCOE, making it significantly more expensive to develop an OWF.
- The estimated costs have increased for foundations by 56% (mainly affected by steel fabrication costs and vessel day rates) and inter-array cables by 33% (affected by raw material costs and vessel day rates). Costs related to wind turbines have increased by 26% (affected by inflation, steel fabrication costs and vessel day rates). Development expenditures[2], taking into account projects have higher complexity compared to 2020, have increased by 17%.
- It is projected that operational expenditures have increased by 20%, assuming that turbine size and the overall capacity remain the same.

IMPACT ON LCOE

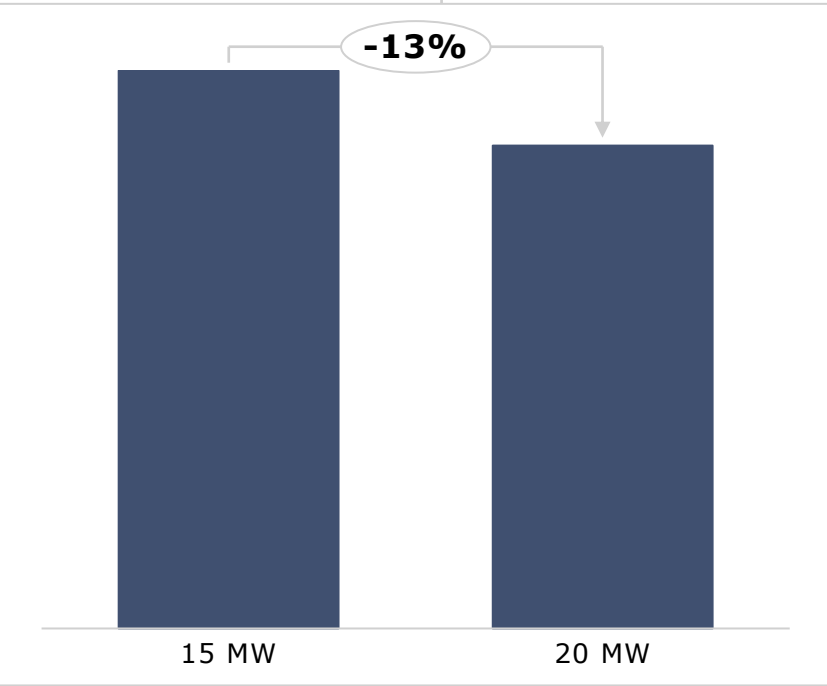
GOVERNMENT OPTIONS

Consider extending the construction timeline[3] to provide developers with greater flexibility in contract allocation

1. Operational expenditures, or opex, consists of wind turbine, foundations and inter-array cable maintenance as well as logistics and insurance. 2. The development costs consists of preparation of the bid and the execution of the qualitative tender criteria. 3. AFRY did not consider the impact of a possible delay on the roll-out of offshore wind in the Netherlands from this measure.

Increasing turbine size from 15 to 20MW results in LCOE decrease of 13%, due to scale effects and decreasing wake losses

LCOE IMPACT



PROJECT AREA	ASSESSED PARAMETERS
2GW offshore wind farm	Changed turbine size from 15MW to 20MW

- Developers are selecting increasingly larger turbines. For the Hollandse Kust (noord) and Hollandse Kust (west) projects, which were tendered in 2020 and 2022 respectively, turbine sizes of 11MW and 14MW were selected. For the recently tendered IJmuiden Ver Alpha and Beta projects, developers are anticipated to opt for higher-rated power turbines ranging from 18MW to potentially as high as 20MW.
- While the previous page showed that the costs for the main components like wind turbines and foundations have increased significantly over 5 years (with 26% and 56% respectively - due to inflation, increased steel fabrication costs and vessel day rates), comparing the LCOE of 15MW with 20MW turbines, excluding these external factors, results in a decrease of 13%.
- Total costs for turbines decreases by 4%. With the same area and constant power density, increased turbine spacing reduces wake losses, increasing estimated energy production by 5%. Total foundation costs decrease by 11%, as fewer foundations are needed, and despite the weight increases per turbine and increased supply an installation costs. Total inter-array cable costs and opex decrease by 15% and 25% with fewer turbines.
- It must be noted that the robustness of these large machines are not proven yet. It cannot be denied that continuous growth in turbines sizes might result in higher main component fatigue rates that might impact the overall project risk.

IMPACT ON LCOE[2]

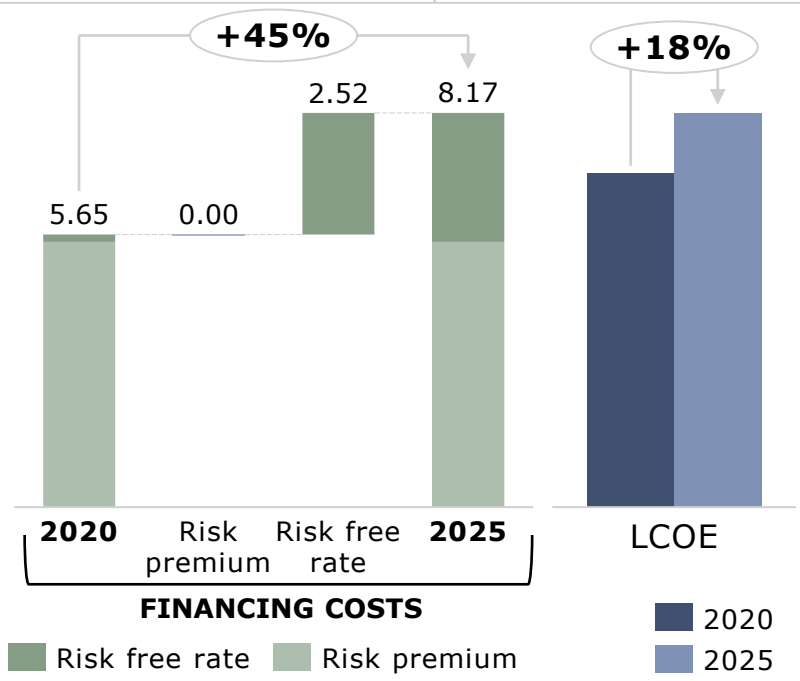
GOVERNMENT OPTIONS

Ensure sufficient flexibility in the tender regulations, allowing developers to select the financially optimal turbine size based on prevailing market conditions

1. Assuming FID/turbine orders being placed in 2025. 2. LCOE impact here assumes 2025 LCOE as a basis for comparison to identify the impact of changing turbine size

Due to a 45% increase in the financing costs, caused by an increase in the risk-free rate, the LCOE has increased by 18% since 2020

CHANGES IN FINANCING COSTS AND LCOE



IMPACT ON LCOE

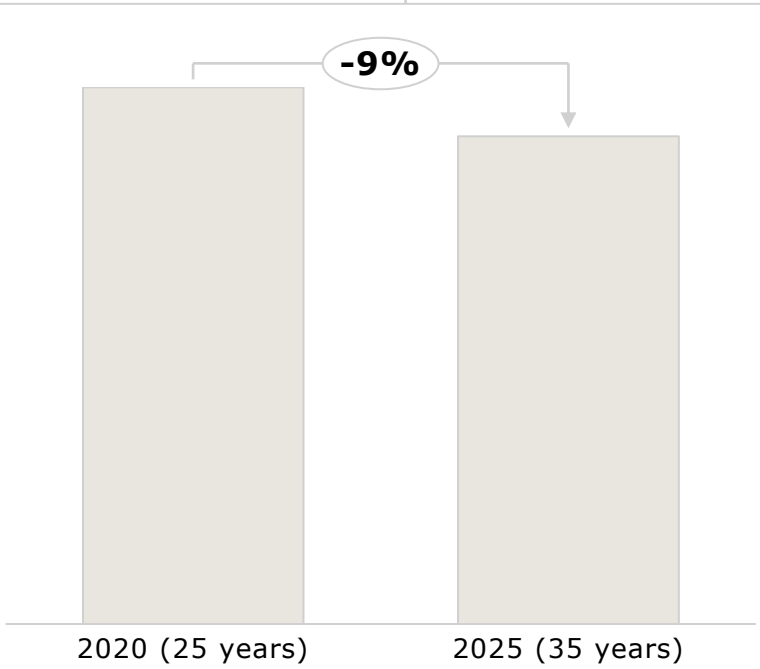
PROJECT AREA	ASSESSED PARAMETERS
750MW offshore wind farm	Changed financing costs (assumed rate changed from 5.5% to 8%)

- Financing costs represent a developer's average cost of capital from all forms of capital. This includes the average rate that a company expects to pay to finance its business.
- The cost of borrowing has increased. For example, the Dutch 30 years government bond rate has increased from 0.15% in January 2020 to 2.67% in January 2024.[1] These government bonds can be considered as a proxy for the risk-free rate required by investors as it is highly unlikely that the Dutch government will default on its debt, and add to the financing cost as it increases the interest paid by lenders of the Dutch central bank.
- Meanwhile, the risk premium that investors attach to Dutch OWFs has not changed to a similar extent since 2020 – given that there is no evidence that that risk has materially increased compared to the base case, we have assumed an increase of 0%. This risk premium represents the risk of an OWF failing that investors factor in when financing OWF projects.
- AFRY estimates that the rate has increased from 5.5% to 8.0% since 2020. This accumulated effect represents a 45% increase in the financing costs, entirely driven by the increase in the risk-free rate, which was close to 0% and has grown to 2.67%. As a result, the LCOE increases by 18%.

1. Barron's, 28 March 2024, 'Netherlands 30 Year Government Bond'.

Updated industry standards about the technical lifetime of OWF projects increased the lifetime from 25 to 35 years and decreases the LCOE by 9%

LCOE IMPACT



PROJECT AREA	ASSESSED PARAMETERS
750MW offshore wind farm	Lifetime from 25 years to 35 years

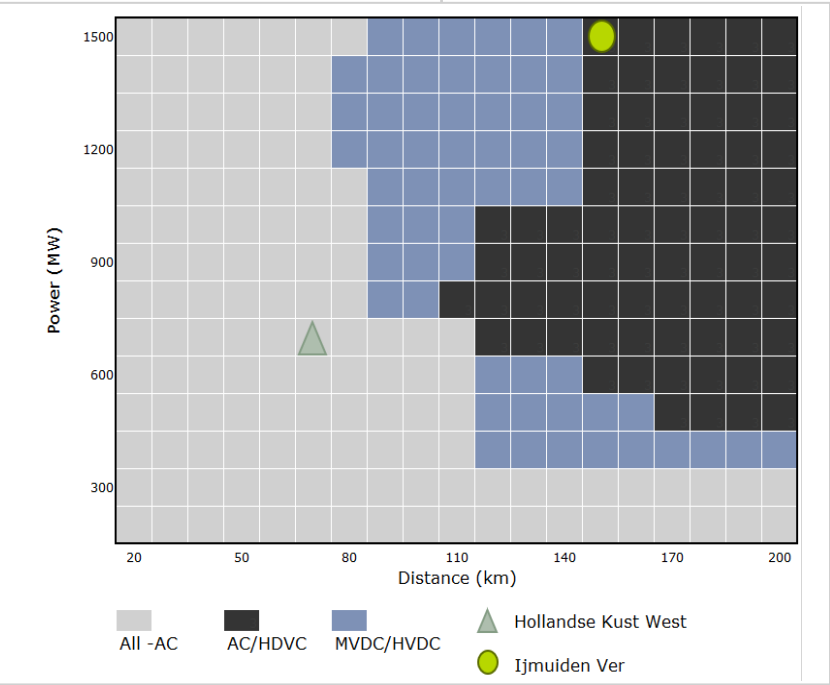
- Since 2020 a number of technological and regulatory advances have made it clear that the lifetime of an OWF is longer than previously expected, here developers in 2020 assumed that an OWF would last 25 years, it is now clear that current practice allows for a lifetime of 35 years. As a consequence, project owners with sites that became operational in the past 3-5 years are now studying lifetime extensions.
- Technological advances constitute the main driver of the extended lifetime. This comprises advances turbine design, the increased quality of turbine control systems, and better knowledge about optimising the operations and maintenance of OWFs.
- In accordance with these changes, both turbine supply agreements and turbine certifications (e.g. technical certificates issued by third parties to approve turbine designs) now include a longer lifetime of 35 years rather than the 25 years that was the standard in 2020. Likewise, the term of the permit has been prolonged with 5 years from 35 to 40 years (including construction).
- The increased lifetime, linked to higher revenues and increased value for money, decreases the LCOE by 9%[1].

IMPACT ON LCOE	GOVERNMENT OPTIONS
	Continuous communication with wind turbine manufacturers to be able to understand the future development of technical lifetime, consider extending the permit by 1 - 2 years to be able to include flexibility in construction timeline[2]

1. AFRY also has taken into account the increase in operational expenditures. 2. AFRY did not considered the impact of a possible delay on the roll-out of offshore wind in the Netherlands.

From 2020 to 2025, the grid connection technology choice introduces grid curtailments which leads to 6% increase in LCOE

OPTIMAL GRID CONNECTION[1]



PROJECT AREA	ASSESSED PARAMETERS
2GW offshore wind farm	Changed the grid connection technology from HVAC to HVDC

- The main driver for selecting the grid connection technology is the trade-off between capex and losses of the system. The system losses are proportional with the transportation distance.
- In **2020**, the distance from OWF to the onshore grid connection point was around **60-70km**. The total installed capacity of a single offshore wind project was around **750MW** (incl. overplanting). In **2025**, the transportation distances go **above 120km** with a total plant capacity of **2GW**.
- When both the distance to the onshore connection point and the project installed capacity increase, a HVDC grid connection system becomes more beneficial than HVAC mainly for two reasons: 1) the relative losses are smaller, and 2) the number of substations and export cables decreases.
- **HVDC selection influences the developers when it comes to overplanting**: Although the Offshore High Voltage Substations are rated at 2.3GW, the grid does not allow to transfer power more than 2GW. AFRY compared the LCOE values of a 2GW site and a 2.3GW site, where overplanting is chosen. The analysis shows that the LCOE increases by 6% caused by grid curtailments.

IMPACT ON LCOE

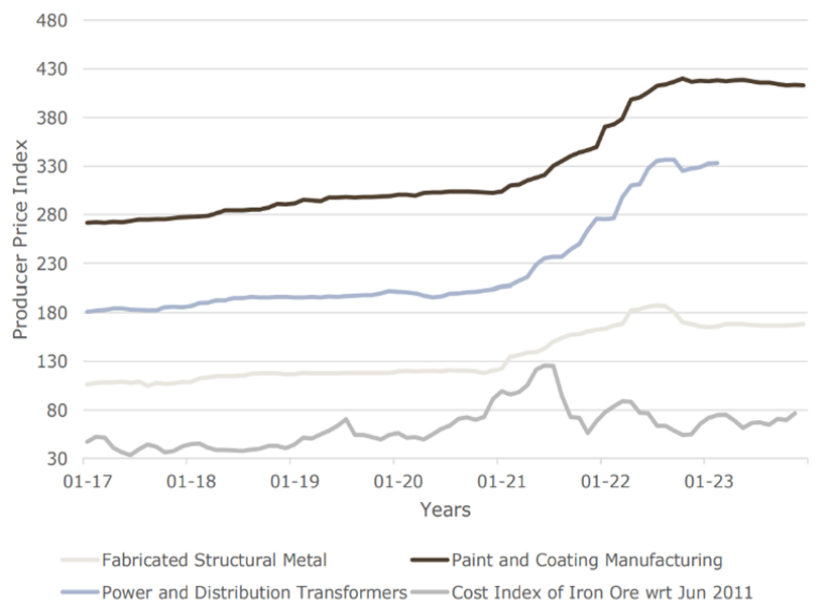
GOVERNMENT OPTIONS

Consider allowing the inclusion of offshore storage or conversion technologies within the permit

1. All-DC offshore wind farms: When are they more cost-effective than AC designs, Timmers et.al., 2022.

A rise in raw material and fabrication costs results in higher LCOE values

PPI TRENDLINE FOR MAJOR COST CONTRIBUTORS



PROJECT AREA	ASSESSED PARAMETERS
Developed markets	Material prices and cost of fabrication

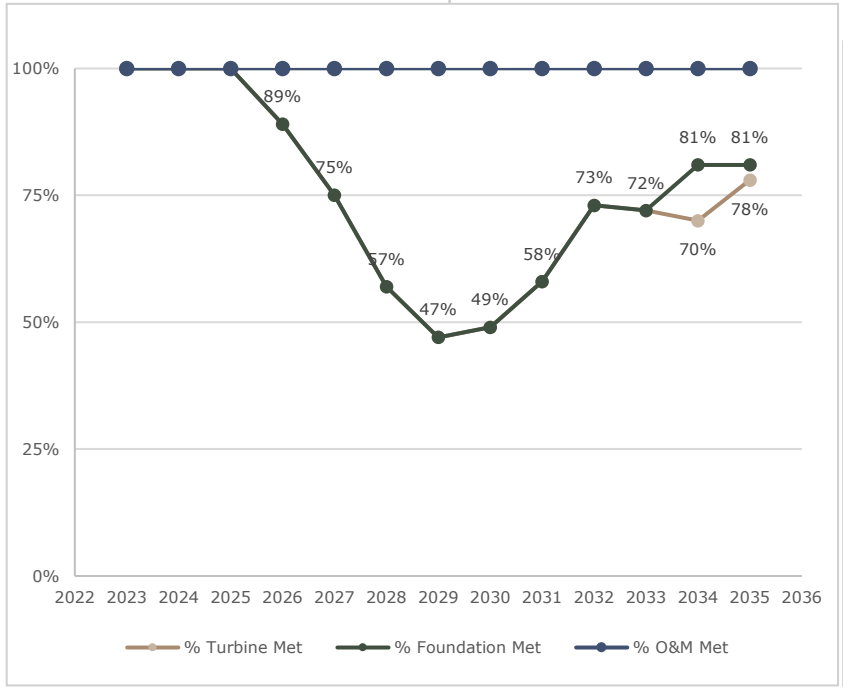
- The main components of an offshore wind farms are mainly made out of metal, making them very prone to the variation of material prices. The Producer Price Index (PPI) of fabricated structural metal manufacturing illustrate the impact of price swings in Engineering, Procurement, Construction and Installation (EPCI) contracts.
- Increases in the PPI outpace the inflation of the Dutch economy as a whole, which was 10% in 2022 and 3.8% in 2023[1]. In real terms material costs have therefore increased significantly since 2020, leading to an increase in main component costs that results as higher LCOE figures.
- The raw material costs have increased compared to 2020. It should be noted that the highest raw material prices have been observed in 2021-2022[1]. Strong increases close to 30% and 20% were seen in aluminium PPIs in 2021 and 2022, respectively, with only a 5% decrease in 2023. However, the cost of the fabrication of main components did not decline up to this date[1].
- The structural metal is currently 45% more expensive than it was in 2020. Producer Price Index of fabricated structural metal manufacturing has increased from 119.8 to 167.1[2].

