Offshore Wind Energy Development in the Netherlands

A Detailed Analysis of Offshore Wind Tendering in the Netherlands

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Declaration

I declare that this document is an original work of my own authorship and that it fulfills all the requirements of the Code of Conduct and Good Practices of the Universidade de Lisboa.

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Abstract

Offshore wind energy is a critical component of the Netherlands' transition to a carbon-free energy supply. The country is on track to have at least 4.5 GW worth of offshore wind turbines in operation by the end of 2023. In its latest offshore wind roadmap, The Dutch government has set a target of having 21 GW worth of offshore wind farms in operation around 2030. This paper investigates how offshore wind tendering happens in the Netherlands and the direction it might take in the future. The offshore wind tendering process employed by the Dutch government has evolved from a subsidy-based, one-sided contract for difference scheme to a comparative assessment model with a financial bid. This unique model was designed to emphasize offshore wind's role in the conservation and restoration of the North Sea ecosystem and its integration into the Dutch energy system. To succeed, offshore wind developers will have to invest significant time and resources in developing solutions that satisfy these criteria while generating sufficient energy and remaining economically sound. Conversely, increasing costs, supply chain constraints, and multinational energy companies willing to pay extreme sums to reach their sustainability targets could threaten this tender model and shift the balance to a more lucrative financial auction model.

Keywords

North Sea renewable energy, Dutch offshore wind, wind farm development, offshore tendering

Resumo

A energia eólica offshore é um componente chave da transição dos Países Baixos para um fornecimento de energia livre de carbono. O país está no caminho certo para ter pelo menos 4,5 GW de turbinas eólicas offshore em operação até o final de 2023. Em seu mais recente roteiro eólico offshore, o governo holandês estabeleceu a meta de ter 21 GW de parques eólicos offshore em operação em torno de 2030. Este artigo tem como objetivo investigar como a licitação de energia eólica offshore acontece na Holanda e a direção futura que pode tomar. O processo de licitação de energia eólica offshore empregado pelo governo holandês evoluiu de um contrato unilateral baseado em subsídio por esquema de diferença para um modelo de avaliação comparativa com uma oferta financeira. Este modelo único foi concebido para colocar ênfase no papel da energia eólica offshore na conservação e restauração do ecossistema do Mar do Norte, bem como na sua integração no sistema energético holandês. Para terem sucesso, os promotores eólicos offshore terão de investir tempo e recursos significativos no desenvolvimento de soluções que satisfaçam estes critérios e, ao mesmo tempo, gerarem energia suficiente e permanecerem economicamente sólidos. Por outro lado, o aumento dos custos, as restrições da cadeia de abastecimento e as empresas multinacionais de energia dispostas a pagar montantes extremos para atingir as suas metas de sustentabilidade podem ameaçar este tipo de modelo de concurso e mudar a balança para um modelo de leilão financeiro mais lucrativo.

Palavras Chave

Energia renovável do Mar do Norte, energia eólica offshore holandesa, desenvolvimento de parques eólicos, licitações offshore

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List of Abbreviations

EU –European Union	PJ – Peta Joule
GHG – Greenhouse Gas	PV – Photovoltaic
LNG – Liquid Natural Gas	SDE –Stimulation of sustainable energy production and climate transition
HKZ – Hollandse Kust Zuid	kW – kilo Watt
O&M–Operation & Maintenance	GW – Giga Watt
TWh– Terra Watt hours	OFW – Offshore Wind
EBN – Energie Beheer Nederland	MW – Mega Watt
CO_2 –Carbon Dioxide	EIA – Environmental Impact Assessment
HKW – Hollandse Kust Noord	TSO – Transmission System Operator
IJVER – Ijmuiden Ver	SI – System Integration
EEZ–Economic Exclusive Zone	AC – Alternating Current
kV – kilo Volt	DC– Direct Current
WFSD – Wind Farm Site Decision	CfD – Contract for Difference
EUR – Euro	m/year – million per year
IRBC – International Responsible Business Conduct	IMVO – Internationaal Maatschappelijk Verantwoord Ondernemen
MONS – Nature Reinforcement in the North Sea	TNO – Netherlands Organisation of Applied Scientific Research
kg – Kilogram	dB – Decibel

1. Introduction

1.1 Renewable Energy in the European Union

By adopting the Paris Climate Accords and, more recently, the "EU fit for 55" package, the European Union (EU) has taken a clear stance on combatting climate change and rapidly reducing greenhouse gas (GHG) emissions in the remainder of this decade. Scaling down EU-wide GHG emissions by at least 55% (since 1990) by 2030 requires comprehensive, targeted action across several sectors. Chief among these sectors in the EU is the energy sector, accounting for approximately 75% of all GHG contributions [1]. To address this, EU member states have committed to increasing their minimum targets for renewable energy penetration from 32% to a 42.5% share of total consumption within the next seven years. To put these targets into perspective: in 2021, on average, nearly 22% of the EU's consumed energy came from renewable sources – roughly half of the March 2023 targets. Figure 1 below shows the renewable energy penetration on a country-by-country level of the EU, displaying significant variation. Sweden leads the pack, with 63% of their energy use stemming from renewable sources. Countries like the Netherlands currently sit at the bottom end of the spectrum, with less than 13% of consumed energy originating from renewables [17].

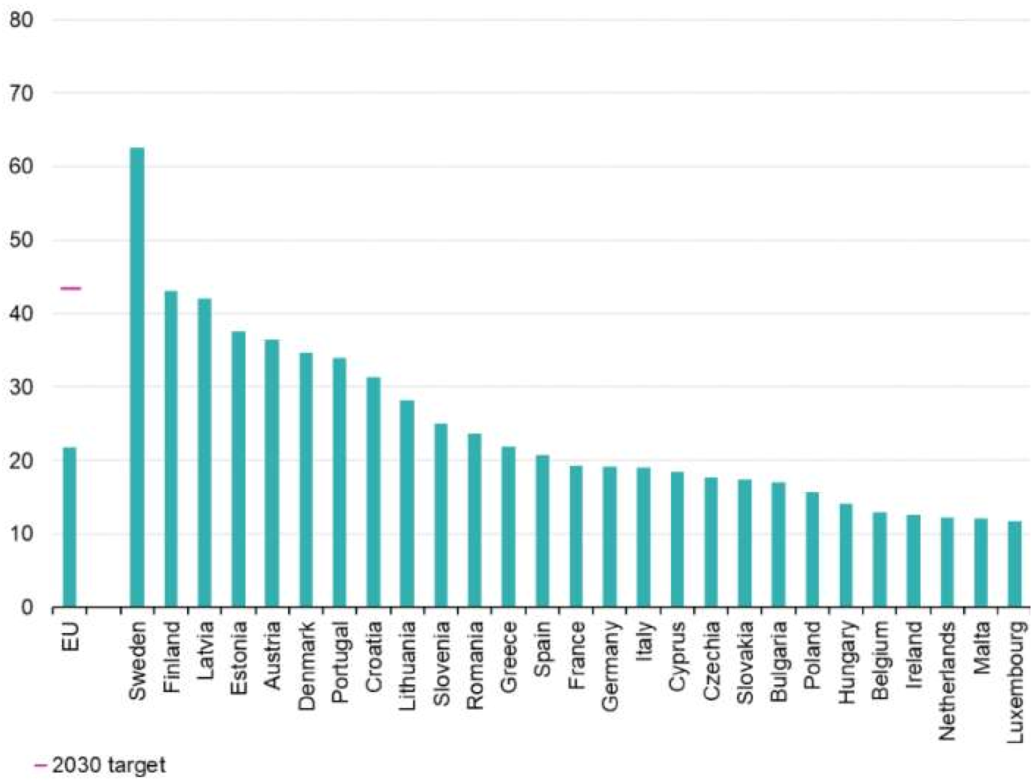


Figure 1: Figure showing the renewable energy penetration of EU member states. There is considerable variability amongst different countries. Source: [27]

1.2 Energy Mix of the Netherlands

To meet EU targets by the end of the decade, a country like the Netherlands will have to make significant strides in realizing new renewable energy capacity across the different generation assets. Having had access to substantial volumes of natural gas (primarily through their Groningen gas field), it is no surprise the Netherlands has grown to be dependent on this fossil fuel. Natural gas is a dominant player in the country's total consumption and total generation, sitting at 27.6% (only surpassed by oil) and 58%, respectively, in 2022 [28]. More recently, however, as shown in Figure 2 below, gas production has been on the decline, more than halving over the period 2015 – 2021. This results from significant scalebacks in Groningen gas production introduced by the Ministry of Economic Affairs following a marked increase in seismic activity in the area [3].