IMPACT ON LCOE	GOVERNMENT OPTIONS
	Consider extending the construction timeline[3] to provide developers with greater flexibility in contract allocation

1. CBS, 11 January 2024, 'Inflatie 3,8 procent in 2023; exclusief energie 6,5%'. 2. FRED: Producer Price Index by Industry: Fabricated Structural Metal Manufacturing: Fabricated Structural Iron and Steel for Industrial Buildings Metal Bar Joists, Short Span. 3. AFRY did not considered the impact on a possible delay of the roll-out of offshore wind in the Netherlands.

AFRY forecasts a decrease in vessel availability starting from 2025 that leads to higher day rates for vessels and a challenge for offshore wind deployment

SHARE OF TOTAL VESSELS DEMAND MET[1]



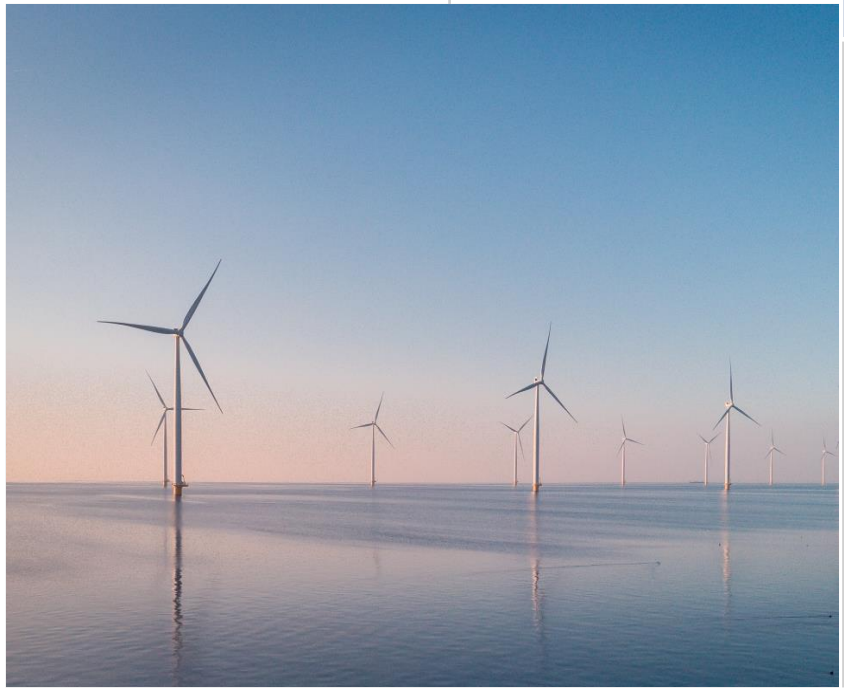
PROJECT AREA	ASSESSED PARAMETERS
North Sea and Baltic Sea	Vessel availability

- As the main components (wind turbines, foundations) are getting bigger, the number of heavy lift vessels that are capable of handling these weights is decreasing.
- Analysis indicates an increase in the number of suitable installation vessels until 2025, based on AFRY's market research on the world's offshore wind vessel availability until 2030[2]. However, post 2025 the number of suitable Foundation Installation Vessels (FIV) and Wind Turbine Installation Vessels (WTIV) is projected to fall due to the rise in turbine and foundation sizes[1]. Since turbine and foundation sizes are constantly getting larger, the investment decision to build new vessels become riskier for vessel operators.
- As contractors are able to predict the availability of their other assets that are technically viable to perform certain jobs, it is likely they will determine the profit margin to be included in proposals.
  - In tight competition and where the vessel portfolio is depleted, contractors tend to set a lower profit margin, typically 10%.
  - If contractors are assured that no alternative assets are capable of fulfilling project requirement, they opt for setting the profit margin as high as possible, often ranging from 20% to 50% of the total base cost.

IMPACT ON LCOE	GOVERNMENT OPTIONS
	Consider extending the construction timeline[3] to provide developers with greater flexibility in contract allocation and construction, ensure sufficient flexibility for developers to select the financially optimal turbine size based on current market conditions, pioneer standardisation

1. Lifting the Future of Monopile Installation, TWD, 2024. 2. Offshore wind vessel availability until 2030: Baltic Sea and Polish perspective, client: PWEA/Wind Europe, June 2022.
2. AFRY did not considered the impact on a possible delay of the roll-out of offshore wind in the Netherlands.

Qualitative criteria boost innovation but also require extra development efforts that result in longer timelines and higher development expenditures

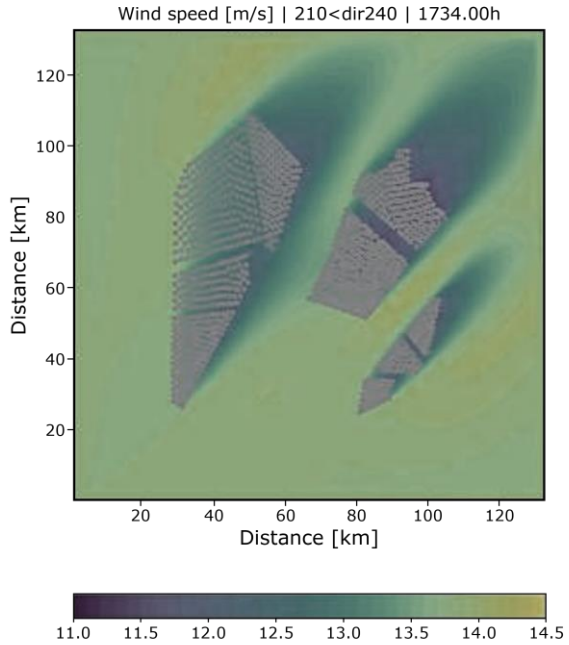
SYSTEM INTEGRATION IN OFFSHORE WIND	PROJECT AREA	ASSESSED PARAMETERS
	Offshore wind farms with total capacity of 750MW and 2GW	Non-price tender criteria

- Compared to five years ago non-price qualitative criteria, such as ecology and system integration, have become a more important part of tenders. Developers are generally supportive of these criteria as it drives innovation, even if the criteria result in increased development efforts and costs, additional resourcing, and possibly higher capex.
- In other mature markets developers require 5-6 months to develop their bids. In the Netherlands, however, more detailed qualitative criteria need to be met. This leads to a longer time required for structuring bids (estimates go up to more than one year).
- Early availability and transparent design of these criteria, combined with facilitation of the right boundary conditions can make these qualitative criteria a win-win for developers and government.
- Holistic criteria that, for example, extend the ecological scope to the area between monopiles or beyond the OWF site, or for system integration with other options than onshore hydrogen would facilitate innovation better and prevent qualitative criteria from becoming a check-list. More subjective criteria would also help distinguish amongst bids without relying on the financial bid element. On the other hand, some developers point out that increased clarity about the boundaries and criteria would reduce their perceived risk of being non-compliant or out-competed due to misinterpretations.

IMPACT ON LCOE	GOVERNMENT OPTIONS
	In case of a comparative assessment, increase clarity and ensure early availability of non-price tender criteria and the evaluation criteria (also in case of more subjective criteria)

AFRY

Wake effects from neighbouring wind farms decrease production and push up the LCOE; growing North Sea offshore wind deployment will accelerate this

WAKE EFFECT IMPACT[1]	PROJECT AREA	ASSESSED PARAMETERS
	2GW offshore wind farm	External wake effects

- Currently, when tendering sites, the estimated production figures and scoring in the tender documentation does not explicitly take into account the external wakes.
- Considering the Dutch governments' targeted capacity and resulting density of offshore wind in the North Sea, external wake effects will play a crucial role in the future estimations of production. This impacts developers facing lower production from their wind farms due to wake effects.
- Analysis indicates (future) energy production from IJmuiden Ver may experience significant production losses from wake effects from upstream wind farms. Based on a Whiffle study, on an annual basis the production deficit could amount to 4%[1].
- A study done by AFRY for IJmuiden Ver site indicates that the external wakes might add an additional 5% loss to the total production.
- Due to the fast-growing offshore wind energy capacity, it is crucial to consider interactions between wind farms. This means that in tender procedures the impact of upstream wind farms must be factored into assessments of annual energy production for both current and upcoming wind farms.

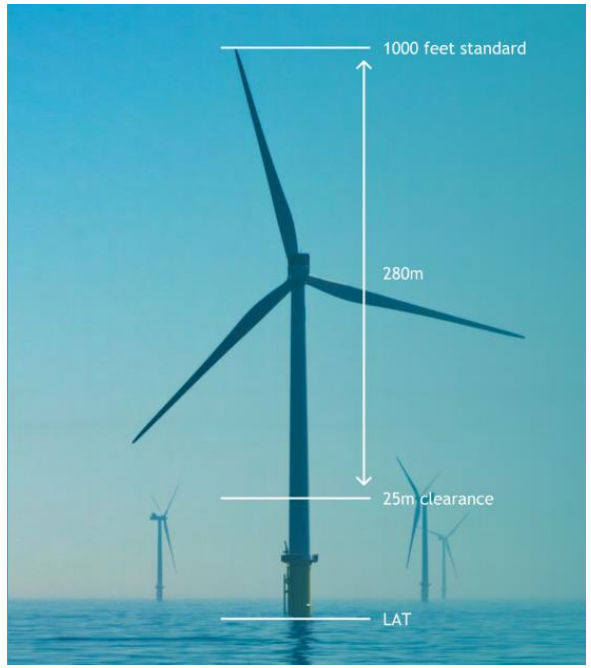
IMPACT ON LCOE	GOVERNMENT OPTIONS
	Consider adding qualitative tender criteria supporting software and component innovations aiming to minimise wake losses

1. The impact of wakes from neighbouring wind farms on the production of the IJmuiden Ver wind farm zone, Baas et.al., 2022

AFRY

Standardisation is an important factor in enabling upscaling: it simplifies the production process, improves cost efficiency and reduces risks

WIND TURBINE STANDARDISATION[1]



PROJECT AREA	ASSESSED PARAMETERS
Europe, developed markets	Wind turbine dimensions

- Until now, unrestricted growth has led to technical challenges due to reduced ability for standardisation. These challenges have only been intensified by geopolitical tensions (i.e. high dependency on a limited number of suppliers for certain metals and minerals) and rising costs (i.e. inflation).
- The European Original Equipment Manufacturers call is for limiting the ongoing development to have larger and larger turbines. Having an endless increase in turbine sizes requires constant improvement and investment on building facilities. Also, lack of testing procedures could result in less availability.
- Creating standards in the offshore wind industry necessitates proactive effort and cooperation among different stakeholders. However, the potential for cost reduction looks promising because numerous participants in the supply chain stand to gain from such collaborations.
- Limiting the turbine size for a longer period in time, facilitates having standardised main components, which will help to reduce the overall costs in the future. Such standardisation could be implemented in future tenders, but EU coordination is required in order to prevent a patchwork of regulations.

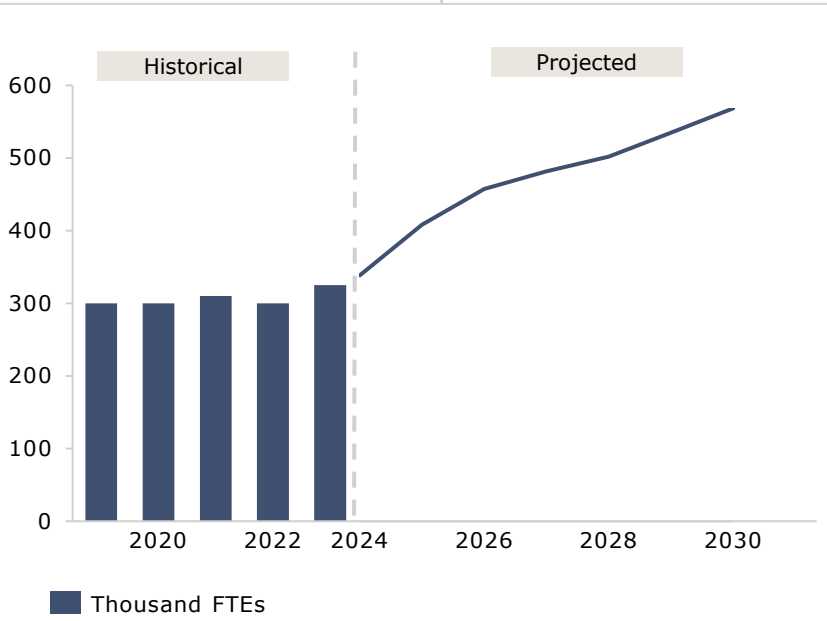
IMPACT ON LCOE	GOVERNMENT OPTIONS
↘	Drive standardisation efforts by engaging with EU member states, industry stakeholders, and organisations and invest in R&D initiatives focused on the risks and benefits of standardising the main components of an offshore wind farm

1. The North Seas Standard: enable growth with wind turbine standardisation, NWEA. OEM - Original Equipment Manufacturer

AFRY

The LCOE is expected to increase towards 2030 due to a projected shortage in the offshore wind workforce

Offshore wind workforce - FTE, Europe[1]



PROJECT AREA	ASSESSED PARAMETERS
Europe, developed markets	Workforce costs

- Development scenarios in 2020 and 2025 differ significantly in workforce availability, most significantly for manufacturing and construction of the offshore wind farm during their respective manufacturing/construction periods in 2024-2026 and 2028-2030.
- The European on- & offshore wind job market has been relatively stable over the period 2019-2024. However, from 2026 onwards annual wind capacity additions step up significantly to reach the EU's 2030 wind power capacity targets.
- At the same time, the EU aims to ensure that wind energy is "made in Europe".
- To achieve the projected wind capacity, and ensure it is "made in Europe", the European wind job market needs to almost double in size (from 336k FTE in 2024 to 564k FTE in 2030). This is expected to further increase the workforce shortage significantly.
- With workforce costs amounting ~25-35% of the total offshore wind farm costs, this is expected to have a (in)significant effect.
- The workforce costs will increase to levels related to the (estimated future) extend of the workforce shortage, which results in an increased LCOE.

IMPACT ON LCOE	GOVERNMENT OPTIONS
	To overcome the shortage in workforce, the government might establish a general policy to enable job traineeship programs and/or dedicated MBO programs for offshore wind that covers all phases of a project.