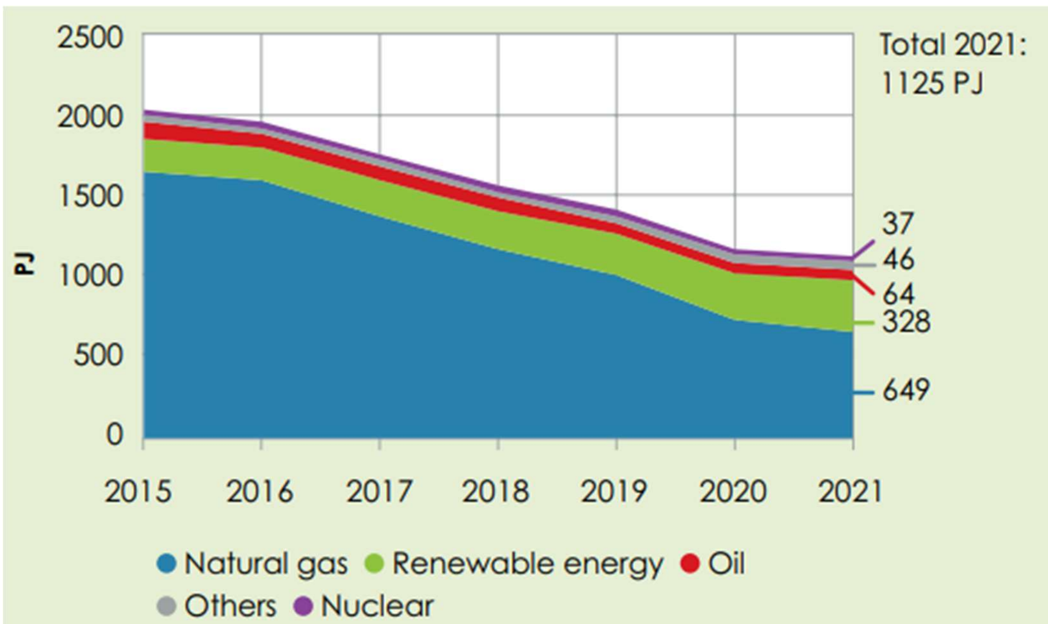


Figure 2: Graph showing the energy generation mix of the Netherlands from 2015 to 2021. It is dominated by gas and renewable energy (including biomass), with only marginal oil, nuclear, and other types of energy production. Natural gas production has been significantly scaled down since 2015. Source: [7]

With domestic energy demand remaining roughly the same across this period, the Netherlands has had to increase imports to cover the resulting supply-demand deficit. Most notably, before the Ukraine War of 2021, 13% of the Dutch gas supply was provided by Russia in the form of pipeline gas and Liquid Natural Gas (LNG) [8]. The Ukraine war induced an energy crisis, and the resulting natural gas price shock exposed the Netherlands' dependence on Russian natural gas, prompting the Dutch government to take various mitigating actions. For the short term, they have invested in securing larger volumes of LNG from other countries like the USA and Norway [18]. For the long term, they have committed to reducing energy demand (via energy efficiency) and increasing renewable electricity generation – particularly offshore wind [4]. The latter goes hand in hand with their drive to electrify and move away from a natural gas-powered society to one powered by the electron [21]. A need for energy security combined with ambitious renewable targets makes for a potent impetus to finance and scale up renewable energy projects nationwide. The next section of this paper will investigate the current renewable energy landscape in the Netherlands and targets per sector and their potential implications on the future (renewable) energy mix. To remain within this project's scope, the focus will be on the role of renewable electricity, omitting renewable energy sources like geothermal energy and biomass energy for heat. Biomass energy, while technically classified as renewable, still contributes to significant CO_2 emissions when combusted, rendering it ineffective for reaching CO_2 reduction targets.

1.3 Renewable Electricity in the Netherlands

Renewable electricity in the Netherlands can be broken down into four distinct categories by order of importance (see Figure 3 below for reference):

1. Wind Energy – A combination of onshore and offshore wind for a total annual contribution of 21,61TWh.
2. Solar Energy – A combination of large-scale photovoltaic (PV) solar and rooftop PV solar for a total annual contribution of 16.83TWh.
3. Other renewables – An umbrella term for geothermal energy, waste to energy, biomass, wave energy, and tidal energy for a total annual contribution of 9.70TWh.
4. Hydroelectric power – Low-head hydroelectric power plants for a total annual contribution of 0,06TWh.

The relatively insignificant hydropower capacity is logical, considering the Netherlands' lack of significant elevation differences. Figure 3 shows that the Netherlands has been investing significantly in both wind and solar installations over the past three decades, with both technologies showing exponential growth in installed capacity. Despite this, the country has fallen short of its renewable energy penetration targets in 2020 and 2021 [20]. The Dutch government has introduced significant financial incentives, such as the SDE++ scheme for onshore renewable energy developers, to stimulate accelerated growth. It subsidizes the difference between the cost of operating a renewable energy project and the value of the energy itself, limiting risk on the developer's side [10]. The government's budget for SDE++ subsidies amounted to 8 billion euros in 2023 [31].

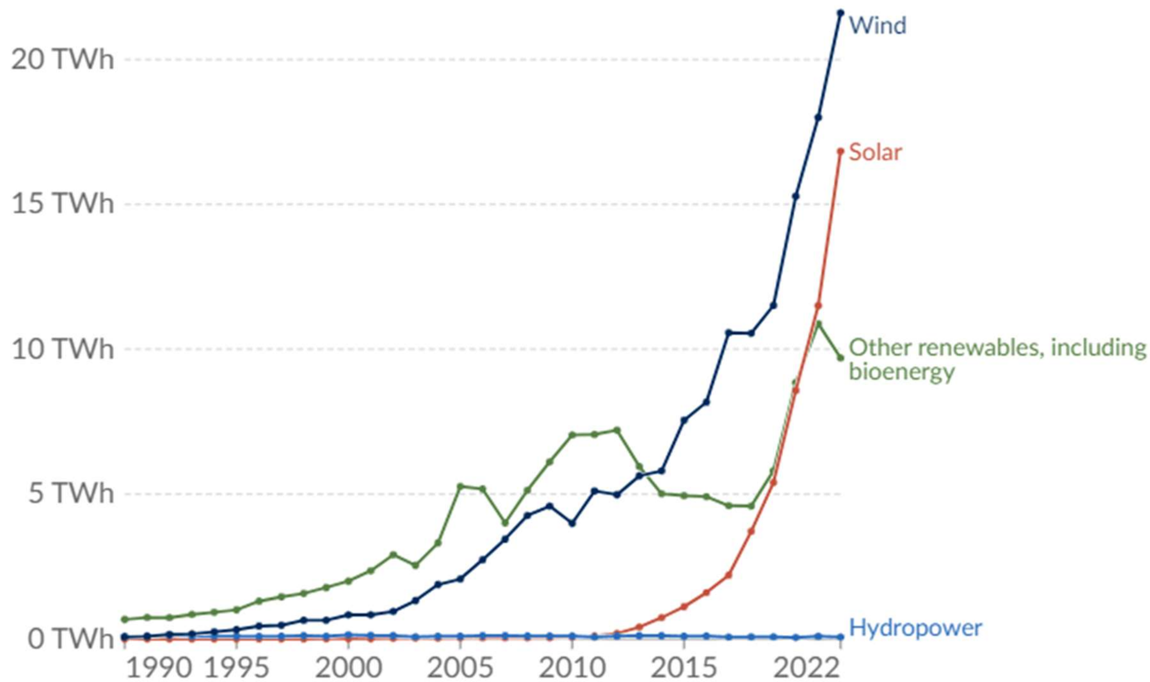


Figure 3: Graph showing the evolution of renewable electricity generation in the Netherlands. Wind and solar-based energy dominate and have grown exponentially over the past 30 years. Source: [28]

The Netherlands has positioned solar and wind technology to be instrumental in its mission to reach targets set out in Fit for 55 and Repower EU. In a report on the government's Multiyear Mission driven Innovation Programmes (MMIPs) on renewable energy, the Netherlands' Topsector Energy Association outlines what the Dutch renewable electricity landscape will look like in the milestone years 2030 and 2050. Commitments stipulated by RePower EU and Fit for 55 have set the estimated required renewable electricity capacity to 200 TWh/year by 2030, growing to over 500 TWh for a completely CO_2-neutral energy system by 2050 [21]. It is interesting to investigate the individual envisioned contributions of each renewable technology to see their respective roles in future energy mix scenarios. The Netherlands has communicated targets regarding offshore wind, onshore wind, and solar PV. They have segregated ambitions for onshore and offshore renewable electricity and additionally split up solar PV into large-scale solar (>15kW peak) and small-scale solar (<15kW peak). Table 1 below shows a breakdown of the current individual targets for said technologies. Going on current numbers, offshore wind is the Netherlands' trump card for reaching their climate goals.

Target Year	Individual Renewable Electricity Target (TWh)			Sum (TWh)
	Offshore Wind	Large Onshore Solar PV + Wind (>15kWp)	Residential Onshore Solar PV (<15kWp)	
2030	94	35	7	146
2050	270	35	7	312

Table 1: Table showing the latest renewable electricity targets on a per-technology basis of the Netherlands. Offshore wind targets are by far the largest, and growth is projected into 2050. Targets for onshore renewable electricity are so far only set for 2030. Source: [21]

Summing per-technology contributions and comparing this with overarching renewable electricity targets stipulated by Fit-for-55 and beyond uncovers a considerable deficit. The current shortcoming of individually summed targets amounts to just over 50 TWh in 2030 and increases to roughly 200TWh for the Netherlands' envisioned carbon-neutral energy system. This is visualized in Figure 4 below, which also showcases a past iteration of Dutch renewable electricity targets (2019 Climate Accord) where individual targets did, in fact, add up to satisfy the bigger picture. This suggests that the strategy behind reaching the latest targets is still a work in progress.

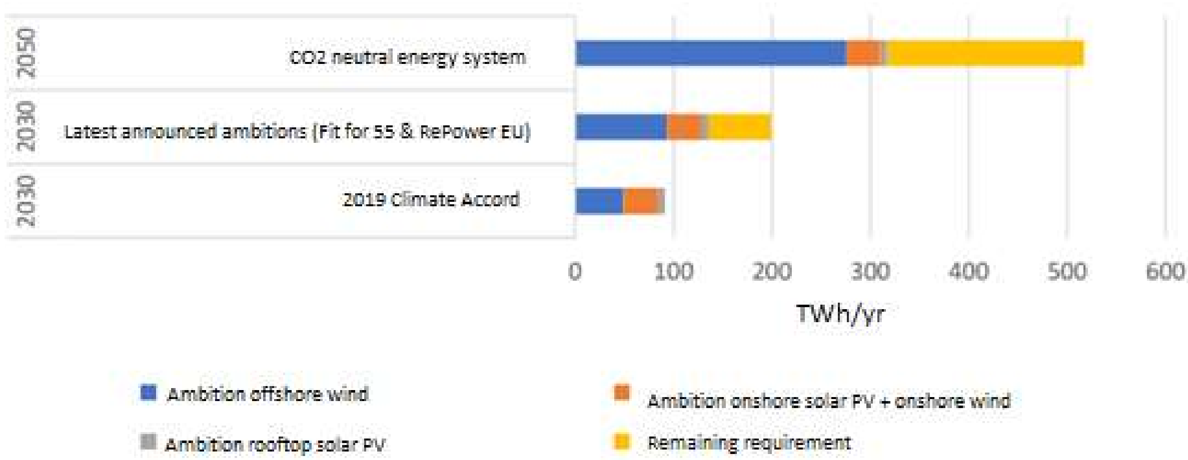


Figure 4: Composition of required Dutch renewable electricity mix according to different targets for 2030 and 2050. Offshore wind is the dominant component of the Dutch government's renewable electricity strategy. Next to onshore solar and wind energy, additional renewable electricity generation is required to meet the latest targets. Source: [21]

Additional policy work, as well as continued development and roll-out of renewable technology, are required in both the short (2030) and long (2030+) term. An additional caveat is that offshore wind targets are at their maximum limit for the short term. This is because these projects take considerable time to realize: 8 years on average from the obtaining of a site permit to the start of commercial operations [25]. This means it cannot be expanded to compensate for the remaining energy requirement shown in Figure 4. Onshore renewables will have to cover the deficit, requiring further development of supporting initiatives such as SDE++ [21].

1.4 Offshore Wind in the North Sea

As it stands, offshore wind is the clear frontrunner in the Dutch renewable electricity roadmap. The country has a 1267km long coastline, which yields a maritime Exclusive Economic Zone (bounded by an international boundary) of roughly 57,000 square kilometers, as depicted in Figure 5 below. The North Sea in this area is relatively shallow, particularly within 50km of the coast. Depths here range from 15 to 35 meters on average, with a predominantly sandy and silty seabed [9]. Both the depth and seabed composition are classically favorable conditions for offshore wind development, as they allow for bottom-fixed offshore wind development. This is a significantly cheaper and more mature technology than floating offshore wind, which is required in areas such as offshore southern Norway, where the depths quickly exceed 60 meters [12].

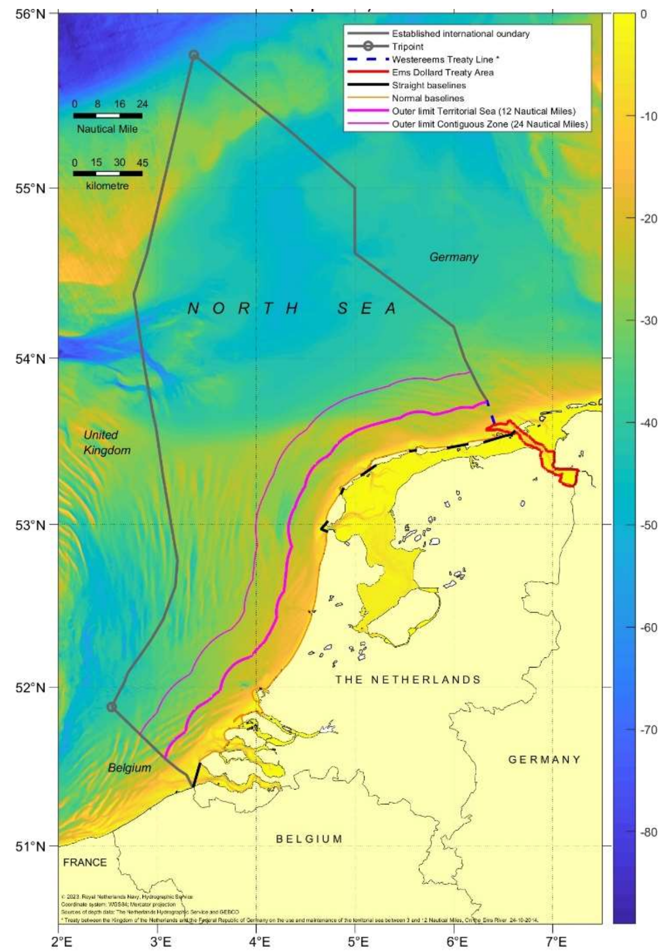


Figure 5: Map of the extent of the Dutch Exclusive Economic Zone and the bathymetry of the Dutch North Sea. Source: [23]

Next to water depth and the available area for maritime development, another key factor to high potential offshore wind is the mean wind power density: $\frac{1}{2} * \rho * v^3$, where ρ is the air density, and v the mean wind speed at a given height. Consequently, a high mean wind speed is vital to having a good wind resource. The global wind atlas database indicates consistent mean wind speeds of around 9.7m/s and corresponding mean power density of 1000W/m^2 in the Dutch North Sea at a height of 150m. 150m corresponds to the hub height of the latest 15MW turbines developed for offshore wind exploitation [13]. This set of conditions makes offshore wind in the Dutch North Sea a viable option for meeting Dutch renewable targets.

These conditions are not unique to the Netherlands but are common to the North Sea basin in general. This has made the North Sea into a European offshore wind hub, containing 79% of all currently installed capacity [26]. Nations with a North Sea coastline such as Germany, Denmark, the United Kingdom, Norway, and Belgium have also turned to offshore wind as a part of their respective decarbonization strategies. In the North Sea area, the United Kingdom leads the offshore wind development scene in terms of both current installed capacity and their 2030 target, at 13.6GW and 50GW, respectively. Germany has set itself a significantly lower 2030 target at 30GW, followed by The Netherlands (21GW) and Denmark (13GW). The targets and currently installed offshore wind capacities of these countries are displayed graphically in Figure 6.

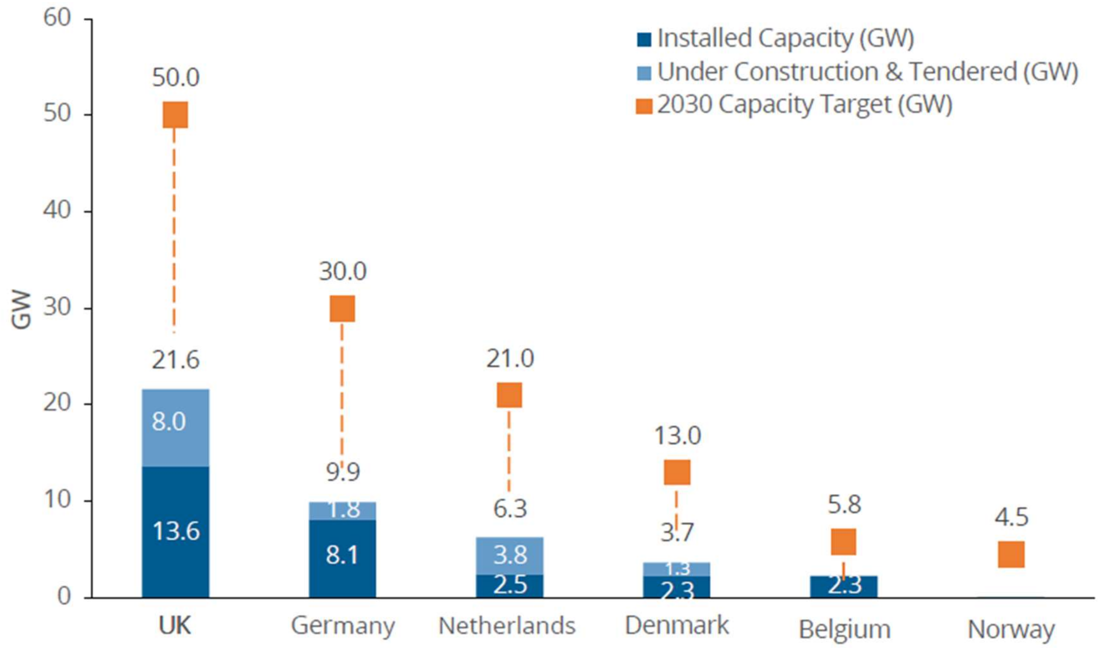


Figure 6: Graph showing offshore wind ambitions and the actual current installed offshore wind capacity of North Sea countries with concrete targets for 2030. Source: [16]

It is not evident to compare these targets directly, as these countries have significantly differing electricity demands. Therefore, to put the targets outlined in Figure 6 into perspective, it is interesting to consider the ratio of a country's electricity demand to its targeted offshore wind capacity. To be able to draw a meaningful conclusion, the following assumptions are made:

1. A uniform capacity factor for all offshore wind energy is assumed.
2. The electricity demand of the countries considered is assumed to grow at an equal rate.