1. Our wind, our value; WindEurope and Rystad Energy, March 2024. Projected values from 2030 Targets scenario.

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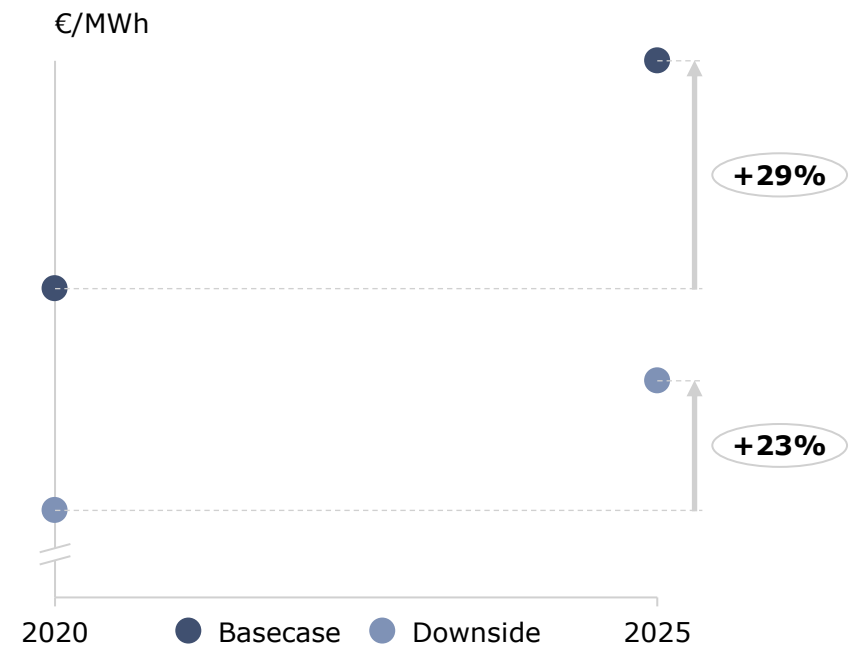
Projected revenues for offshore wind projects have increased since 2020, but OWF operators still face the challenge of hours with low wholesale prices

AGGREGATED REVENUE DEVELOPMENT[1]



- Projected revenues (aggregated Day Ahead and GoO revenues) for offshore wind projects have changed between the tender for Hollandse Kust (west) and IJmuiden Ver Gamma[2]. These values understate offshore wind revenues to some degree, as income from some markets (e.g. intraday and ancillary services) are not taken into account.
- Projected OWF revenues have increased since 2020 even if projected renewable capacity has increased. This is mostly due to inflation; increased short term prices after shocks to energy markets; increased carbon prices over the OWF lifetime; and tighter margins as projected demand has increased.
- As the total capacity of offshore wind increases in the Netherlands and surrounding markets, OWF operators are likely to increasingly face the cannibalisation of revenues. As a zero marginal cost technology, OWFs usually bid at (close to) €0/MWh. If all demand is met by zero marginal cost technologies (i.e. most RES capacity: solar PV and wind) the market clears at €0/MWh or lower.
- Cannibalisation effects can be mitigated in various ways, such as increased interconnector capacity with surrounding markets or increasing flexible demand through, amongst other options, batteries and electrolysers.

DRIVER	IMPACT ON REVENUES	DRIVER	IMPACT ON REVENUES
Cannibalisation due to increased RES capacity	↘	Increased interconnection and flexibility of demand	↗

1. Nominal EURs. 2. AFRY asset-specific capture prices and Guarantee of Origin (GoO) revenues for Hollandse Kust (west) (2020) and IJmuiden Ver Gamma (2025) for a 35-year period after a three-year construction phase: 2023-2060 for HKW and 2026-2063 for IJV. Presented values are aggregated over the asset lifetime and do not include assumptions about asset degradation

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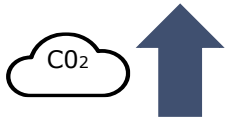
The main revenue for offshore wind is the capture price, which is influenced by both level and shape of electricity baseload market prices

INFLUENCE OF ISOLATED DRIVERS ON OFFSHORE WIND REVENUES



FUEL AND CARBON PRICES

Rising gas and carbon prices will positively affect wind capture prices. Higher gas and carbon prices will increase electricity prices.

ELECTRICITY DEMAND

Growth in electricity demand, such as via electrification and increased interconnection, could have a positive impact on wind capture prices by supporting electricity prices during times of high wind generation. Particularly growth in flexible demand would support this, such as electric vehicles, but also specifically demand for green electricity e.g. electrolysis and RFNBO-compliant green hydrogen.

GENERATION CAPACITY MIX

Increasing wind penetration levels increases wind cannibalisation effects and puts downward pressure on capture prices

SCARCITY PRICING

Tighter capacity margins lead to thermal generators bidding above their variable costs, but this usually occurs when wind is not expected to generate

TECHNOLOGY COSTS

Wind costs have increased from 2020 and are anticipated to eventually fall again but not before the late 2020s / early 2030s. If costs decline at a later date, this will result in more deployment of wind leading to higher cannibalisation levels for all wind generation.

ADDITIONAL REVENUE: GUARANTEES OF ORIGIN (GoOS)

GoOs are electronic certificates which provide proof of generation from a sustainable source (or 'green'). Demand for green electricity in the Netherlands has always been relatively high and has attracted a premium for its value.

ADDITIONAL REVENUE: ANCILLARY SERVICES

Wind generators have the capability to offer ancillary services, primarily focusing on aFRR market (automatic Frequency Restoration Reserve).
They can operate below their maximum capacity to provide additional power if required (aFRR up), or reduce output (/curtail) if there is an excess of energy on the system (aFRR down).
However, as the provision of ancillary services is relatively new for renewable assets, it currently does not significantly contribute to their revenue streams. It is expected that this will change in the future as remote regulation technology continues to improve.

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The Dutch business case for offshore wind is challenging: are there lessons to learn from other markets?

HOW DOES THE NETHERLANDS COMPARE TO OTHER EUROPEAN MARKETS?

– We compare the offshore wind tender processes in the Netherlands, Denmark, Germany and Great Britain. Identifying the key similarities and differences between these tenders and the Dutch tenders with a focus on the risk distribution between the wind farm operator and government. The more participants in a tender process, the more competitive the tender. There are a limited number of developers in the offshore wind market in Europe and where these developers focus their investments will depend on the business case in each market.

WHAT CAN BE LEARNT FROM OTHER EUROPEAN MARKETS?

– We identify if there are any learnings for the Netherlands from Denmark, Germany and Great Britain. Are there any elements used in the tender processes in the other European markets reviewed that could be applied in the Netherlands to improve the offshore wind business case?

HOW DO OTHER MARKETS PROTECT AGAINST PROJECT CANCELLATION RISK?

– We review the design features for offshore wind tendering to understand the potential for project cancellations or capacity reductions. How are tender processes designed to ensure only developers capable of delivering projects are awarded? What are the penalties to developers and/or specific project sites for not delivering the expected capacity or within defined timeframes?

HOW DO QUALITATIVE CRITERIA AND SUBSIDY LEVELS COMPARE ACROSS THE OTHER MARKETS?

– We present the qualitative criteria and subsidy levels available to offshore wind in Denmark, Germany and Great Britain. What subsidy basis, if any, are all schemes operating on? What is included if successful in a tender process? Have qualitative criteria or subsidies changed in recent years?

COMPARISON WITH OTHER MARKETS - SUMMARY

Though market risks are significant, the Dutch tender set-up is attractive compared to other European markets

The Netherlands is comparatively attractive

- The Dutch tender system currently compares favourably with other markets. The one-stop-shop provision of permits, site and grid connection presented to the tender winner is popular with developers.
- The Netherlands has had a reliable tender set-up with clearly communicated plans and accessible interaction between industry and government. Benefits for developers participating in Dutch offshore wind tenders include certainty of pipeline volumes and transparency of process which reduces risk and overall cost to the business case.

There are two main lessons from other markets

- Germany more easily allows developers to change the turbine size during permitting[2]. This still requires some effort and is also allowed in NL[3], but for NL the complexity includes that the requirement that the permit application would have resulted in an equal or higher rating in points on applying each ranking criterion.
- It is important to retain elements that are working well and to avoid creating uncertainty but a willingness to adapt to current market situations is beneficial. In the UK no bids were submitted in AR5 (2023) as maximum strike prices were set too low. The clear evidence from AR5 led to a response by the UK Government. The UK government has adapted and increased the maximum strike price for offshore wind by 66% for 2024.

Germany and Denmark have a similar market risk

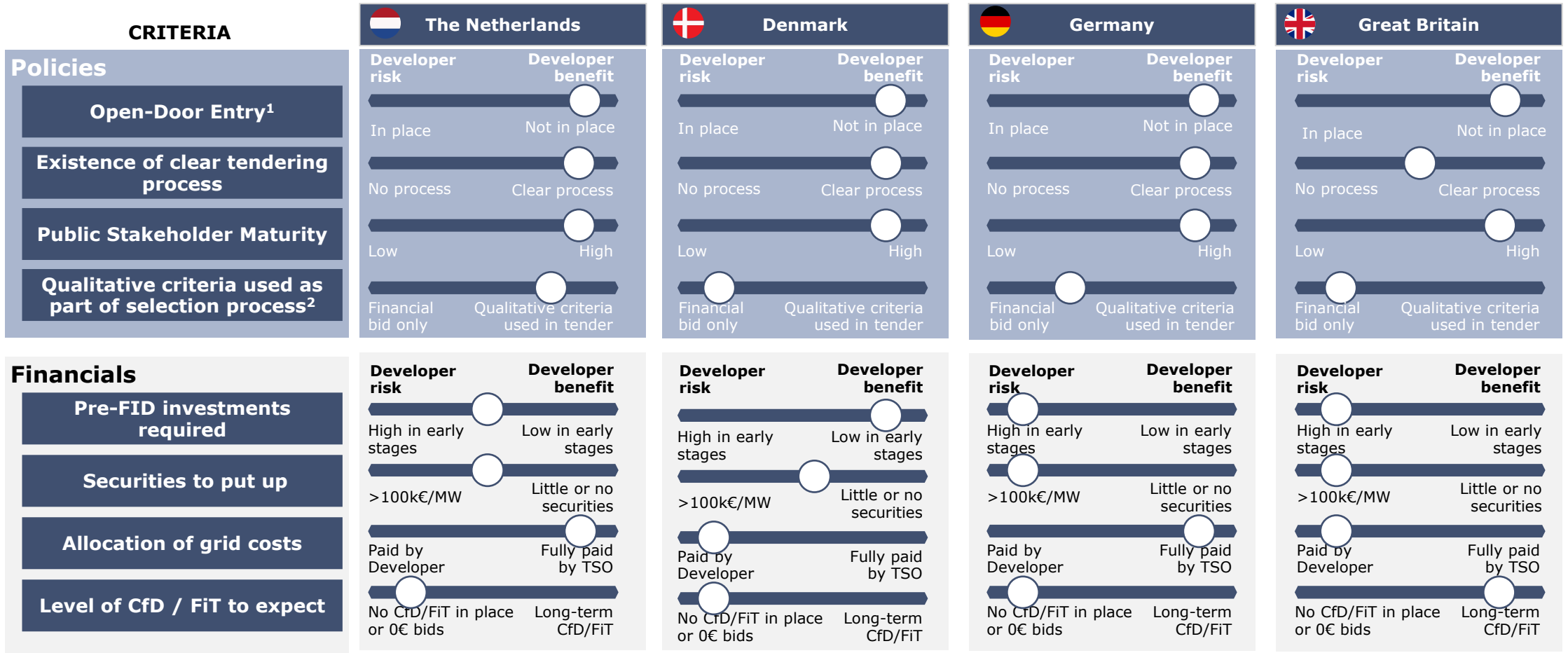
- As is the case in the Netherlands, Germany has a clear tendering process with a single state entity (BSH[1]) acting as central entity for OWF development. This decreases the overall complexity and streamlines processes.
- In Denmark, too, a single state entity acts as central entity for OWF development, which decreases the overall complexity and streamlines processes.
- In Germany, splitting of large sites into smaller parts to enable increased market entries and competition is under discussion.

Dutch qualitative criteria are preferred

- Overall, qualitative criteria set-up in the Netherlands is found to be preferred compared to the qualitative criteria in other markets examined.
- Though they are not mandatory, over recent Dutch tenders the requirements have been increasingly demanding for developers with growing qualitative criteria as well as financial commitments.
- Suggested improvements are to employ the same set of qualitative criteria across all sites to streamline preparations and stimulate innovation.

Notes: 1. "Bundesamt für Seeschifffahrt u. Hydrographie". 2. This allows developers to optimise their project design if circumstances change or unknown factors about the site are discovered. 3. Policy Rule, December 2023

Distribution of risk between government and developer is favourable in the Netherlands supported by a clear tender process and grid costs paid by TSO



Notes: 1. Open-Door Entry' is developers having a route to the offshore wind market without the need to compete in government-run tenders. This basically means a developer does the siting and acquires all necessary permits to move forward with the project. 2. The use of qualitative criteria can be seen as both a risk and a benefit, depending on who the bidder is.

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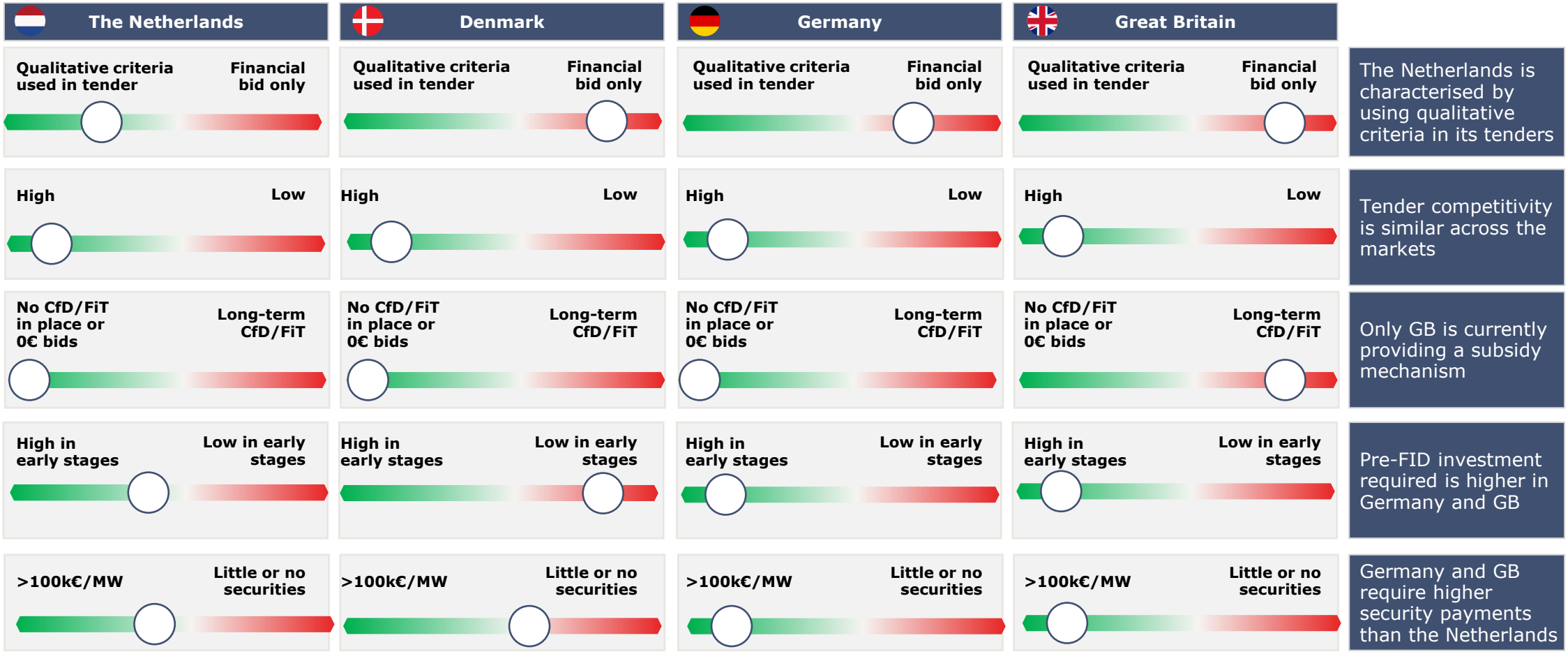
The Netherlands is characterised by using qualitative criteria as part of its tender procedure, but this does not affect the tender competitivity