It is important to point out that the demand-to-capacity ratio is not in fact a physical quantity, but rather serves as a manner to rank targets in terms of their contribution to the national electricity demand. The results of this comparison are shown in Table 2 below. Denmark's target of 12.4 GW by 2030 is the most significant when compared to their 33TWh electricity demand, followed by the United Kingdom and the Netherlands. Using this method of comparison, Norway's ambitions are the least ambitious.

Country	2022 Electricity Demand (TWh)	Electricity Demand/OFW 2030 Target	Rank
United Kingdom	275	5.5	2
Germany	484	16.1	5
Denmark	33	2.5	1
Netherlands	117	5.6	3
Norway	125	27.8	6
Belgium	82	14.1	4

Table 2: Table showing the 2022 electricity demand and the ratio of this demand with the 2030 offshore wind targets of different North Sea countries.

1.5 Objectives and Deliverables

This thesis serves to investigate the offshore wind energy landscape of the Netherlands and aims to explore the latest published tender criteria to address the following research questions:

- How does a prospective offshore wind developer win a Dutch offshore wind tender? What are the key scoring criteria and how can these be maximized?
- How and why do offshore wind tender criteria vary from draft to final publications,
- In which direction might this continue to evolve in response to changing political and economic conditions in the Netherlands and the EU offshore wind sector?

1.6 Thesis Outline

Chapter 1 consists of the introduction of renewable electricity ambitions within Europe and a focus on the Netherlands with regards to their ambitions. It proceeds into outlining offshore wind in the North Sea basin and the role of the technology to meet the EU countries climate ambitions.

Chapter 2 is a literature review of offshore wind in the Netherlands. It covers the historical development of offshore wind, as well as the available tender models that the relevant ministry might employ to assign offshore wind site licenses.

Chapter 3 explains the methods of this thesis and how analysis with the purpose of obtaining results is carried out.

Chapter 4 consists of a detailed breakdown of the IJmuiden Ver Alpha and Beta tender criteria. It shows how points can be scored per criteria as well as the evolution from draft tender criteria to final tender criteria.

Chapter 5 contains the discussion of the results presented in chapter 4. Special attention is paid to reasoning for changes from draft to final tender criteria, and to the implications of the final tender criteria for offshore wind farm developers.

Chapter 6 presents the most important conclusions of this thesis and suggests further work that expands on conclusions and hypotheses obtained from this work.

2. Literature Review

2.1 History of Dutch Offshore Wind

The Netherlands' history of developing renewable wind energy offshore dates to 2007, when it commissioned the Egmond aan Zee project. Situated roughly 13km offshore, it is the Netherlands' smallest offshore wind park, counting 36 three MW Vestas turbines for a total capacity of 108MW. A year later, the Prinses Amalia wind park was built and operational for an additional 120MW of offshore wind capacity. This was eventually succeeded by the Luchterduinen wind park (129MW) in 2015 and the Gemini wind park in 2016 (600MW), bringing the total offshore wind capacity to 958MW. At this time, the Netherlands did not have any concrete climate goals in place, and investment in offshore wind was relatively scarce. This was one of the primary drivers for the initial slow development of offshore wind in the Netherlands, despite government-provided subsidies. The turning point came in 2013 when the *Energy Agreement for Sustainable Growth* was signed into law [32]. This agreement entailed concrete, binding targets for renewable energy penetration – 16% by 2023 – as well as the installation of an additional 1000 wind turbines next to Egmond aan Zee and Princes Amalia. In 2016, the government additionally transformed the permitting, licensing, and development processes of an offshore wind park from a fragmented approach to a centrally led "one-stop-shop" approach [16]. The responsibility for time-intensive processes like site selection and site investigation was allocated to different branches of government and the permitting, subsidy allocation, and grid connection processes were combined into a single central tendering process. This effectively removed risk from the wind farm developer's side and significantly cut the time between site selection and wind farm commissioning. The key stakeholders involved in this are: the Netherlands Enterprise Agency, the Ministry of Economic Affairs and Climate Policy, the Ministry of Infrastructure and Water Management, Rijkswaterstaat and Dutch power grid operator TenneT. Their roles in this new form of tendering are summed up in the section below. More information on this content can be found under the *Development & Tendering* chapter further on in this paper.

Netherlands Enterprise Agency:

Responsible for coordinating the offshore wind tenders, carrying out supporting environmental studies of the designated offshore wind zones and the publishing of tender criteria.

Ministry of Economic Affairs and Climate Policy:

Responsible for the creation and progression of the offshore wind roadmap. Also rules on the type of tendering model/allocation scheme (see chapter *Development & Tendering*). Additionally supports the Ministry of Infrastructure and Water Management with the decision on new offshore wind development zones.

Ministry of Infrastructure and Water Management:

Responsible for the decision on which new offshore wind zones to develop in coordination with the Ministry of Economic Affairs.

Rijkswaterstaat:

Responsible for carrying out the environmental impact assessment (EIA) – a comprehensive environmental study on the footprint of a new offshore wind farm project. This EIA is the basis for the eventual site decision – a ruleset stipulating specific conditions that should be developers must adhere to. See chapter on development and tendering for more information.

TenneT:

Responsible for connecting offshore wind parks to the onshore grid. This includes the building of substations and the offshore grid on the whole.

These two comprehensive policy developments formed the foundation on which the Dutch government designed their first roadmap for large-scale offshore wind roll-out in 2016. The Roadmap 2023, as it came to be called, targets 4.5GW capacity by year-end 2023 through 5 wind farms within three studied and designated offshore wind zones. These zones are named: Borssele Wind Farm Zone, Hollandse Kust Zuid (HKZ) and Hollandse Kust Noord (HKN). Table 3 shows the properties of the five large-scale wind farms in this roadmap.

Wind farm Zone	Wind farm Name	Capacity (MW)	Turbine Rating (MW)	Year of Operation
Borssele	Borssele I & II	752	8	2020
	Borssele III & IV	732	9.5	2020
HKZ	HKZ I & II	760	11	2023
	HKZ III & IV	760	11	2023
HKN	HKN V	760	11	2023

Table 3: Table showing the five offshore wind farms that have been installed as a part of the Dutch Roadmap 2023. Both Borssele and Hollandse Kust Zuid are wind farm zones with four sites for wind parks. These were tendered per two – sites I & II and sites III & IV. Source: [32]

More recently, the Dutch government has released an additional roadmap spanning the years 2023 – 2030. Originally, this targeted 11.5GW of offshore wind development by the end of the decade. In 2022 however, following the country's updated commitments with the Green Deal, this was upgraded to 21GW. This roadmap features 5 additional wind farm zones, listed here in chronological order of tendering (subject to change): Hollandse Kust West (HKW), Ijmuiden Ver, Nederwiek, Ten noorden van de waddeneilanden and Doordewind. Figure 7 shows a complete overview of all the offshore wind zones and individual wind farms, including details on the capacity, location, tender winners of completed tenders and projected tender dates of tenders still in the pipeline.