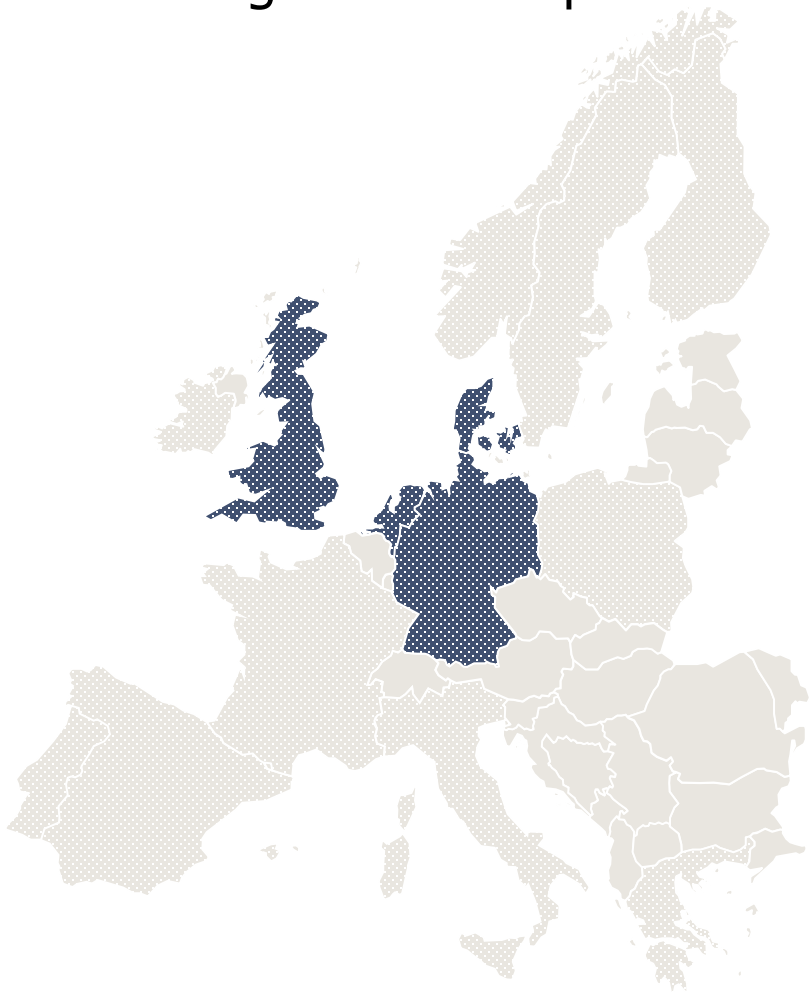
Eligibility criteria such as bank guarantees and securities, are required to mitigate the risk of projects being cancelled

	The Netherlands	Denmark	Germany	Great Britain
Pre-FID investments required Stringent eligibility criteria ensure only applicants capable of delivering projects are awarded contracts in tenders. In the Netherlands and Denmark rigorous tender criteria is used. In Germany high tender payments and securities are needed. In GB projects must be significantly developed: site lease (separate tender process), planning permission and agreed grid connection before participating in an allocation round for the support mechanism.	**Developer risk** — **Developer benefit** High in early stages — Low in early stages	**Developer risk** — **Developer benefit** High in early stages — Low in early stages	**Developer risk** — **Developer benefit** High in early stages — Low in early stages	**Developer risk** — **Developer benefit** High in early stages — Low in early stages
	Though exact specifications of the eligibility criteria can differ per tender, permits can only be granted when projects are technically and economically feasible and comply with the site decision. Projects need to be completed by a predefined timescale.	In order to be considered for pre-qualification in the tenders, applicants must meet the minimum requirements regarding economic, financial, and technical capacity. The final details of upcoming Danish tender are expected Q2 2024.	Tender payments of up to 2.02 M€ per MW for non-predeveloped sites require strong financial capabilities (Total tender payments are spread over time of lease and paid yearly). Penalties also apply if a project is not completed by a predefined timescale.	Prior to CfD tender developers will have invested significantly in a project and development costs will be at risk if the project does not continue. Projects awarded a CfD have defined dates by which milestones have to be met or risk CfD termination.
Securities to put up Financial incentives are in place to ensure that developers awarded contracts are incentivised to deliver the awarded capacity. Different markets have different levels of security payments required. Additionally, in GB the specific site is excluded from participating in another CfD allocation round for a defined period of time if its CfD Contract terminated.	**Developer risk** — **Developer benefit** >100k€/MW — Little or no securities	**Developer risk** — **Developer benefit** >100k€/MW — Little or no securities	**Developer risk** — **Developer benefit** >100k€/MW — Little or no securities	**Developer risk** — **Developer benefit** >100k€/MW — Little or no securities
	A bank guarantee or deposit must be provided for the period between the granting of the permit and the full commissioning of the wind farm. A bank guarantee must also be provided for wind farm decommissioning.	The Danish Energy Agency requires certain guarantees to be put up for payment, defective performance and decommissioning.	Securities of 200 k€/MW for predeveloped and 100 k€/MW for non-predeveloped sites. Potential penalties if developer does not adhere to the data submitted during the planning process, potentially fined 100% of the security.	Projects have to pay for site land leases before CfD tendering but no specific security payment is needed in the CfD tender process.

AFRY

Whilst NL and Germany use qualitative criteria, GB allocates tenders based on lowest subsidy, but Denmark tenders sites based on highest fees paid

	The Netherlands	Denmark	Germany	Great Britain
Process	Centralised tender: developers submit financial offers for the seabed rights, development permits and grid connection rights	Central site-specific tender, then developer is responsible for permitting and grid connection	Two distinct tender processes: predeveloped and non-predeveloped	Separate processes: seabed, permits, grid and support mechanism are all separate processes undertaken by the developers
Support Mechanism	Without subsidy, but does incl. grid connection. Developers submit financial offers for Offshore Wind Permit	Without subsidy	Without subsidy	Two-way Contract for Difference (CfD)
Tender Eligibility Criteria	Differs per tender, project must be 'achievable' and a bank guarantee must be provided	Minimum requirements regarding economic, financial, and technical capacity	Security payment and letter of intent regarding offtake	Site (lease), planning, grid and supply chain plan
Tender/ Allocation Criteria	4 different tender procedure options, ranging from fully financial or mainly dependent on qualitative criteria	Highest annual 'concession payment' (essentially a maritime land lease fee)	Price - pay as bid (recent tenders most bids were submitted at €0), predeveloped uses qualitative criteria	Price - Pay as clear



The Netherlands is attractive compared to other markets with developers preferring a one-stop-shop and stable policy, although some advocate subsidy

GENERAL

- Markets with a CfD are more attractive to developers. Given the market circumstances a CfD mechanism is described as the best way to share risks and benefits between society and developers and as placing a market on the top of the markets to invest in.
- This is per se not the same as advising a CfD for the Netherlands. Given that there are wind farm developments without a CfD this could introduce complexities for those sites. Developers therefore recommend predictable and stable policy and possibly implementing a CfD scheme, or other measures to stimulate the demand side.
- The Dutch system is also described as relatively complex – the bidding process has become so detailed that developers almost need to develop the entire plan in order to even participate.
- The Netherlands stands out with respect to other markets due to the grid connection TenneT provides. This makes a very significant positive difference to the business case. Similarly, the one-stop-shop approach offered in the Netherlands provides an attractive business context for offshore wind development.

GERMANY

- Germany allows developers to change the turbine size during permitting. Though this takes effort, it is mentioned as a positive because it allows developers to optimise their project design if circumstances change or unknown factors about the site are discovered.
- qualitative criteria in Germany (and other countries such as Norway) are implemented in a simpler way with a more 'objective' scoring system. This lowers the impact of qualitative criteria on the decision to bid but also mean the criteria have a lower effect on the project design. This has mixed response from developers who overall prefer the Dutch set-up[1].
- A recent tender in Germany received a 12.6bEUR bid, which is considered extremely high. Multiple developers warn against seeing this as a potential model for the Netherlands. The costs of such bids are expected to be passed on to customers, to require refinancing at some point in the future, or in the worst case, to lead to cancellation. This would delay the offshore wind build out. Given the importance of offshore wind for the Dutch renewable energy ambitions, this is seen as a risk the Dutch government cannot take.

GREAT BRITAIN

- The British permitting system is criticised for its uncertainty. Where the Dutch system provides clarity by providing everything in a one-stop-shop (permits, grid connection, etc.), in Britain it is possible to win a tender round and later getting a permit request rejected.
- In addition, the levels of the strike price that were rewarded recently (e.g. for Norfolk Boreas) were not sufficient for a strong business case. This underlines the risk of a potential CfD scheme for the Netherlands.

BELGIUM

- In Belgium developers can contract up to 50% of total electricity generation through a PPA with industry and citizens, as long as the negotiated price does not exceed the strike price by 3EUR/MWh[2]. This allows for optimising the business case while maintaining the revenue security needed for an investment decision. This is mentioned as a good, flexible system idea for the Netherlands, especially if it could be organised without the 3EUR/MWh limit.

1. Prior to IJV Alpha/Beta. 2. FPS Economy, 5 July 2023, 'Belgian Offshore Wind Energy Tender & Corporate PPA's'.

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COMPARISON WITH OTHER MARKETS – THE NETHERLANDS

The Netherlands has a well established centralised offshore wind tender process that mostly relies on a set of qualitative criteria

Overall principle of the tendering process

- Article 14a of the Offshore Wind Energy Act allows for four separate procedures, divided into two main mechanisms:
    1. Subsidised procedure awarded to the lowest bidder (15-year 1-sided CfD)
    2. Subsidy-free procedure awarded to a winner via one of the below procedures: Comparative assessment with financial bid (usually capped), Comparative assessment based on qualitative criteria, Tender based solely on financial bid (auction).
- All tenders are decided via energy agreements that involve various government authorities in order to identify areas for offshore development, creating commitment for securing the sites
- Since 2018, the tenders have been awarded without subsidy - the comparative test with financial bid being used for HKW and IJmuiden Ver. Note, this is without subsidy apart from the provision of connections to shore
- There is no open-door procedure available
- Projects can be sold/transferred to third parties after bank bonds have been placed – new owners need to prove same level of qualifications. Authorities need to approve such transfers individually
- The winning bid receives an offshore wind permit for up to 40 years while due to state aid reasons the government development costs for e.g. seabed studies, identifying offshore wind development sites are passed on to the winner; TSO TenneT covers the costs of the grid connection

Eligibility criteria within tendering

- A permit can only be granted to a project which for it reasonably can be assumed that it is 'achievable': i.e. the projects can be completed, technically feasible, compliant with Government stipulated timelines (per the Ministerial Order), financially feasible
- The assessment of the applicant's qualifications depends on the type of procedure chosen and published through a Ministerial order; e.g. in the comparative assessments (with and without financial bids) bids are compared on the points they score on various elements, including ecological and demand-side increasing requirements
- For the recent tenders for IJmuiden Ver Alpha (2000MW) and Beta (2000MW) the government allocated the permit based on a comparative assessment with a financial bid based on three standard criteria: (1) Size of the financial offer, (2) Certainty of realisation (e.g. experience in offshore wind development), and (3) energy supply contribution
- Ground-breaking environmental requirements have been introduced in recent tenders. For example, the Ijmuiden Ver tender included qualitative criteria on compliance with the principles of IRBC[1] agreement for renewable energy; insight into raw material consumptions; environment impact and value retention in design, construction, operating and decommissioning; the contribution to the integration into the Dutch energy system; the contribution to reducing porpoise disturbance days in the construction phase; the contribution to the ecosystem of the Dutch North Sea

1. International Responsible Business Conduct.

AFRY

The current Offshore Wind Energy Act provides the choice of four different tender procedures under Article 14a

1 Procedure with subsidy

- Subsidies currently possible under the Offshore Wind Energy Act are based on the SDE+(+) model
- During the 2018-2021 update, the government opposed CfD[1] subsidies on the grounds that it does not fit well in the Dutch legal framework and that the SDE+(+) model (which includes a price floor) allows for better integration with the power market, as CfDs remove market exposure

2 Comparative assessment

- The comparative assessment procedure is without subsidy
- Bids are compared based on the points they score on various elements, for instance ecological or requirements to stimulate demand-side
- Hollandse Kust (zuid), won by Vattenfall was the first site in which this procedure was followed

3 Comparative assessment with financial bid

- This procedure is the same as procedure 2, but is complemented with a financial bid to be made by developers
- The procedure for Hollandse Kust (west), won by Ecowende (Shell and Eneco) and RWE was the first site in which this procedure was used
- Likewise, the IJmuiden Ver Alpha/Beta procedures follow this set-up

4 Auction

- Auction methods are based on auctions for frequencies in the telecom sector
- The highest bidder wins the right to develop the offshore wind site
- Under the Offshore Wind Energy Act, this procedure has so far not been used for assigning wind farm sites[2]

COMMENTS

- The Dutch government can use any of these four different tender procedures.
  - The four different procedures should be understood as separate
  - Practically, the government can organise three combinations of procedures simultaneously, allowing for receiving bids with and without subsidies (e.g. 4-1). This is designed for cases in which the need for subsidies is not clear
- In practice, tenders have so far been based on a single procedure rather than simultaneous procedures
- The current 2021 update of the Offshore Wind Energy Act is the result of a lengthy negotiation between government and Parliament

Sources: Wet Windenergie op Zee; Memorie van Toelichting op Wet Windenergie op Zee, 2.2.6, 2.2.7, 28 November 2018. 1. CfD: Contract for Difference. 2. The first wind farm sites at the beginning of the century, however, were auctioned.

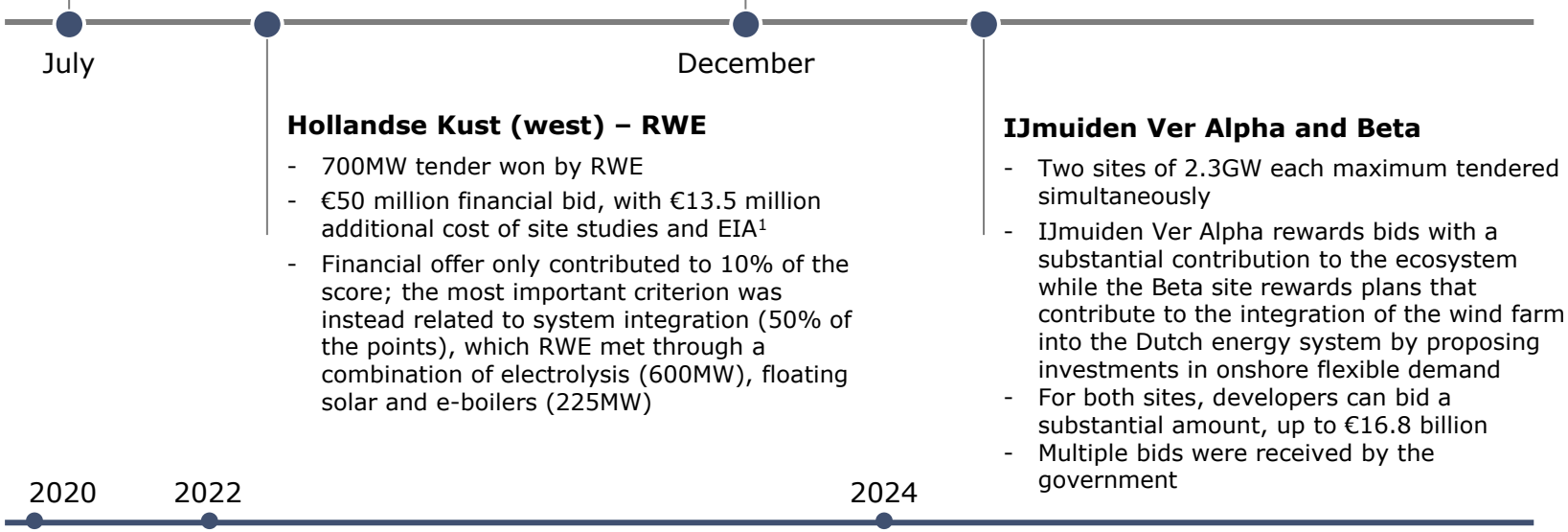
Since 2020, there have been three tender procedures, based on a mix of the procedures available to the Ministry of Economic Affairs and Climate Policy

Hollandse Kust (noord) – CrossWind

- 759MW tender organised before new Offshore Wind Energy Act, won by a consortium consisting of Shell and Eneco
- Procedure based on 3.3TWh annual production criteria, up from 2.8TWh in previous tender rounds

Hollandse Kust (west) – Ecowende

- 700MW tender won by a consortium consisting of Shell and Eneco
- €50 million financial bid, with €13.5 million additional cost of site studies and EIA[1]
- Financial offer only contributed to 10% of the score; the most important criterion was instead related to sustainability and biodiversity (50% of the points), which Ecowende met through larger spacing between turbines and biodiversity-enhancing reef structures



Hollandse Kust (west) – RWE

- 700MW tender won by RWE
- €50 million financial bid, with €13.5 million additional cost of site studies and EIA[1]
- Financial offer only contributed to 10% of the score; the most important criterion was instead related to system integration (50% of the points), which RWE met through a combination of electrolysis (600MW), floating solar and e-boilers (225MW)

IJmuiden Ver Alpha and Beta

- Two sites of 2.3GW each maximum tendered simultaneously
- IJmuiden Ver Alpha rewards bids with a substantial contribution to the ecosystem while the Beta site rewards plans that contribute to the integration of the wind farm into the Dutch energy system by proposing investments in onshore flexible demand
- For both sites, developers can bid a substantial amount, up to €16.8 billion
- Multiple bids were received by the government

1. EIA: Environmental Impact Assessment

COMMENTS

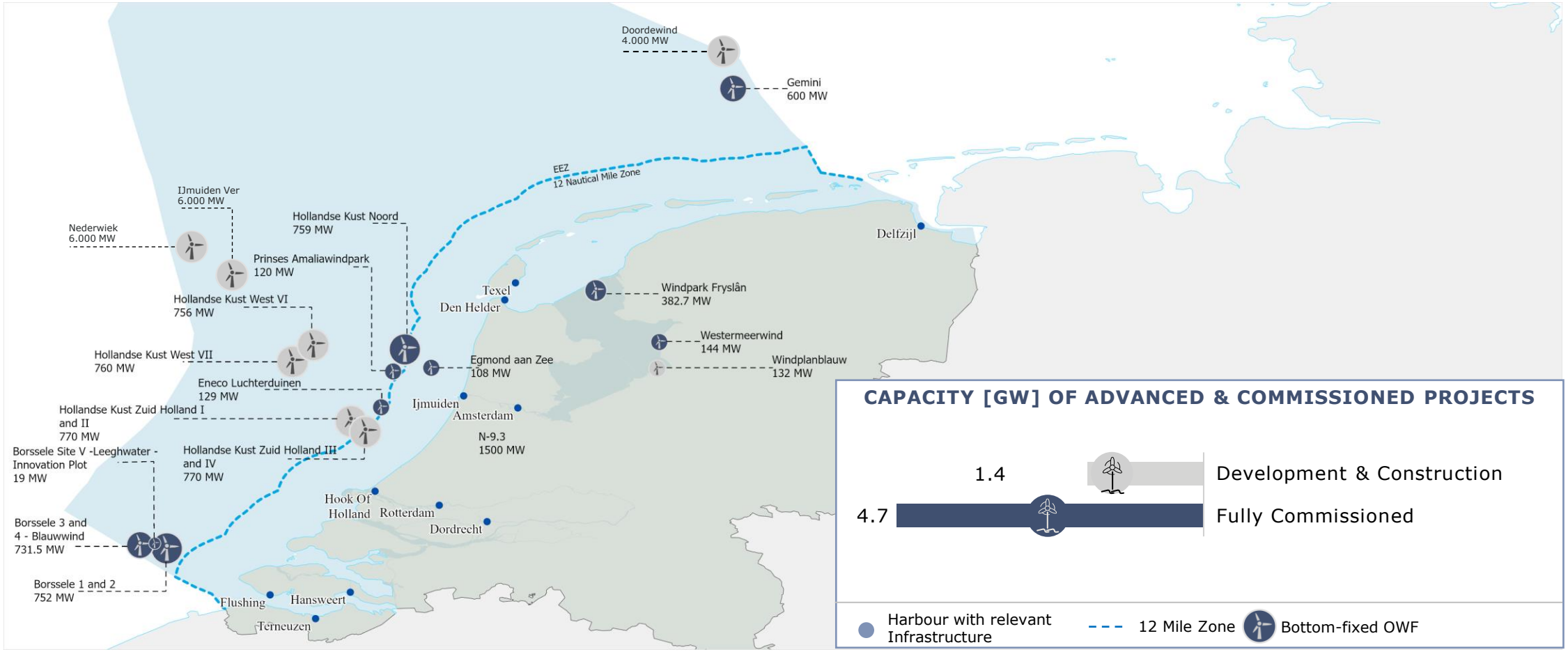
– The Dutch tender structure has so far been considered a success, helping to exceed the 2013 Energy Agreement target of 3.5GW of offshore wind by 2023 – at the end of 2023, a total of 4.7GW was installed

– The Dutch tender procedures are also noteworthy for breaking ground by including qualitative (ecological and system integration) criteria

- Before the tenders shown on the left, numerous offshore wind tenders were organised as well. Notably, the first Dutch OWF sites, e.g. Egmond aan Zee, finalised in 2007, and Amalia, finalised in 2008, were built supported by subsidies

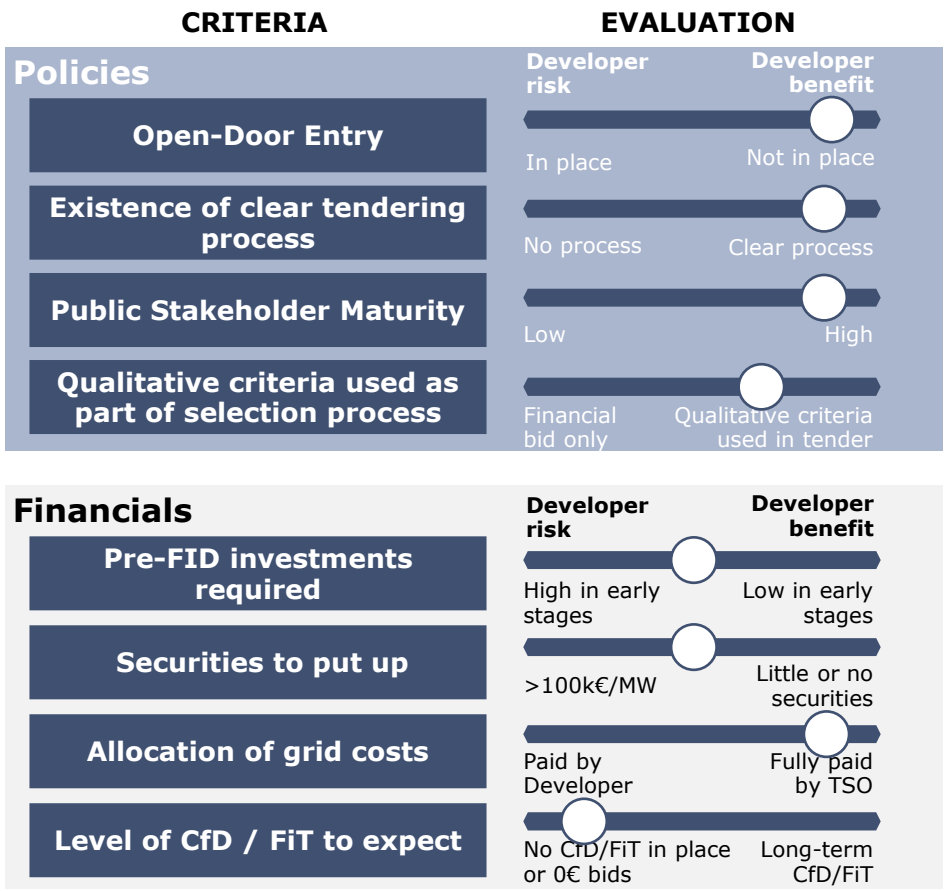
- In 2017 the Dutch gov. started discussing subsidy-free OWFs; Vattenfall's Hollandse Kust (zuid), finalised in 2023, won this bid in 2018-9 and became the world's first OWF awarded without subsidy

With 1.4GW of major projects currently in development and construction, the Netherlands is set to increase its installed capacity to 6.1GW shortly



Sources: 4c Offshore, Wind Europe, AFRY analysis

A successful bid is awarded a fully permitted project, while grid connection is largely responsibility of TSO



KEY TAKEAWAYS

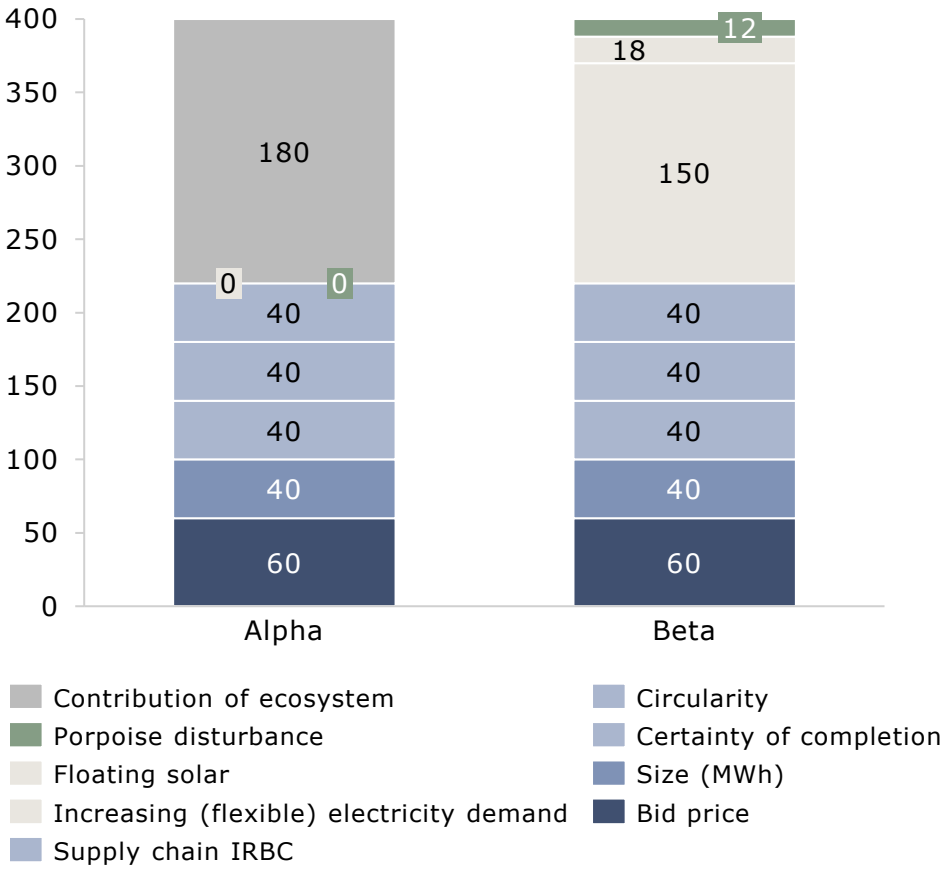
- **Open Door Entry:** There is no open-door entry process in place
- **Existence of clear tendering process:** Single state entity (RVO[1]) acts as the central entity for OWF development decreasing the overall complexity and streamlining processes
- **Public Stakeholder Maturity:** The RVO[1] has been involved in 7 offshore wind tenders and runs the SDE++ subsidies; currently it is assessing ±4GW of tenders.
- **Selection criteria at tendering:** Dependent on the tender it is either fully financial or mainly dependent on qualitative criteria

- **Pre-FID investments required:** The Dutch Government executes the site decision and environmental impact assessment procedures and passes the costs on to the winner
- **Securities to put up:** Bank guarantee must be provided
- **Allocation of grid costs:** TSO is responsible for financing planning, building, and operating the offshore grid connection
- **Level of CfD / FiT to expect:** Since 2018, the tenders have been subsidy-free, with the comparative test with financial bid being used for Hollandse Kust (west) and IJmuiden Ver Alpha and Beta.

1. RVO: Netherlands Enterprise Energy

The tender criteria points for Alpha and Beta are distributed differently, with Alpha emphasising ecosystem contribution and Beta increasing flex demand

TENDER CRITERIA POINTS FOR IJMUIDEN VER



Source: AFRY analysis

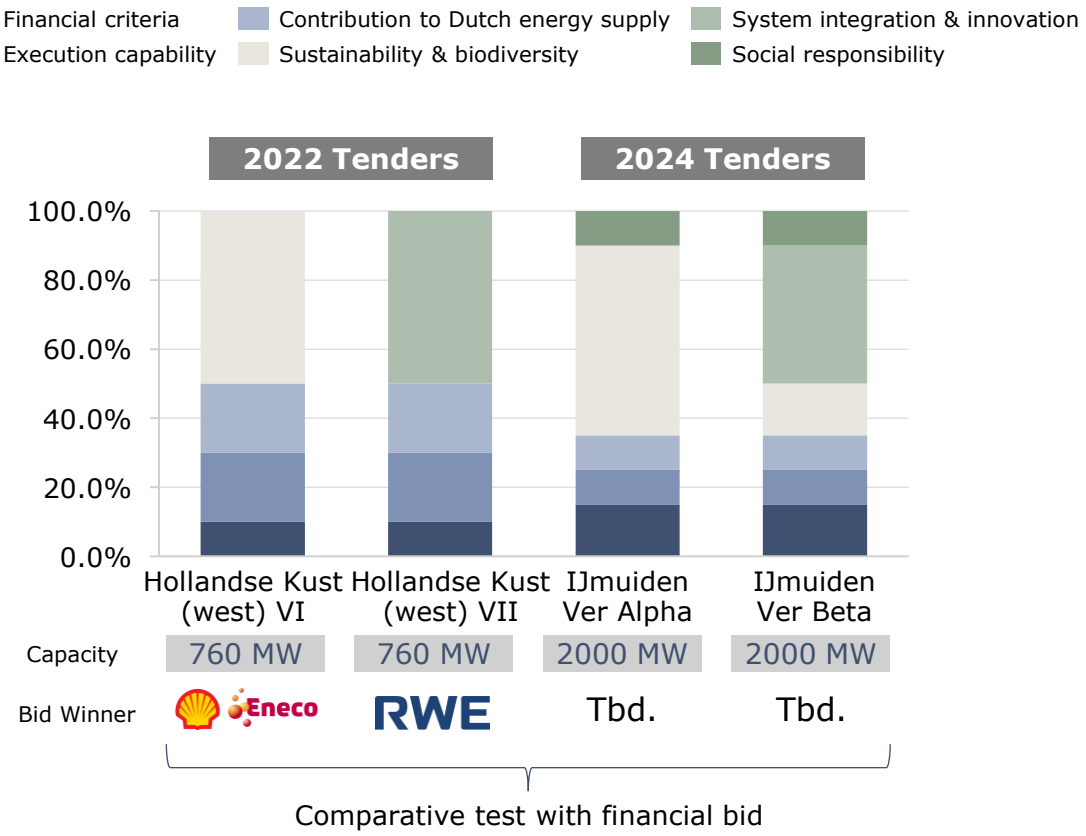
COMMENTS

- The recent tender for IJmuiden Ver concerns two sites of up to 2.3GW, 62km from the IJmuiden coast, that have been tendered simultaneously. At time of writing, the results have not yet been announced.
- The location of the OWF sites for IJmuiden Ver are such that the Beta site is located behind the Alpha site, which is likely to lead to wake loss and lower generation over its lifetime.
- The criteria set for the tender of the Alpha and Beta sites had a very different emphasis. IJmuiden Ver Alpha placed a heavy emphasis on the contribution to the ecosystem, for instance by considering bird migration.
- IJmuiden Ver Beta criteria rewards most points to increasing (flexible) electricity demand to make sure the generation of the OWF will have sufficient demand. The criteria are written such that it must be additional demand that must match with generation at an hourly level, with an increasing amount of points rewarded for an increasing amount of demand. This makes it attractive to create an offer in combination with, for instance, a large-scale electrolyser.
- The maximum amount of points for the bid price can be gained for the substantial amount of €16.8 billion for each site.

Tender criteria for one OWF site may work in both positive and negative directions. For instance, larger turbines (e.g. 18MW) may lower the LCOE and improve the business case, but the tender criteria also increase their risk by choosing an unproven technology. On the other hand again, larger turbines would require fewer foundations to meet the site's 2GW limit and disturb the North Sea ecosystem to a lesser extent.

The high financial bid cap puts large players at an advantage – while the fulfillment of qualitative criteria requires preliminary investments

TENDER CRITERIA



2022 TENDERS (HOLLANDSE KUST (WEST) VI & VII)

- For both 2022 tenders, the financial bid was set at 50M€ (maximum bid value). Additionally, 13.5M€ cost of site studies & EIA (both projects) were born by winner
- In the Hollandse Kust (west) tenders, the qualitative criteria were highly important. However, 50% of the applications did not meet the eligibility requirements for entry
- For both tenders, the amount in the financial offer only contributed to 10% of the score. The most important criteria were sustainability and biodiversity (50% of the points HKW VI) and system integration and innovation (70% in HKW VII)

2024 TENDERS (IJMUIDEN VER ALPHA & BETA)

- Financial bid cap is set at 420M€ for both Alpha and Beta (paid annually over 40 years), which is significantly higher than the maximum in the previous tenders
- It is unlikely that winners will meet the new caps, therefore making the financial criterion more relevant
- In addition to the financial criterion, the tender contains qualitative criteria such as ecological-related criteria for Alpha, system-integration criteria for Beta and circularity and IRBC criteria for both. These qualitative criteria have a significant share of the total amount of points in the tender (65%)
- Results of this tender round had not been announced at the time of writing

Sources: Netherlands Enterprise Agency, AFRY analysis

COMPARISON WITH OTHER MARKETS - THE NETHERLANDS

Selection of tender process is underway, supported by analysis into the current market conditions as part of this study

Important upcoming changes in legislation

- There are no major upcoming changes in legislation expected
- However, note that the Government has scope to adapt the process – which includes setting bid criteria – for each individual tender
  - Although basic tendering principles are set, each respective tender can look different
  - It could significantly impact the criteria on which the permit is granted, as well as the size of the bank guarantee and the costs for the site assessment and the EIA
- Note also that the currently on-going talks to form a new government coalition after the November 2023 election might result in a shift in climate policy, including offshore wind policy

Outlook on subsidy mechanisms and subsidy levels

- The Dutch Government monitors the market conditions prior to tender rounds and as part of the four tender options available, has the option to select subsidy, although if not required it will continue to use one of the three tender procedures without subsidy.
- However, if subsidy is required, before implementation approval would need to be granted from both the Dutch government and also at EU levels because this would constitute State Aid.
- As recommended in AFRY's 2020 study, the Dutch Government has been looking at other ways to improve the business case by assessing its hydrogen policy as well as creating synergies with the decarbonisation and electrification of industry.