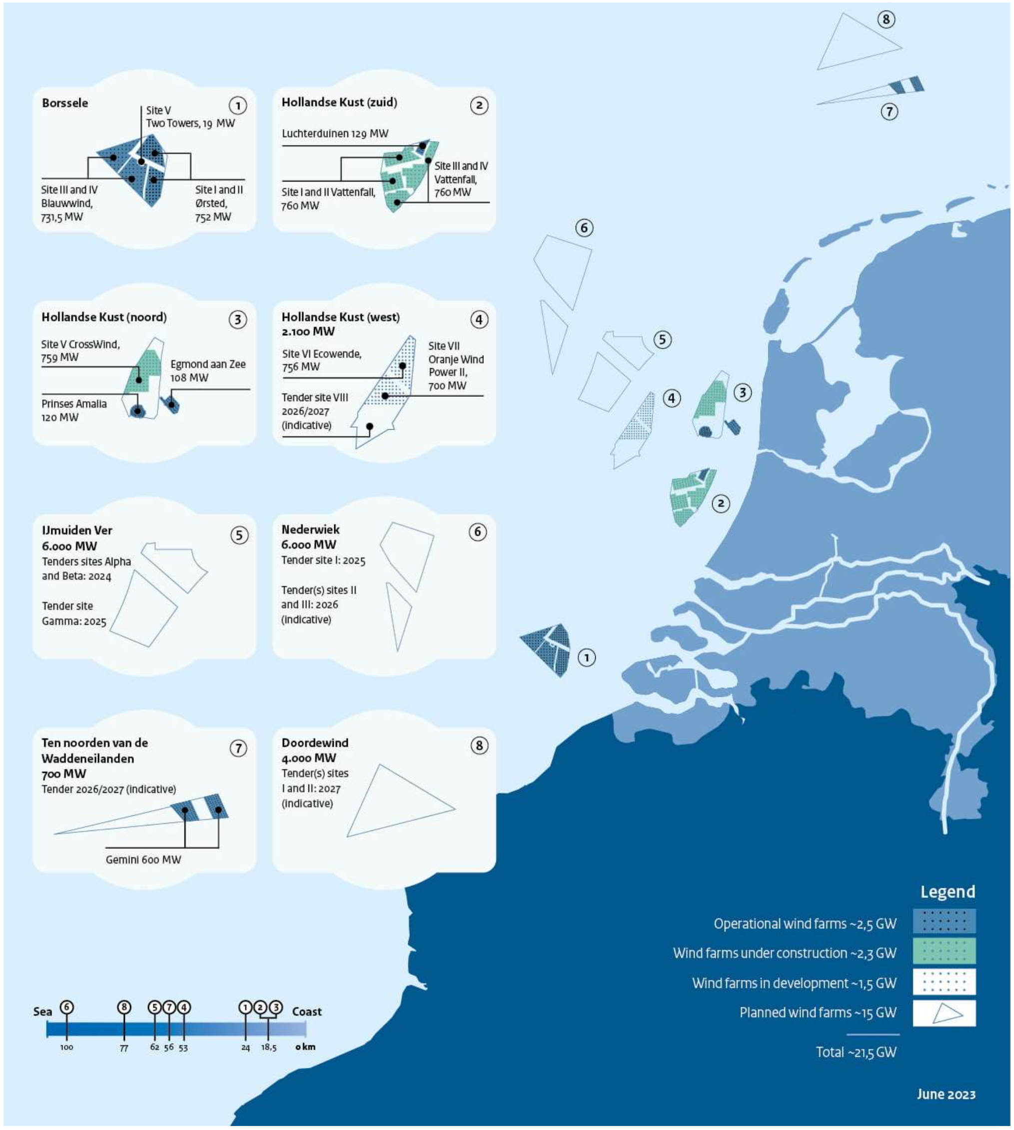


Figure 7: Annotated map of all the offshore wind zones and corresponding offshore wind farms in the Dutch pipeline as of September 2023. Note that dates for sites yet to be tendered are indicative. Source: [32]

2.3 Ownership of Dutch Offshore Wind

As of 12 December 2022, 11 large-scale Dutch offshore wind parks have been tendered, with 8 of the tenders going to joint ventures. In total, 17 different companies are involved in these 11 wind parks. These are listed chronologically and by ownership split in Table 4 below:

Tendered Wind Farm Site	Ownership					
Egmond aan Zee	Shell (100%)					
Prinses Amalia Windpark	Eneco (100%)					
Luchterduinen	Eneco (50%)	Mitsubishi (50%)				
Gemini Windpark	Northland Power (60%)	Siemens (20%)	Van Oord (10%)	HVC Groep (10%)		
Borssele I & II	Orsted (50%)	Norges Bank Investment Management (50%)				
Borssele III & IV	Partners Group (25%)	Shell (20%)	Swiss Life Asset Managers (20%)	Eneco (10%)	Inpex (15%)	Luxcara (10%)
Hollandse Kust Zuid I & II	Vattenfall (50.5%)	Allianz (25.2%)	BASF (24.3%)			
Hollandse Kust Zuid III & IV	Vattenfall (50.5%)	Allianz (25.2%)	BASF (24.3%)			
Hollandse Kust Noord V	Shell (80%)	Eneco (20%)				
Hollandse Kust West VI*	Shell (50%)	Eneco (50%)				
Hollandse Kust West VII*	RWE (100%)					

Table 4: Overview of the companies owning the currently tendered offshore wind farm sites. Sites marked with an asterisk are still in development and not yet operational.

The nature of the companies owning the Dutch offshore wind farms is diverse. The majority are power-producing companies – Shell, RWE, Eneco, Vattenfall, Inpex, Northland Power Luxcara, HVC Groep and Orsted. This is followed by financial services companies – Allianz, Swiss Life Asset Managers, Norges Bank Investment Management and Partners Group. Finally, Van Oord is a contracting company and Siemens is a multinational energy conglomerate. These companies have, individually or by joint venture, bid for and won their respective government-issued tenders. Since the Netherlands' 'one-stop-shop' regulatory and tender framework overhaul in 2016, Dutch offshore wind has seen several iterations of its tendering scheme. The next chapter will highlight the general policy approach that is currently in place for the development of offshore wind in the Netherlands.

2.4 Development and Tendering

This section will explain the details of the development and tendering of offshore wind since the regulatory framework overhaul in 2016. From this moment in time, Dutch offshore wind development has followed a stepwise approach, starting with the preparatory wind farm zone allocation and offshore wind rollout steps.

2.4.1 Wind farm zone allocation

The Ministry of Infrastructure and Water Management, in cooperation with the Ministry of Economic Affairs and Climate Policy conducts rigorous spatial studies of the Dutch EEZ in the North Sea. These studies consider various factors, among which: the presence of other critical infrastructure (shipping lanes, pipelines, other offshore wind farms, etc.) and the restrictions imposed by conservation and nature protection areas. The result of these studies is an allocated offshore wind zone – for example Borssele. As demonstrated in Figure 7 earlier, a single offshore wind zone may hold multiple offshore wind farm sites. Offshore wind development outside of these designated offshore wind zones is not permitted. This is typically done for multiple zones at a time and constitutes a necessary input for the creation of an offshore wind roadmap like Roadmap 2023 and Roadmap 2030+.

2.4.2 Offshore wind rollout plans

The two latest offshore wind roadmaps have been key to giving developers, investors, and other parties involved in offshore wind projects clarity on the timing and sizing of upcoming offshore wind projects. It allows for the simultaneous development of offshore wind farms, offshore infrastructure (substations, inter-array cables, and a connection to the onshore grid. The idea behind a concrete offshore wind pipeline is to streamline development both spatially and temporally. As mentioned before, the responsibility for this task lies with the Ministry of Economic Affairs and Climate Policy [32]. The legal basis of current offshore wind roadmaps is the Wind Energy at Sea law, which was drafted in 2015 as a cooperative effort between the Dutch government and the wind energy sector.

Upon conclusion of these preliminary steps, Roadmap 2023 and Roadmap 2030 wind farm tenders proceed according to the following order:

1. Study Phase

As a prerequisite for the publishing of a wind farm site decision, rigorous site-specific studies are conducted. These can be split into two categories: the environmental impact assessment and general site studies. General site studies serve to obtain subsurface data, metocean data (wind resource assessment, wave, and climate), ecological data and to map the presence of unexploded ordinance [29]. The environmental impact assessment serves to determine both the ecological and socio-economic consequences of the realization of an offshore wind farm as stipulated in the relevant roadmap. Additionally, it includes necessary actions/precautions to handle adverse impacts on for example local bat and bird species. Once finalized, these are binding and must be adhered to by the winner of the tender. For example, in the environmental impact assessment of Hollandse Kust West VI and VII, it was suggested that rotation speed of turbines in certain periods of high bird migration activity should be limited to less than 2 rotations per minute, as studies showed this reduced the risk of mortality [19]. As the results of this study are legally binding, the government installs a window of time between publishing of the EIA and irrevocability of the EIA. In this time, concerned parties may give feedback and appeal certain clauses. These studies help project developers more accurately gauge costs and time requirements, ideally resulting in increased competitiveness during the tendering step. Prior to 2013, these studies would have to be carried out by prospective offshore wind developers to determine a site’s viability for bidding. Post 2013, the government has assumed this burden and charges the cost for this only to the eventual winner of the tender.

2. Grid Connection

The Dutch electricity transmission system operator (TSO), TenneT, is responsible for linking newly developed offshore wind parks to the Dutch onshore grid infrastructure. This process tends to be time intensive, typically taking up to 10 years to realize depending on factors like distance to the onshore connection point, permitting, and stipulations set out by the EIA. TenneT oversees the construction of the offshore substation, offshore cables, and land cables. The offshore substations used by TenneT is a standardized 700MW alternating current (AC) design for wind farms closer to shore and 2GW direct current (DC) design for wind farms further out such as Ijmuiden Ver (62km from shore). The AC design receives alternating current from a wind farm at 66kV and steps it up to 220 kV for transport to a grid substation where it is stepped up to 380 kV for compatibility with the high voltage onshore transmission grid. The DC design steps up incoming AC current to 525 kV and rectifies it to DC for transport to a converter station. Once inverted to AC, it is stepped down to 380 kV for compatibility with the high voltage onshore transmission grid. These processes are depicted graphically in Figure 8 below, with TenneT responsible areas highlighted. TenneT uses the offshore wind rollout plans created by the Ministry of Economic Affairs and Climate Policy to map out its own projects. Upon conclusion of a tender series, TenneT signs a contract with wind farm operators to connect their wind farms to the onshore grid. It is then responsible for unscheduled downtime of offshore infrastructure under its jurisdiction, resulting in compensation for wind farm developers.