Additional Comments

- The Government can set a bank bond to guarantee the park is realised.
- Before each tender round, the government is required to perform a market study to assess the state of the offshore wind energy market and the most appropriate procedure in this context.
- The Dutch Government has streamlined the site selection and environmental impact assessment procedures. These costs are passed on to the bid winner.
- Some OWF zones are ideally located to function as an interconnecting hub with the UK or Nordics, which could affect the tender process.
- The Dutch TSO, TenneT, has been appointed as the offshore wind grid operator. As such it is responsible for developing the offshore grid and the cost is paid for by the Dutch state.
- TenneT has developed a model 'Connection and Transport' and 'Realisation' agreements that will form the basis for all projects it connects.
- Subsidy and subsidy-free tender schemes allow for changes to this plan in relation to development or operation of OWF, providing flexibility about key characteristics to enable bidders to use the most up-to-date technology and pursue cost reductions through innovation.
- The Ministry of Economic Affairs and Climate Policy can choose from the four remuneration schemes in each tender, enabling the regulator to apply the right pricing model for individual sites. The regulator hosts workshops open for everyone to discuss details on the remuneration for a tender. The exact model chosen will be announced approx. 1 year prior to the tender via a dedicated platform.

AFRY

Contents

Using a central auction, the Danish Government aims to provide favourable conditions for offshore wind developers

Overall principle of the tendering process

- The central auction was the most common way to build new wind farms in Denmark and since February 2023 is the only way
- In 2023, a broad group of political parties agreed on a tender framework for the next 9GW offshore wind tenders with potential to install up to 14GW via overplanting
- The Danish Energy Agency (DEA) announces a site-specific tender for an offshore wind farm. The offshore wind farm must be established within a geographical area which is defined in the tender
- In the central auction all tenders are decided in political energy agreements, where different government authorities are involved in the process of identifying areas for offshore development, creating commitment for securing the sites
- Before 2023 there was also a second option, an open-door procedure, where the project developer initiates the establishment of an offshore wind farm of a chosen size in a specific area – which was suspended because of suspected breaches of EU competition law
- Of the formerly open door tendered projects, 24 were permanently closed, six will be opened again as an exception and the development of three projects is still under consideration

Eligibility criteria within tendering

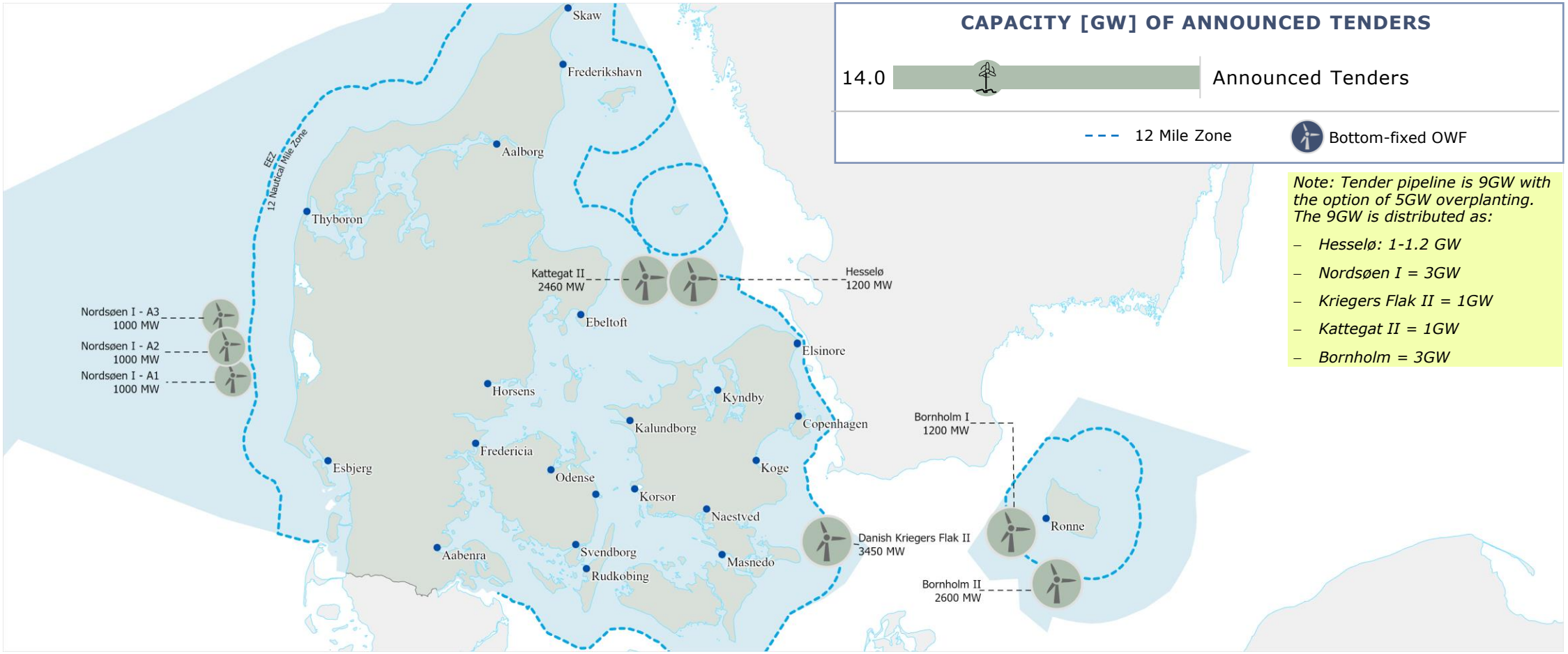
- In order to be considered for pre-qualification in the tenders, applicants must meet the minimum requirements regarding economic, financial, and technical capacity, as stated in the specific contact notice published in the Supplement to the Official Journal of the European Union
- The assessment of the applicant's economic and financial capacity considers, inter alia, the applicant’s overall turnover, total equity or credit rating, its full annual report and audited accounts
- In order to fulfil the technical capacity requirement, the applicant must possess experience with project development and management of the construction of offshore wind farms
- New and stricter environmental and sustainability requirements will be introduced to the upcoming tenders

Tender evaluation process

- The tenderers will purely be evaluated based on:
- For all projects excluding Bornholm: Highest annual ‘concession payment’ (essentially a maritime land lease fee) as a fixed annual fee paid to the State over 30 years
- For Bornholm (3GW): Lowest submitted bid for feed-in premium or highest annual ‘concession payment’ if developers opt for zero-subsidy bids

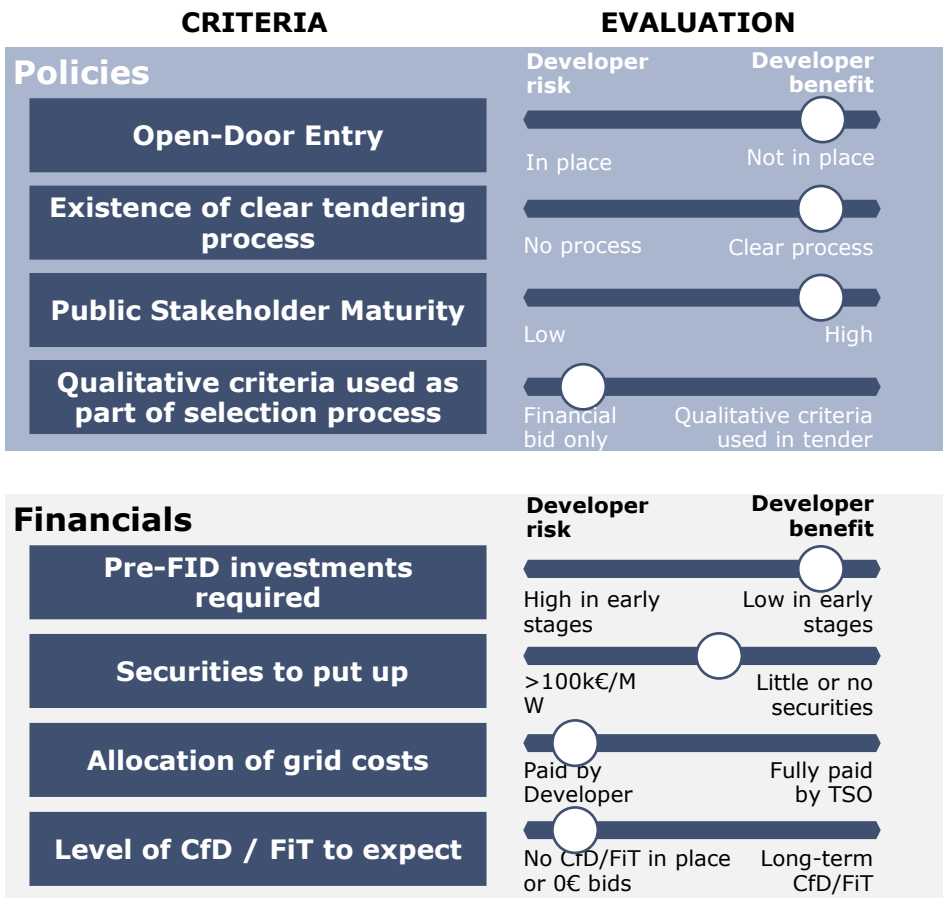
Sources: Danish Energy Agency; 4C Offshore; AFRY analysis

The announced tender pipeline of 14GW is set to be built by end-of-year 2031 and includes planned capacity increased through overplanting



Sources: DEA; AFRY Analysis
Note: In January 2024 the Danish Energy Agency announced slight changes with regards to tender order and (overplanting) capacities.

Tender selection criteria limited to financial bids and fully merchant offtake requires strong financial backbone for investments into offshore wind



KEY TAKEAWAYS

- **Open-Door Entry:** Shut down due to conflicts with EU Commission competition law and is likely to be replaced in some way
- **Existence of clear tendering process:** Single state entity acts as central entity for OWF development which decreases the overall complexity and streamlining processes
- **Public Stakeholder Maturity:** Highly mature, due to conduction of tenders and OWF realisation of ~4GW
- **Selection criteria at tendering:** Tender award purely based on financial bids – however, stricter environmental & sustainability requirements to be introduced for upcoming tenders (as an eligibility requirement for tender rather than tender comparative assessment)

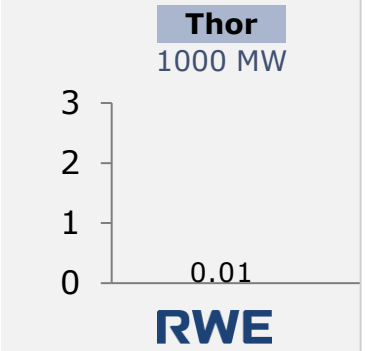
- **Pre-FID investments required:** Concession payments are due annually over the lifetime of the OFW project, consequences for non-payment in the upcoming tender are not yet clear
- **Securities to put up:** The Danish Energy Agency requires certain guarantees to be put up for payment, defective performance or decommissioning[1]
- **Allocation of grid costs:** Since 2018, the winner of the OWF tender is responsible for constructing, owning, and operating the grid connection up to the point of contact
- **Level of CfD / FiT to expect:** Offshore wind projects are now expected to be sufficiently profitable to be developed on merchant basis, and therefore no subsidies are provided to offshore wind development

1. A guarantee for payment of a penalty for defective performance and a guarantee for dismantling and decommissioning the wind farm pursuant to the terms and conditions of the construction license and the electricity production authorisation.

The most recent Danish auction concluded in 2021 without subsidy, resulting in a change to the tender design

Winning Bid price [DKK/KWH]

PREDEVELOPED



6 companies and consortia pre-qualified for the tender:

- Ørsted;
- Vattenfall;
- a consortium of Total and Iberdrola;
- RWE-owned Thor Wind Farm I/S;
- a joint venture of SSE Renewables and Thor OFW K/S, which is owned by Copenhagen Infrastructure IV Thor OFW ApS and Andel Holding;
- and Swan Wind P/S, a joint venture between Eneco and European Energy.

Danish Contract for Difference (CfD)

- Historically, the subsidy scheme in Denmark has been a fixed price per kWh based on a Contract for Difference (CfD) for the electricity generated during 50,000 full-load-hours, corresponding to approximately 11-12 years of operation depending on the project.
- The strike price is defined by the winning bid price.

Tender Analysis

- **Auction date:** December 2021 (the most recently concluded tender)
- **Commissioning date:** 2027/2028
- **Support mechanism:** CfD
- **Competitive:** 6 companies and consortia pre-qualified for the tender (see left).
- **Lottery allocation:** one bidder offered to build the Thor offshore wind farm to the maximum capacity of 1,000 MW at the minimum price of DKK 0.01/kWh, therefore the tender was decided by a lottery draw.
- **Consequences:** the result led to changing the tendering scheme in Denmark as these results were interpreted as 'subsidies are no longer needed and we can charge developers for building offshore wind now'. Going forward there will be no Govt backed support for the upcoming tenders, and developers will compete on who is willing to pay highest 'concession fee' in the form of an annual maritime land lease. There is one exception to this: The Bornholm energy island will receive some subsidy in the form of feed in premium.

Sources: AFRY analysis

COMPARISON WITH OTHER MARKETS - DENMARK

Although offshore wind is seen as a key element in the Danish emission reduction targets, uncertainty around the ambitions has recently arisen

Important upcoming changes in legislation

- In a recent climate agreement, the Danish Government highlights significant measures for increased offshore wind capacity in the form of energy islands with interconnectors to Continental Europe and deployment of Power-to-X, in particular hydrogen production through electrolysis. Auctions are in planning, for around 2GW of offshore wind capacity envisioned by 2027
- Offshore wind is seen as a key element in the Danish Government's plan to reach the 2030 target of a 70% emission reduction
- Every year in September, the Danish Government presents a climate program with short- and long-term initiatives highlighting how to adjust policies in order to remain on track to meet the country's targets. The program is then evaluated by the Parliament, who assesses if proposed initiatives are sufficient or not

Outlook on subsidy mechanisms and subsidy levels

- Offshore wind projects are now expected to be sufficiently profitable to be developed on merchant basis, and therefore no subsidies are provided to offshore wind development

Additional Comments

- Denmark used to have CfDs, however following the zero-subsidy tender for Thor in 2021, the tender scheme was changed.
- The DEA usually prequalifies between 4 and 7 applicants. Applicants for pre-qualification may be a single company, a consortium of several companies, a joint venture or a company established specifically for the project – a so-called Special Purpose Vehicle (SPV)
- The uncertainty surrounding Danish offshore wind ambitions and timeline has increased significantly in the past year, due to
  - changes to the tendering scheme & outlook for subsidy,
  - open-door projects being unexpectedly closed, and permits being withdrawn,
  - the North Sea energy island tender being paused due to cost issues,
  - stricter broader environmental and sustainability requirements in upcoming tenders
- The Danish State plans for direct ownership stake in upcoming offshore wind tenders. Since at an early stage, this introduces complexity and potential delays to tenders and the construction of the wind farms, but could also represent an opportunity. The states planned 20% ownership is an untested approach globally, the state's stake has been reduced from the initial government proposal to mitigate concerns between government-run enterprise and political interference. Measures are also being taken to prevent any potential delays in the construction process. Government involvement indicates political support to offshore wind but concerns have been raised over whether other companies are better placed to progress the offshore wind capacity needed.

Sources: Danish Energy Agency; 4C Offshore; AFRY analysis

Contents

Since 2023, there are two tendering procedures used by the German Government with different eligibility and selection criteria

Overall principle of the tendering process

- The Offshore Wind Energy Act (WindSeeG 2023), introduced two tendering procedures:
  - **Predeveloped sites**
  - **Non-predeveloped sites**
- Before 2023, all sites were centrally predeveloped
- Auctioning volumes for the expansion of offshore wind are determined in the Zonal Usage Plan (FEP) with the objective of achieving the increased expansion targets defined in the EEG 2023
- The FEP specifies which areas require a preliminary investigation by a public agency (Federal Maritime and Hydrographic Agency, BSH)
- Developers of predeveloped sites must seek planning approval to build the projects from BSH. Winners must also reimburse the BSH for the costs of the preliminary examinations; this stands at €6.2m for N-3.7 (225MW), €5.5m for N-3.8 (435MW) and €8.2m for O-1.3 (300MW).
- In the case of non-predeveloped sites, the awarded bidders are responsible for carrying out preliminary surveys of the marine environment, subsoil and wind and oceanographic conditions prior to the construction of the wind farms
- The invitations to tender and auctions for the defined areas are generally conducted by the Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway ("BNetzA") and announced on their website of the Ruling Chamber 6
- Auctions for non-predeveloped sites held in June, for predeveloped sites in August

Eligibility criteria within tendering

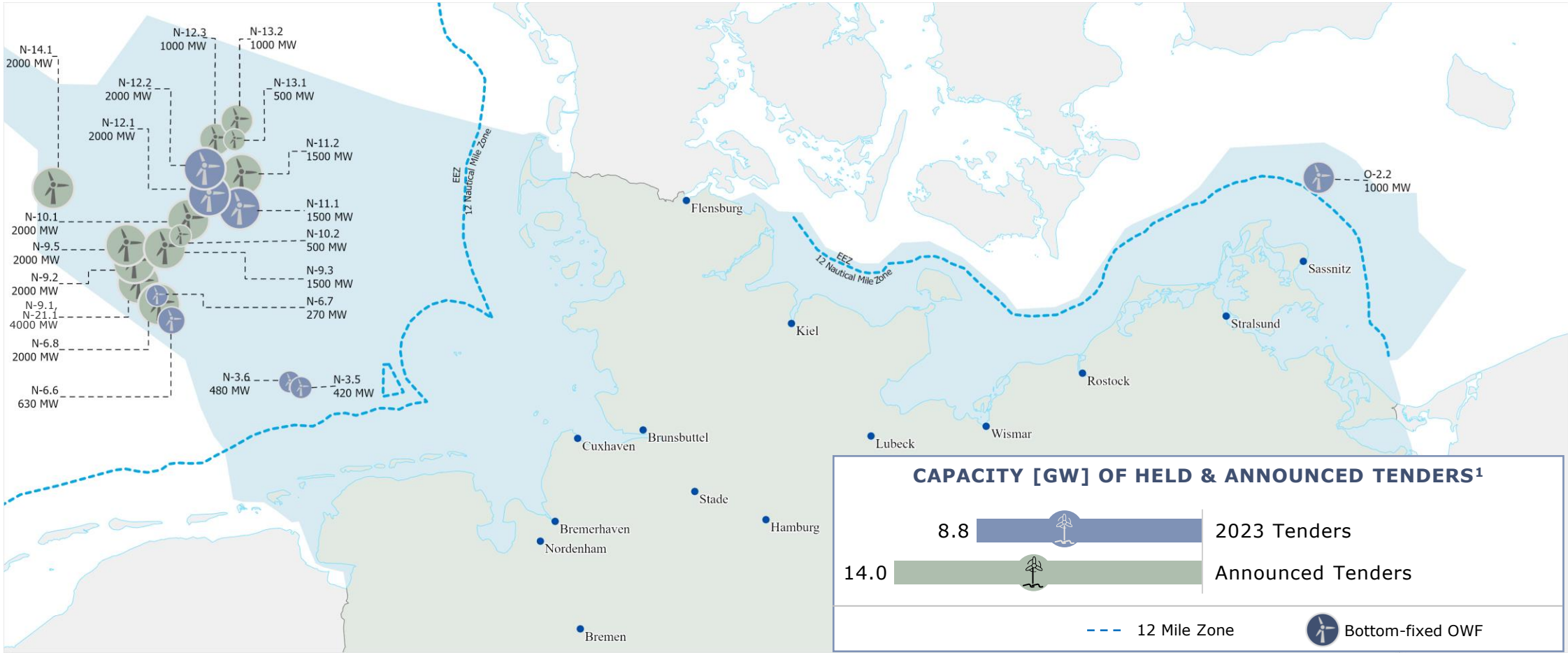
- Securities must be paid 25% before the auction and 75% after the surcharge
  - **Predeveloped sites:** Security payment of 200 k€/MW must be paid to the BNetzA prior to the auction and a letter of intent regarding offtake for 20% of tender volume for a minimum 5 years is required
  - **Non-predeveloped sites:** Security payment of 100 k€/MW must be paid prior to the auction. Letter of intent regarding offtake for 100% of tender volume

Tender evaluation process

- **Predeveloped sites**: Bids are sorted by price (value to be applied for the market premium) and by newly introduced qualitative criteria. In the case of several bidders submitting the same bid - opportunity to raise the bid. The qualitative criteria concerns how projects tackle aspects such as the decarbonisation in OWF or securing skilled workers by including job traineeship programs
- **Non-predeveloped sites**: Bids in the tendering process are sorted by price. In the case of multiple same bids, a dynamic bidding process takes place, with payments as a bid component. It takes place in parallel for all tenders and bidders receive information on each round such as starting time of bidding, number of bidders, and the amount which is required to be invested (min. 30.000 EUR/MW; no cap)

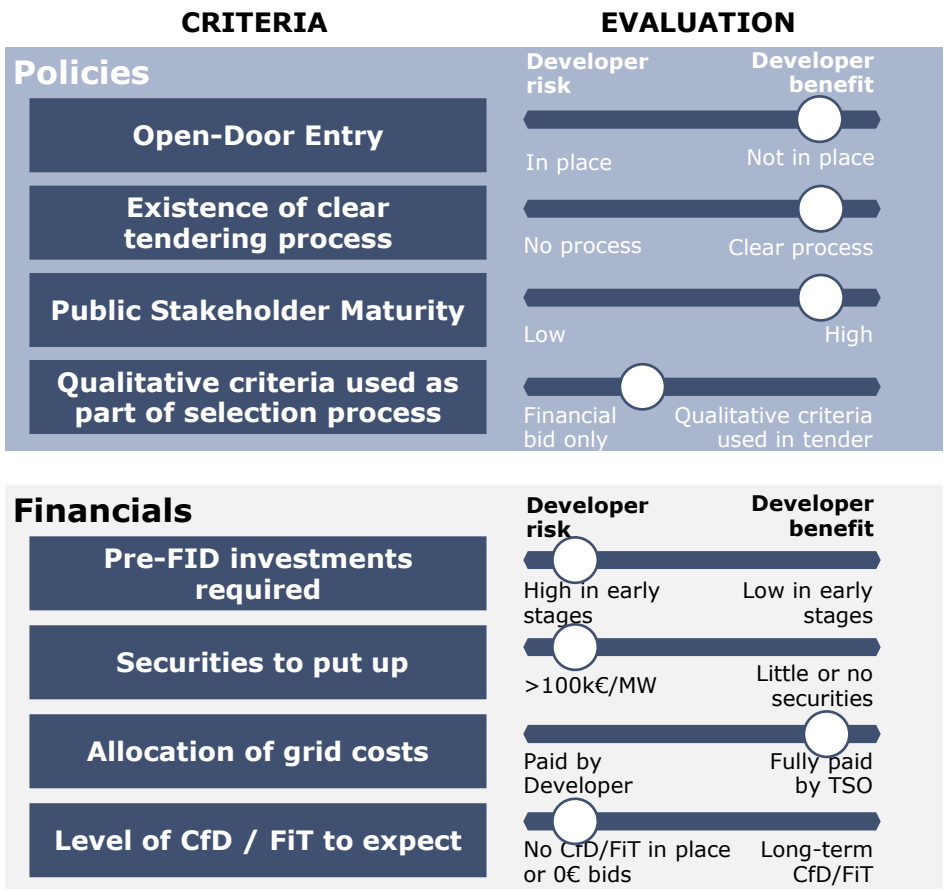
Sources: 4C Offshore; AFRY analysis

Germany is targeting 30GW+ installed by 2030, with 14GW in announced planned tenders and a total of 50GW installed capacity expected by 2035



Notes: 1 – held tenders includes those in 2023, but additional to those summarised in this chart are tenders already held prior to 2023.
Sources: BSH; DWG; AFRY Analysis.

German policies and processes are well established, although financially the environment is demanding for market participants



KEY TAKEAWAYS

- **Open-Door Entry:** Half of German sites are non-predeveloped and can be fully realised by developers, enabling margins and lowering capex
- **Existence of clear tendering process:** Single state entity (BSH[1]) acts as central entity for OWF development decreases the overall complexity and streamlining processes
- **Public Stakeholder Maturity:** Highly mature, due to conduction of tenders and OWF realisation of >8GW
- **Selection criteria at tendering:** Financial criteria are weighted with 60% for predeveloped sites and are decisive for non-predeveloped sites

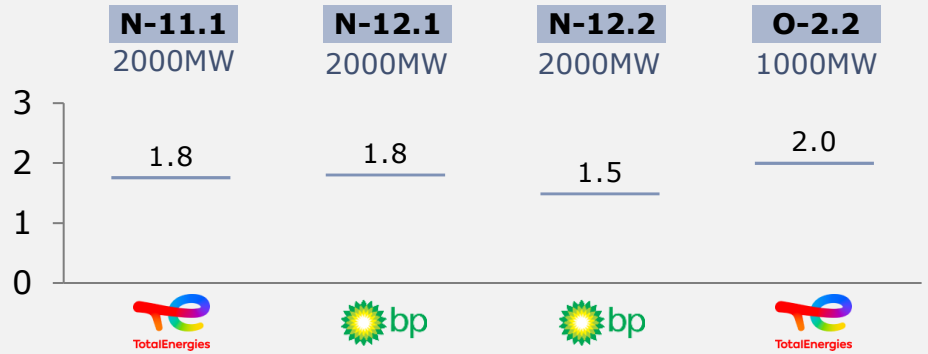
- **Pre-FID investments required:** Tender payments of up to 2.02M€ per MW for non-predeveloped sites[2] require strong financial capabilities
- **Securities to put up:** Securities of 200k€/MW for predeveloped sites and 100k€/MW for non-predeveloped sites required
- **Allocation of grid costs:** Favourable conditions for developers due to TSO providing majority of grid infrastructure including substation for OWF
- **Level of CfD / FiT to expect:** Pay-as-bid remuneration scheme in place but in recent tenders most bids were submitted at 0€

1. "Bundesamt für Seeschifffahrt u. Hydrographie"; 2) Total tender payments are spread over time of lease and paid yearly

The most recent German auctions showed a high willingness to pay negative bid prices showcasing advantages of players with strong financial capabilities

Winning Negative Bid prices per project[1] [M€/MW]

NON-PREDEVELOPED



Bid Areas and Winners

PREDEVELOPED

N-3.5	N-3.6	N-6.6	N-6.7
420MW	480MW	630MW	270MW
RWE	RWE	RWE	Luxcara

BID CRITERIA (WEIGHTED POINTS)

1. Uncapped financial bid (60)
2. Decarbonisation contribution (5)
3. Electricity generation in GWh (10)
4. Used Foundations (10)
5. Trainee Quota (10)

Tender Analysis

- **Auction date:** 01 June 2023
- **Highly competitive bidding:** The auction entered the dynamic bidding (negative bidding) stage after the Federal Network Agency received eight zero-subsidy bids for the three North Sea areas, and nine zero-subsidy bids for the one Baltic Sea area. Up to 66 tender rounds for O-2.2 emphasize competition as well as high attractivity of German Offshore Market
- **Winners were able to effectively leverage their advantage due to the following:** (1) Purely financial criteria, (2) No limitation on number of areas a bidder can bid on, (3) limited information regarding other parties and conducted bids and (4) no possibility of transferring bids between areas

Tender Analysis

- **Auction date:** 01 August 2023
- **Bid criteria determines winner:** Criteria, which was weighted by points, determined winner.
- **Uncapped financial bid:** Gives players with strong financial backbone a strong advantage

1. Winning Bid Price describes the 2nd bidding component in the tender process of non-predeveloped sites
Sources: AFRY analysis

Newly introduced criteria for tendering processes is under consultation and could be changed in the future

Important upcoming changes in legislation

- Solutions must be developed for the security of maritime critical infrastructure and its protection against sabotage
- A rescue concept is needed to protect the skilled workers at locations further offshore

Outlook on subsidy mechanisms and subsidy levels

- No subsidy mechanism is currently being actively used. Through the Zero bids in the last years, the guaranteed offtake renumeration via EEG Subsidy has been at 0€/MWh for the tenders
- Pay-as-bid remuneration scheme in place but in recent tenders most bids were submitted at 0€

Additional Comments

- The newly introduced tendering of two sites is under consultation. Experts suggest improving newly introduced qualitative criteria in the selection of reference bidders for pre-developed sites as well as a careful consideration of recently introduced dynamic bidding process component in the tendering for not pre-developed sites
- Furthermore, it has been argued that the newly introduced qualitative criteria should be improved. Since legally the processes of selection of winners can take up to four months, experts argue the selection should be based on more qualitative criteria
- Further ongoing discussions with regulator:
- Tendering of smaller areas and better enabling partnerships between developers in order to open market for new market entrants and smaller developers
- Limiting the number of areas on which participants can bid on in a single tender. This would enable a higher number of players to successfully participate in tender

Sources: 4C Offshore; AFRY analysis

Contents

General information on the current tendering process

Overall principle of the tendering process

- The process involves obtaining a seabed lease option through competitive bidding, with a 10-year validity. Lease execution aligns with financial close, requiring planning consents, a grid connection agreement, and probably a CfD support contract. Generator applications for onshore grid connections go through National Grid ESO
- Planning consent applications, usually as National Significant Infrastructure Projects, are submitted to the Planning Inspectorate in England and Wales, with decisions made by the secretary of state. In Scotland, Marine Scotland reviews applications, and Scottish Ministers decide on consent. Developers compete for a CfD through an annual auction, with successful bids receiving a pay-as-cleared CfD
- During pre-generation (construction), Wind Farm Lease rent is the lower of the CPI-indexed annual option fee instalment and the base rent. Once the wind farm generates power, the rent becomes greater of 2% of gross turnover, the minimum output multiplied by a fee based on 2% of the average project revenue over the past two years, and the base rent
- The wind farm developer constructs transmission assets to the onshore grid, subsequently transferring them to an offshore transmission owner (OFTO) through a competitive process managed by Ofgem. (This model may change as more integrated offshore grids develop)

Eligibility criteria within tendering

- To qualify for CfD, a developer must have managed a 50 MW+ project in a 'designated country' under 'Equator Principles' or demonstrate a similar stakeholder engagement. EIA proof by a Development Services Provider is accepted
- For participation, plants need planning consents, a grid connection offer, and must not be commissioned. A supply chain statement, though not assessed, is crucial for Option Agreements, with penalties for non-compliance. Developers can update as projects progress
- Phased offshore wind projects (≤1.5GW) with the first phase ≥25% of total capacity must commission within 2 years of the final phase's start. Floating projects cannot be phased, and water depth must be ≥45 m

Selection criteria in bidding process

- Fixed bottom offshore wind plants compete separately (different ‘Pots’), as do floating offshore wind and other 'less established technologies' like remote island wind, tidal stream, and wave. Each category has its budget and possibly a capacity cap, with potential technology-specific limits
- Projects submit bids ranked from lowest to highest strike price, irrespective of delivery year. The budget impact is assessed using the strike price, becoming the new clearing price for successful projects. To succeed, there must be budget remaining for all prior projects to adjust to the new strike price
- The auction concludes when a project's strike price cannot set a new clearing price without breaking the budget or capacity cap. If unsuccessful, bidders can resubmit bids in the next allocation round

Sources: The Crown Estate, AFRY analysis

Newly introduced criteria for tendering processes is under consultation and could be changed in the future

Support Mechanism

- The mechanism for supporting large-scale renewable generation is (2-way) CfD. When the market reference price is below the plant's strike price, they will receive a top-up payment to the level of the strike price but will pay the difference when the reference price is above the strike price
- CfDs are awarded as part of a competitive allocation process. Allocation rounds take place at a time specified by the government, currently expected annually. The contracts currently have a tenor of 15 years
  - The latest CfD round (AR6) has been launched, with the auction taking place in summer 2024
- Generators have to secure their own route to market to achieve the CfD reference price, typically through a PPA.