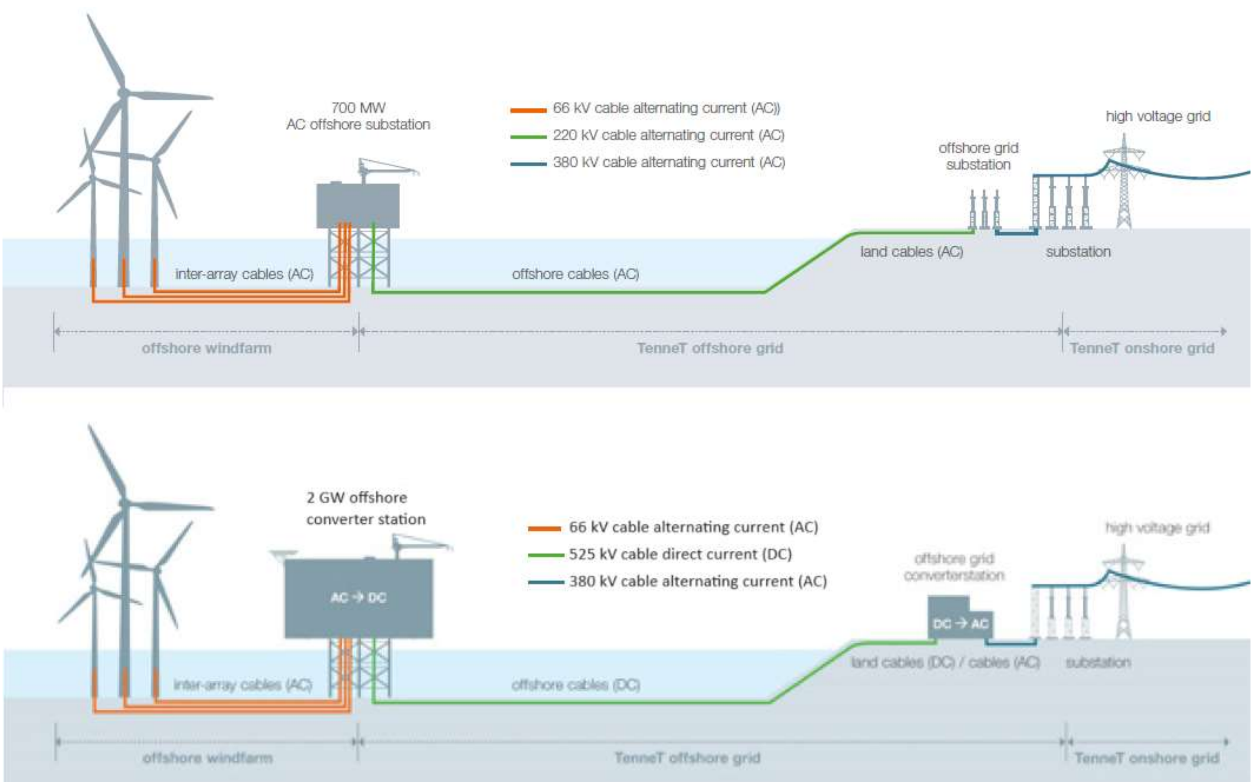


Figure 8: Depiction of the systems connecting an offshore wind farm to the onshore grid. Dutch TSO TenneT is responsible for the segments from the offshore substation through to the onshore grid. Source: [1]

3. Wind Farm Site Decision

The wind farm site decision (WFSD) marks the conclusion of government studies. It is a combination of the results of the EIA, site specific studies, and the law Wind Energy at Sea. It delineates the exact location where wind turbines may be built and sets forth general criteria that developers must abide by. This generally includes constraints on the minimum power output of turbines, maximum and minimum blade tip height and other criteria stemming from the EIA. The WFSD does not stipulate the exact design of the wind farm, lending individual developers the freedom to do so in line with their individual concepts of optimal design. Once again, the site decision is open to appeal for a certain period for prospective developers after which it becomes irrevocable.

4. Tendering

Upon publishing the WFSD, the Minister of Climate and Energy Policy initiates the tendering process by publishing a ministerial order detailing the offshore wind tender rules. This letter is communicated to prospective developers via the Netherlands Enterprise Agency, which is the coordinating body for this step. Tender rules are criteria that developers aim to meet to be considered eligible and to score points. The highest scoring eligible bid receives the tender award. Eligibility criteria are often surrounding the anticipated realization and start of operations of the projected wind farm. Scoring criteria generally pertain to pricing mechanisms, the amount of power expected to be delivered, developer experience and financial bids offered by developers. The legislative framework forming the basis of Roadmap 2023, and Roadmap 2030 has governed (and still governs) the type of tender models that can be selected by the Minister of Climate and Energy Policy. It currently sets forth three distinct tender models:

1. <u>Lowest Subsidy Bid Model</u>

The Lowest subsidy bid model is the only of the three where subsidies are granted to offshore wind developers for a set period – maximally 15 years. The subsidy in question is the Stimulation of Sustainable Energy Production Scheme (SDE). Rather than a flat premium for developers, it provides benefit based on the difference between a developer's bid price per unit energy and the wholesale electricity price, up to a maximum amount (See Figure 9 for clarity). Profits for electricity prices above the bid amount are retained by the developer, effectively making the SDE subsidy a one-sided contract for difference (CfD) scheme. CfD's in general are popular renewable energy support schemes offered by governments to incentivize investment as it protects the interests of both developers and consumers [6].Classically, CfD's are two sided: developers are given subsidies when electricity prices fall below the bid price, and consumers are given subsidies when electricity prices exceed the bid price. Being a one-sided CfD, the Dutch SDE model favours developers.

Under the lowest subsidy bid model, Dutch offshore wind developers build financial models to determine and subsequently bid their most competitive price per unit energy. The winning bid will be that which offers the lowest price per unit energy, as this results in the lowest awarded subsidy following low wholesale electricity prices. Up to and including the Borssele Offshore Wind tenders (2019), all tendered offshore wind projects have been carried out via the lowest subsidy bid model. For clarity, Borssele III and IV is taken as a case study.

Case Study: Borssele III-IV

The Borssele III and IV sites were won by the Blauwwind consortium (see Table 4 for shareholders). Their bid of 54.5 EUR/MWh was the lowest of the competition, granting them the offshore wind permit. If the wholesale electricity price fell below this bid threshold, the Dutch government compensated them the deficit for the respective duration. To avoid extreme costs, this mechanism only held true down to a base price of 30 EUR/MWh, beyond which no additional financial support was granted. For wholesale prices above 54.5 EUR/MWh, subsidies are not paid out. Figure 9 below portrays this graphically.

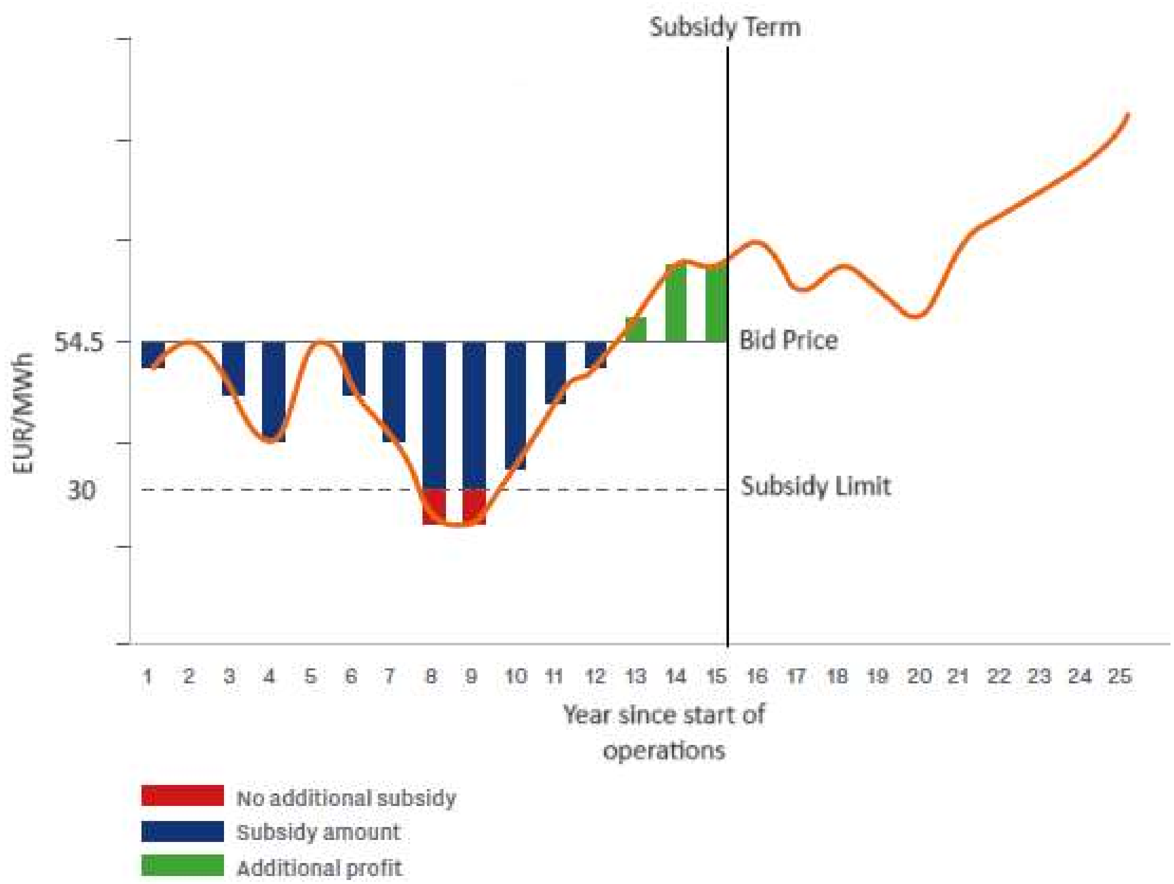


Figure 9: Figure showing different possible subsidy regimes for the Borssele III & IV tender. No subsidies are granted above the bid price, nor after the subsidy term of 15 years. Source: adapted from [32]

2. Comparative Assessment Model

As interest in Dutch offshore wind from developers increased, bid prices tended to zero – so called zero-subsidy bids. In 2018, price alone was no longer differentiating requiring the adoption of a new tendering model – the comparative assessment model. The lowest subsidy bid model was phased out but could be reintroduced in case investor/developer interest wanes significantly, as was seen in the latest CfD tendering round in the United Kingdom [15].

In the comparative assessment model, differentiating criteria spanning different areas of interest are set forth. These can be categorized as quantitative and qualitative criteria. Quantitative criteria entail topics such as, but not limited to:

- Lease Price – The financial bid offered for the lease.
- Security of realization of the wind farm – based on knowledge and experience of the developing parties, their financial strength, etc.
- Contribution of the wind farm to the Dutch energy system

Qualitative criteria on the other hand entail topics such as, but not limited to:

- Degree of ecological protection initiatives included in the tender.
- Knowledge sharing initiatives.
- Degree of integration into the Dutch energy system

The above criteria will be clarified in the chosen case study on the Hollandse Kust West VI and VII tenders. To objectively evaluate comparative assessment model bids, a panel of independent assessors is assembled, often from academia with expertise in renewable energy economics and offshore wind development. The composition of this panel is kept confidential to avoid bias. Once each of the individual criteria are scored, points are tallied up, and the tender is awarded to the highest-ranking bid. To give time to developers to contact potential partners and prepare bid solutions, the government publishes draft tender criteria ahead of the publishing of the WFSD. There is once again a window of time during which developers can challenge criteria and offer suggestions for improvements after which the final tender criteria are published.

For clarity, the comparative assessment model tender HKW VI & VII are taken as a case study.

Case Study: HKW VI-VII

HKW VI-VII is the latest of the Dutch offshore wind tenders to conclude, with the tender winners announced on 15 December and 10 November respectively. HKW VI was won by the Ecowende consortium and HKW VII was won by German multinational energy company RWE. The tender criteria for both sites followed a similar structure, with filtering quantitative criteria and differentiating qualitative criteria. The quantitative criteria are identical for both sites and are summarized and displayed in Table 5. The more differentiating criteria are distinct (see Table 6), with HKW VI focussing on fostering and protecting local ecology and HKW VII geared towards what the Dutch government calls system integration. System integration (SI) has become crucial with the rapid growth of variable renewable energy resources, as this requires additional grid flexibility and balancing solutions during periods of mismatch between energy supply and demand.

A maximum total of 200 points per site could be earned, evenly distributed between qualitative and quantitative criteria. Within the quantitative criteria, points were scored via the value of financial bid (20 points), realization certainty (40 points) and the modelled energy the proposed windfarm would contribute to the Dutch grid (40 points). A financial bid exceeding 50 million euros achieves maximum points. Sufficient experience in offshore projects, wind turbines, foundations, operation and maintenance (O&M) and offshore cabling, coupled with a 500-million-euro financial guarantee and company equity exceeding the projected investment costs achieves maximum points. Lastly, demonstrating (via expert third party company) a yearly P50 net electricity production exceeding 3.4TWh also achieves maximum points.

Quantitative tender criteria (100 points total)

Criterion	Assessment	Assessment	pts	Total
Lease Price	Maximum points with payment of **EUR 50M**			20 pts
Certainty of realization of wind farm	Projects developed	If cumulative capacity of wind at sea installed ≥ 25 MW	3	40 pts
	Foundations supplied	If foundations supplied for wind at sea ≥ 10	1	
	Foundations installed	If foundations installed for wind at sea ≥ 10	1	
	Wind turbines supplied	If wind turbines with a platform supplied ≥ 10	1	
	Wind turbines installed	If wind turbines with a platform installed ≥ 10	1	
	Cables supplied	If cables supplied for connections at sea ≥ 10	1	
	Cables installed	If cables installed for connections at sea ≥ 10	1	
	O&M performed	If O&M on wind at sea's cumulative capacity ≥ 25 MW	1	
	Financial strength	If own equity is ≥ 100% of investment costs	15	
	Financial guarantees	If guarantee ≥ EUR 500 m	15	
Contribution of wind farm to energy system	Net electricity production per year ≥ 3.4 TWh per year)			40 pts

Table 5: Table summarizing the quantitative tender criteria for the HKW VI and VII offshore wind sites. Source: adapted from [14]

Within the qualitative criteria for HKW VI, points were scored via investment in ecology (bird, bat, benthos, etc. protection – 30 points), stimulation of innovative solutions for ecology (environmental DNA, AI bird detection software, etc. – 50 points) and dissemination of knowledge gained (knowledge sharing plan – 20 points). The solutions proposed for each of these categories were assessed by a committee of experts in the field of ecology and offshore wind interactions [14]. The Dutch government did not disclose the exact way to achieve maximum points for these categories but rather left it an open-ended challenge for competitors. The same systematic was used for HKW VII, but instead of ecology, the focus was on system integration: points were scored via investment in system integration solutions (batteries, hydrogen electrolysers, heat storage, etc. – 30 points), innovation in system integration solutions (floating solar, novel storage methods, etc. – 50 points) and dissemination of knowledge gained (knowledge sharing plan – 20 points).

Qualitative tender criteria (100 points total)

HKW VI: Contribution to Ecology
Contribution of wind farm to the ecology of the North Sea (species, populations and habitats) and to the protection of birds and marine habitat

Investment in ecology	Stimulation of investments for the benefit of ecology and North Sea biodiversity.	30pts
Ecology innovation and development	Stimulation of innovation and development of new solutions for the benefit of ecology and North Sea biodiversity.	50pts
Dissemination of ecology knowledge	Knowledge sharing plan regarding new innovation and solutions benefitting ecology and North Sea biodiversity.	20pts

HKW VII : System integration (SI)
Wind farm's integration in Dutch energy system, providing flexibility to the grid and ensuring system balancing by avoiding network congestions and by managing shortages

Investment in SI	Stimulation of investments improving the proposed wind farm's integration into the Dutch energy system.	30pts
SI innovation and development	Stimulation of innovation and development improving the proposed wind farm's integration into the Dutch energy system.	50pts
Dissemination of SI knowledge	Knowledge sharing plan regarding new innovation and solutions improving system integration into the Dutch energy system	20pts

Table 6: Table summarizing the distinct qualitative criteria for HKW VI and HKW VII: contribution to ecology and system integration respectively. Source: adapted using information from [14].

3. <u>Financial Auction Model</u>

The third possible tendering model for Dutch offshore wind is a financial auction, much like in Germany. Competitors bid a price for the offshore wind lease in sequential rounds until only the highest bidder remains. This model has not yet been implemented to date.

5. *Permit award*

The winner of the chosen tender model is awarded a permit to develop the proposed offshore wind farm by the Minister of Climate and Energy Policy. This must be announced within 13 weeks of tender closure. Competing parties may object and request clarification on the winning conditions for a period of six weeks from the moment of award [33]. If no objection occurs, the permit becomes irrevocable, and first production of wind energy must occur within 48 months of permit irrevocability.

2.5 Ijmuiden Ver

The Ijmuiden Ver (IJVER) offshore wind tender is currently ongoing and is the focus of this study. It is to be the largest wind farm commissioned by the Netherlands to date, with a projected capacity of 4GW. As can be seen from Figure 7, it is split up into three sites: IJVER Alpha, IJVER Beta and IJVER Gamma. IJVER Alpha and Beta are to be tendered in 2024. IJVER Gamma is to be tendered in 2025. As for the preceding HKW VI-VII tenders, the Ministry of Climate and Energy Policy has selected a comparative assessment with financial bid as the tendering model.

3. Methods

This study employs a comprehensive approach to analyze the tender criteria of the Dutch offshore wind tender IJmuiden Ver. More specifically, it investigates what offshore wind developers are required to include in their bids to score a maximum number of points for both IJVER Alpha and IJVER Beta. This is done by deconstructing the official IJVER tender criteria published by the Netherlands Enterprise Agency into scoring categories and identifying the implications of said criteria for large-scale developers like Shell, Orsted and TotalEnergies.

Primary data was collected from the official tender documents of the IJmuiden Ver offshore wind tender. This includes the tender notice, the tender specifications, and the scoring guidelines. Secondary data was collected from industry reports, academic literature, and news articles related to the IJmuiden Ver tender.

The tender criteria were identified from the tender documents. Each criterion was listed and described in detail. The criteria were then categorized into different types, such as financial bid, ecological, etc. The scoring of each criterion was analyzed in depth. This involved studying the scoring guidelines provided in the tender documents. The scoring system was broken down and each component was studied separately. The weightage of each criterion in the overall score was also determined.

A comparative analysis was conducted to understand how the IJmuiden Ver draft tender criteria (published in March 2023) differ from the IJmuiden Ver final tender criteria (published in July 2023). This involved comparing both tender criteria documents and identifying key changes and the motivating factors for these changes. This gives insight into how the Dutch government reacts to stakeholder input, as well as to other market development such as other EU offshore wind tenders.

This study acknowledges certain limitations, including the availability and reliability of data, the complexity of the tender process, and the subjectivity involved in scoring the criteria.