Number of sites in a single bidding process

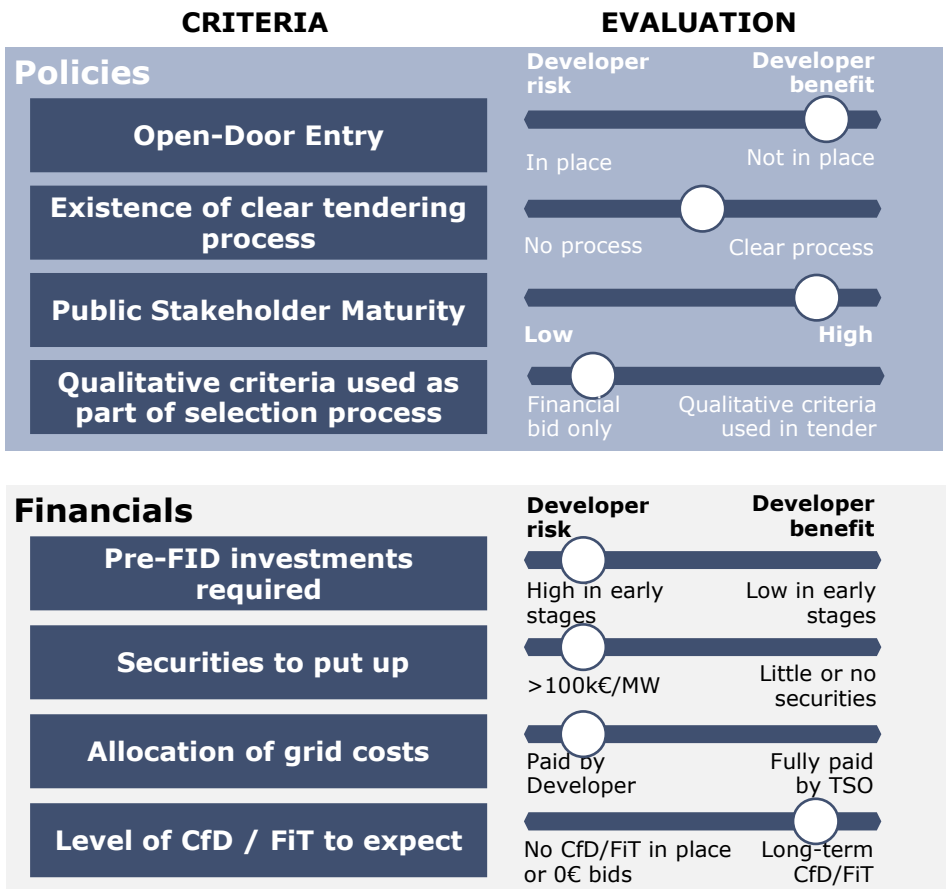
- Seabed: Recent seabed leasing rounds have been very competitive. The latest Scotwind round (for seabed in Scottish waters) had 74 applicants, of which there were 17 successful projects. The Crown Estate leasing round 4 process resulted in high option fees for all of the sites (bids were assessed based on option fees)
- CfD: There is no limit to the number of sites that can enter a CfD auction, except for the number which are eligible to enter. Given the recent seabed leasing rounds, the offshore wind pipeline in GB has grown substantially, which could lead to further competition in future CfD rounds, especially considering the increase in strike prices for AR6

Typical retention clauses in tenders

- In general, projects can be sold along the entire process. In the seabed option phase, a change of ownership of less than 25% in aggregate will be permitted without the consent of TCE. Any other change of control will require TCE consent
- Lease option: is maximum 10 years and offers the developers a time window to carry out surveys and install instruments. The developer will need to obtain all consents and grid connection offers, as well as (if required) participate in the CfD auction and secure financing if they want to continue the project and enter a Form of Lease for 60 years. The developer can terminate the option (subject to payment of a break fee equal to one year's option fee instalment) at any time on or after the second anniversary
- Agreement for Lease: The developer will have a break right in the Wind Farm Lease after 25 years from completion of construction. This ensures that the developer is required to commit to at least a full life-cycle operation of wind turbines, with flexibility after that with a rolling three-year break option to allow for re-powering, life extension or decommissioning
- CfD: The CfD contract is for 15 years

Sources: The Crown Estate, AFRY analysis

High pre-FID costs for grid and leases favour players with strong financial capabilities – CfD can only be secured via tender shortly before construction



KEY TAKEAWAYS

- **Open-Door Entry:** UK future wind farms are authorised only by the Crown Estate or the Crown Estate Scotland – Open door entry is not possible
- **Existence of clear tendering process:** The tender process is well defined – However, because it consists of separate tenders for sites and support it is quite complex
- **Public Stakeholder Maturity:** Stakeholders are highly mature, due to the conduction of tenders and OWF commissioning of >14GW
- **Selection criteria at tendering:** The financial bid is the only criteria after participants fulfilled qualitative pre-qualification criteria

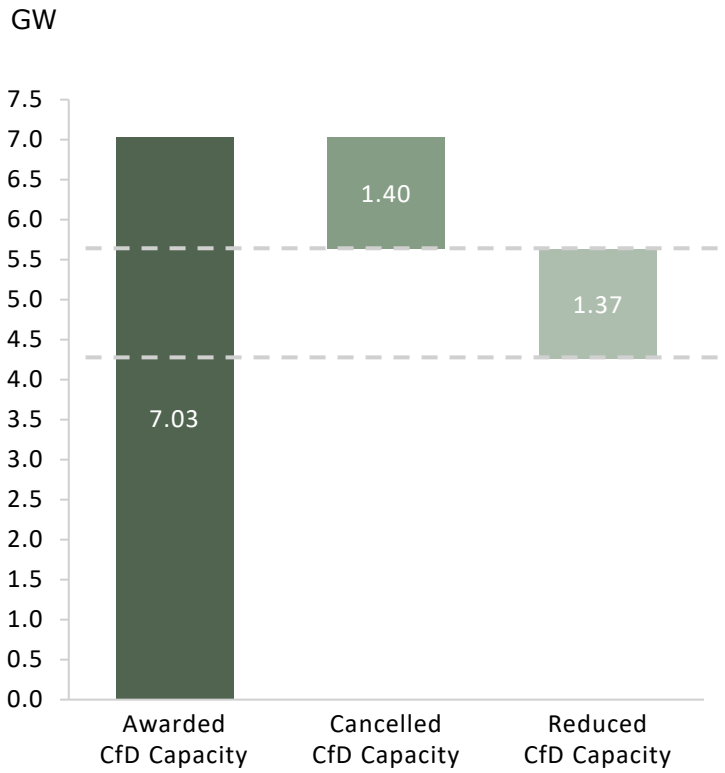
KEY DEVELOPMENT DESIGN/RISK

- **Pre-FID investments required:** Site tenders are conducted prior to support tender – hence fees are paid yearly from the site tender onwards
- **Securities to put up:** Securities for option fees and other obligations are required – Specific amount depends on the financial bid
- **Allocation of grid costs:** The developer is fully financially responsible for the connection of the wind park
- **Level of CfD / FiT to expect:** 15-year two-way CfDs are awarded in a competitive allocation process which is conducted separately from the site tender - No bids were submitted in the last offtake tender (AR5) as maximum strike prices were set too low. Expectation is bids will be submitted into the next AR (AR6, 2024) or may go merchant

Sources: The Crown Estate, AFRY analysis

At least 2GW of OWF awarded support in Allocation Round 4 (AR4, 2022) for delivery in 2026/27 will not commission as anticipated

ALLOCATION ROUND 4 OWF CAPACITY[1]

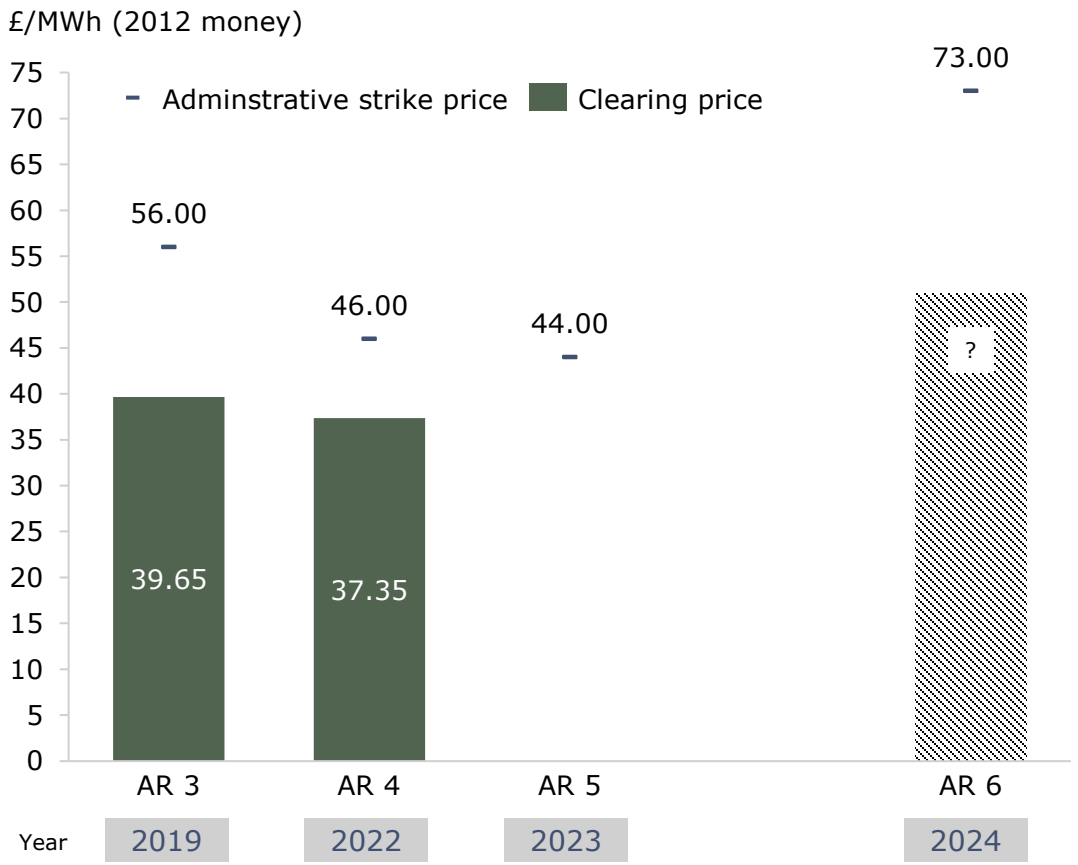


- **Cancelled CfD capacity:** Norfolk Boreas terminated its CfD, 9 February 2024. In January 2024 RWE acquired Norfolk Boreas, Norfolk Vanguard East and West from Vattenfall.
- **Reduced CfD capacity:** All OFW projects awarded CfD contracts in AR4 have reduced their capacity. Inch Cape, East Anglia 3, Hornsea 3 and Moray West have reduced their capacity by 24% on average.
- **CfD Contract T&Cs:** Under the GB CfD scheme, projects are allowed to reduce capacity up to a pre-defined amount for pre-defined reasons (e.g. issues identified during construction or a reduction prior to FID). CfDs awarded capacity in AR4 have reduced capacity under the 'permitted reduction' clause[2]. Permitted reduction allows for AR4 offshore wind to reduce their installed capacity estimate by up to 25%.
- **OFW capacity alternative options:** The CfD capacity that has been cancelled or reduced could:
  - rebid in a future allocation round to try and secure a higher CfD Strike Price, or
  - secure a PPA and go merchant.
- **CfD Regulations:** The CfD regulations include a 'non-delivery disincentive'. Sites awarded a CfD in AR4 are excluded for non-delivery from the next CfD allocation round. Therefore the capacity and reduced capacity from AR4 can participate in AR6. However, from AR5 onwards this was increased to exclusion from two allocation rounds.

1. Sources: Low Carbon Contracts Company, AFRY analysis March 2024. 2. Clause 6, Part 4, FiT Contract for Difference Standard Terms and Conditions, Version 4, 25 November 2021.

No OWF bids were submitted in the last offtake tender as maximum strike prices were set too low – UK government increased caps by 66% for 2024

ALLOCATION ROUND OWF BID PRICES[1]



Sources: The Crown Estate, AFRY analysis

COMPARISON TO OTHER ALLOCATION ROUNDS

- **Allocation Round 5** (AR5) was conducted in September 2023:
  - **No OWF bid was submitted** due to the government maximum bid price at **£44.00/MWh** being set too low for it to be financially attractive at current cost levels
- In comparison:
  - **AR 4 in 2022:** OWF developers bid at £37.35/MWh with the administrative strike price being £46.00/MWh
  - **AR 3 in 2019:** OWF developers bid at £39.65/MWh with an administrative strike price of £56.00/MWh for delivery in 2023/24 and at £41.61/MWh with an administrative strike price of £53.00/MWh for delivery in 2024/25
- The **trend of falling prices** was put to an end due to **higher costs** for **construction** and installation of OWFs and increased borrowing costs caused by rising global **interest rates**
- **AR 6 in 2024:** DESNZ has announced that administrative strike prices will **increase by 66%** compared to AR5 to £73.00/MWh (2012 money) and 52% from £116/MWh to £176/MWh (2012 money) for floating offshore wind. In AR6 offshore wind will also compete in a separate 'Pot 3' ringfenced from other technologies
- It remains to be seen if the increased strike price is sufficient for developers to submit bids

Outlook on the tendering process

Important upcoming changes in legislation

- CfD:
  - Further evolution of CfD design is expected – for example consideration of 'non-price factors' in CfD allocation, and exposure of generators to slightly more market risk. The Energy Security Strategy outlines government plans to consult on 2024 auction changes, aiming to encourage renewables to minimise overall system costs. DESNZ, in response to a Call for Evidence, suggests shorter-term adjustments, such as altering reference prices, capping subsidies during low prices, and exploring pricing floor and cap designs
  - More radical changes are expected later in the decade as a result of the Review of Electricity Market Arrangements (REMA), but details unclear at this stage. This could involve zonal pricing
- Planning consents: The Energy Security Strategy targets a reduction in offshore wind project consent time from 4 years to 1 year, aiming to streamline development
- Grid connections: The ongoing offshore transmission network review explores transitioning from the current radial approach to a more coordinated offshore grid approach

Additional Comments

- A general election is due to take place in 2024 (or at least must be held before 28 January 2025) which is likely to lead to a change of government. However, the Labour Party (likely incoming government) is at least as committed to the energy transition as the current government – potentially more so

Outlook on subsidy mechanisms and subsidy levels

- The Government has recently increased offshore wind ambition to 50GW by 2030, suggesting strong support for offshore wind going forward. Offshore wind remains the cornerstone for meeting the target to decarbonise the grid by 2035. While support design may change, we expect support to be available assume UK remains committed to Net Zero

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Contents

Glossary (1/2)

aFRR	Automatic frequency restoration reserve	DE	Germany	FEP	Site development plan (Germany)
AR	Allocation Round	DEA	Danish Energy Agency	FID	Final investment decision
BE	Belgium	DENZ	Department for Energy Security and Net Zero (Great Britain)	FiT	Feed-in tariff
BESS	Battery energy storage systems	DEVEX	Development Expenditure	FIV	Foundation installation vessel
b	Billion	DK	Denmark	FTE	Full time employee
BnetzA	Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway (Germany)	EEG	Renewable energy sources act (Germany)	GB	Great Britain
BSH	Federal Maritime and Hydrographic Agency (Germany)	EIA	Environmental impact assessment	GoO	Guarantee of origin
Capex	Capital expenditure	EPC	Engineering procurement construction	GW	Gigawatt
CfD	Contract for difference	EPCI	Engineering, procurement, construction and installation	GWh	Gigawatt hour
COD	Commercial operation date	ESG	Environmental, social, and governance	HKN	Hollandse Kust (noord)
cPPA	Corporate power purchase agreement	EU	European Union	HKW	Hollandse Kust (west)
DA	Day-ahead	EUR	Euro	HKZ	Hollandse Kust (zuid)

Glossary (2/2)

HVAC	High voltage alternating current	NL	The Netherlands	RFNBO	Renewable Fuels of Non-Biological Origin
HVDC	High voltage direct current	NWE	North-west Europe	RVO	Netherlands Enterprise Energy (Rijksdienst voor Ondernemend Nederland)
IJV	IJmuiden Ver	OFTO	Offshore transmission system operator	SDE(++)	Dutch RES subsidy scheme (Stimulering Duurzame Energie-transitie en Klimaattransitie)
IRBC	International responsible business conduct	Opex	Operational expenditure	SPV	Special Purpose Vehicle
k	Thousand	OWE	Dutch hydrogen subsidy scheme (Opschaling volledig hernieuwbare waterstofproductie via elektrolyse)	TCE	The Crown Estate
Km	Kilometer	OWF	Offshore wind farm	TSO	Transmission system operator
LCOE	Levelised cost of electricity	PNZ	North sea program	TW	Terawatt
m	Meter	PPA	Power purchase agreement	TWh	Terawatt hour
M	Million	PPI	Producer price index	UK	United Kingdom
MBO	Secondary vocational education (the Netherlands)	PV	Photovoltaic	WACC	Weighted average cost of capital
MW	Megawatt	REMA	Review of electricity market arrangements	WTIV	Wind turbine installation vessel
MWh	Megawatt hour	RES	Renewable Energy Sources		

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ANNEX II

AFRY is dedicated to the Wind Power industry

AFRY is at the forefront of wind power development. **For almost 30 years, AFRY has been actively involved in numerous wind power projects around the world.** AFRY'S dedicated team of wind experts have cutting-edge engineering and technology expertise to serve clients **throughout the entire value chain and project lifecycle**.

AFRY's wind power numbers:

- Involved in more than **70GW** wind projects worldwide as Technical Advisor / Owner's Engineer and more than **90GW** as Commercial / Market Advisor
- **400+** Wind projects delivered
- Around **30** years of experience in Wind Power
- **200+** Wind Power Experts of which **80+** with dedicated offshore wind expertise

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