This methodology provides a detailed and comprehensive approach to understanding the tender criteria of the Dutch offshore wind tender IJmuiden Ver (Alpha and Beta sites). The findings of this study could help policymakers, industry stakeholders in understanding the tender scoring system.

4. Results

4.1 Draft IJVER Tender Criteria

The draft IJVER tender criteria were published on the 31st of March 2023. As mentioned before, the tender took the form of a comparative assessment tendering model. Table 7 below shows the different categories that make up the IJVER tender criteria as well as the number of points to be scored per category. The precise details of these categories are then expanded on in subsequent sections.

Scoring Category	Wind Farm Site	Points (total 400)	Weight (%)
1.Financial Bid	Alpha & Beta	60	15
2.Realization Certainty		40	10
3.Energy Contribution		40	10
4.International Responsible Business Conduct		40	10
5.Circularity and GHG footprint		40	10
6.Ecology	Alpha	180	45
7.System Integration	Beta	150	42
8.Porpoise Disturbance	Beta	12	3

Table 7: Table showing the scored categories and their respective weights in the latest (2023) Dutch offshore wind tender. Categories 1-5 are identical for both Alpha and Beta sites. Category 6 only pertains to site Alpha and Categories 7-8 only pertain to site Beta.

4.1.1 Financial Bid

Government communication revealed that The IJVER Alpha and Beta sites differ slightly in terms of wind resource due to the wake effect from nearby windfarms. Alpha has the better wind resource of the two sites. Both sites have a financial bid as part of the tender criteria with a maximum of 60 points to be awarded. This financial bid is an amount to be paid yearly to the Dutch government for a period of 40 years. Points are awarded linearly depending on the fraction: $\frac{Financial\ bid}{Maximum\ bid} * 60\ points$.

IJVER Alpha

The maximum financial bid for IJVER Alpha was set at 44,448,138.91 euro per year. Candidates bidding this amount receive the maximum 60 points. Over a period of 40 years, this would amount to approximately 1778 million euro. This is displayed graphically in Figure 10 below.

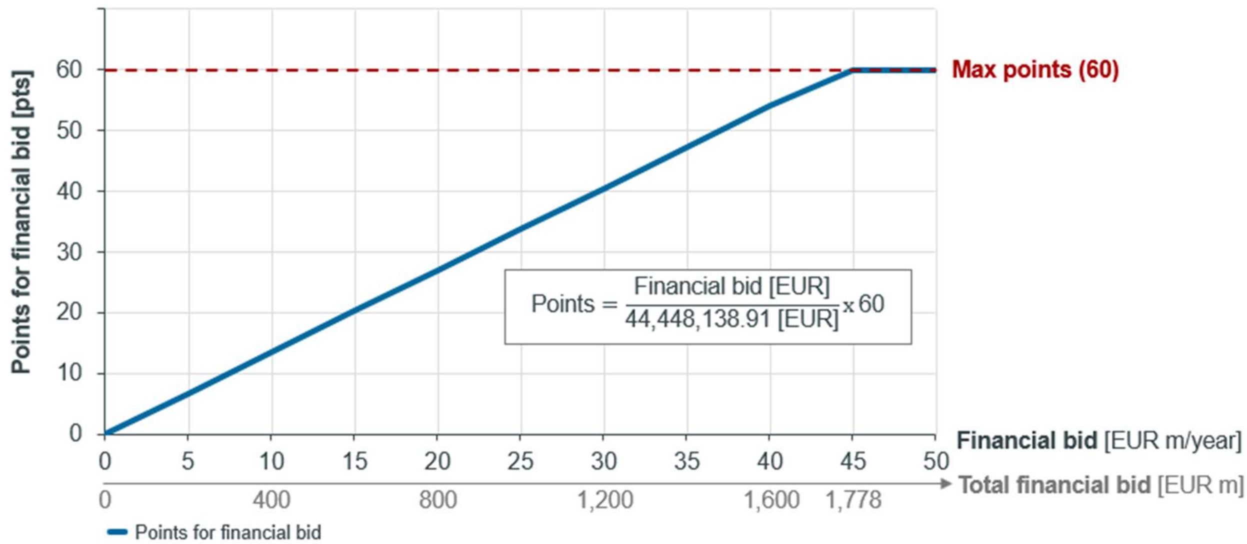


Figure 10: Figure showing how offshore wind developers can score points in the financial bid category of IJVER Alpha.

IJVER Beta

The maximum financial bid for IJVER Beta was set at 40,004,838.09 euro per year. Candidates bidding this amount receive the maximum 60 points. Over a period of 40 years, this would amount to approximately 1600 million euro. This is displayed graphically in Figure 11 below.

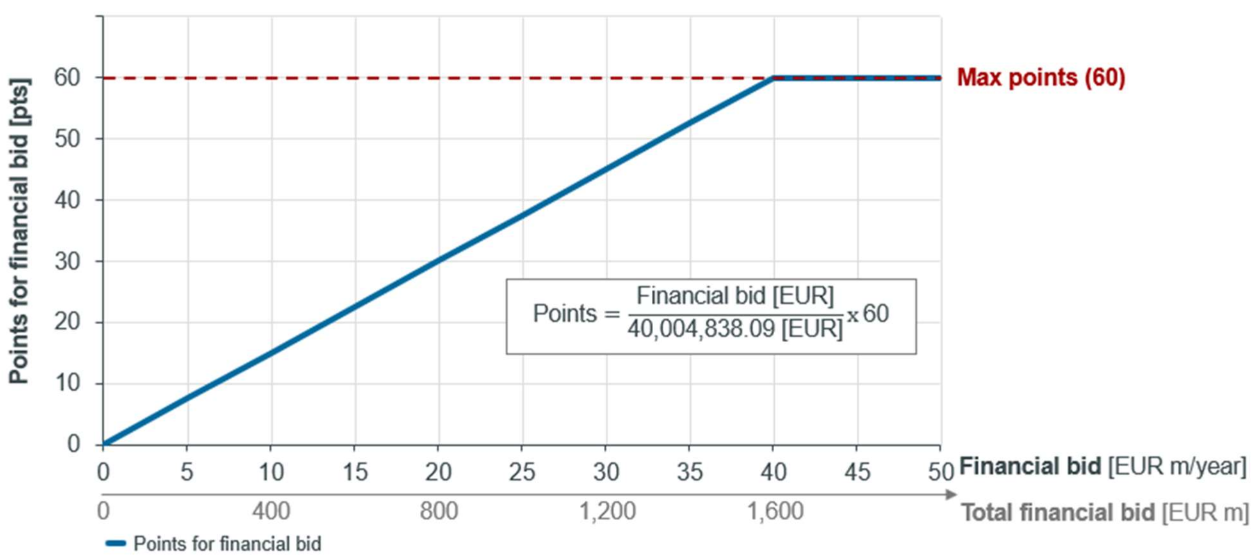


Figure 11: Graph showing how offshore wind developers can score points in the financial bid category of IJVER Alpha.

4.1.2 Realization Certainty

The Dutch government attaches importance to the relevant experience of offshore wind developers and their supply chain partners to ensure the wind park gets built within the desired timeframe. A total of 40 points are to be earned in this category, which is identical for IJVER Alpha and IJVER Beta. The following are assessed: (1) the number of projects developed by the consortium, (2) the number of foundations supplied and installed, (3&4) the number of wind turbines produced and installed, (5&6) the number of cables supplied and installed for platform based offshore wind turbines, (7) experience in operations and maintenance and (8) the financial strength of the respective responsible parties. The manner of assessment and allocation of points belonging to each of these subcategories is outlined in Table 8 below.

Category	Assessment	Points
Projects developed	If cumulative capacity of wind at sea installed ≥ 25 MW	10
Foundations supplied	If foundations supplied for wind at sea ≥ 10	2
Foundations installed	If foundations installed for wind at sea ≥ 10	2
Wind turbines produced	If wind turbines produced ≥ 10	2
Wind turbines installed	If wind turbines installed ≥ 10	2
Cables supplied	If cables produced for wind turbines with platform ≥ 10	2
Cables installed	If cables installed for wind turbines with platform ≥ 10	2
O&M performed	If O&M on wind at sea's cumulative capacity ≥ 25 MW	2
Financial strength	If own equity is ≥ 100% of investment costs	16
Total points		**40**

Table 8: Table showing how offshore wind developers can score points in the project realization certainty category.

4.1.3 Energy Contribution

The goal of offshore wind tenders such as IJVER is to contribute to realize optimally producing offshore wind farms. This is reflected in the energy contribution category of both Alpha and Beta sites. A total of 40 points are to be scored by producing more than 8.8 or 8.9TWh of electricity on a yearly basis. The exact target is to be determined by a study on the available offshore wind resource by Dutch research center TNO. Points are scored in a stepwise way, starting from 2 points for a yearly energy production of 8TWh. The next step is at 8.1TWh, yielding 8 points. Beyond this, every additional 0.2TWh of yearly energy production yields 8 additional points up to a maximum of 40. Generating 8.9TWh with a 2GW windfarm requires a capacity factor of approximately 51%. This is displayed graphically in Figure 12 below. Energy contribution must be determined by a third party with expertise in offshore wind yield modelling and is dependent on choice of wind turbine, wind farm configuration and cut-in wind speed.

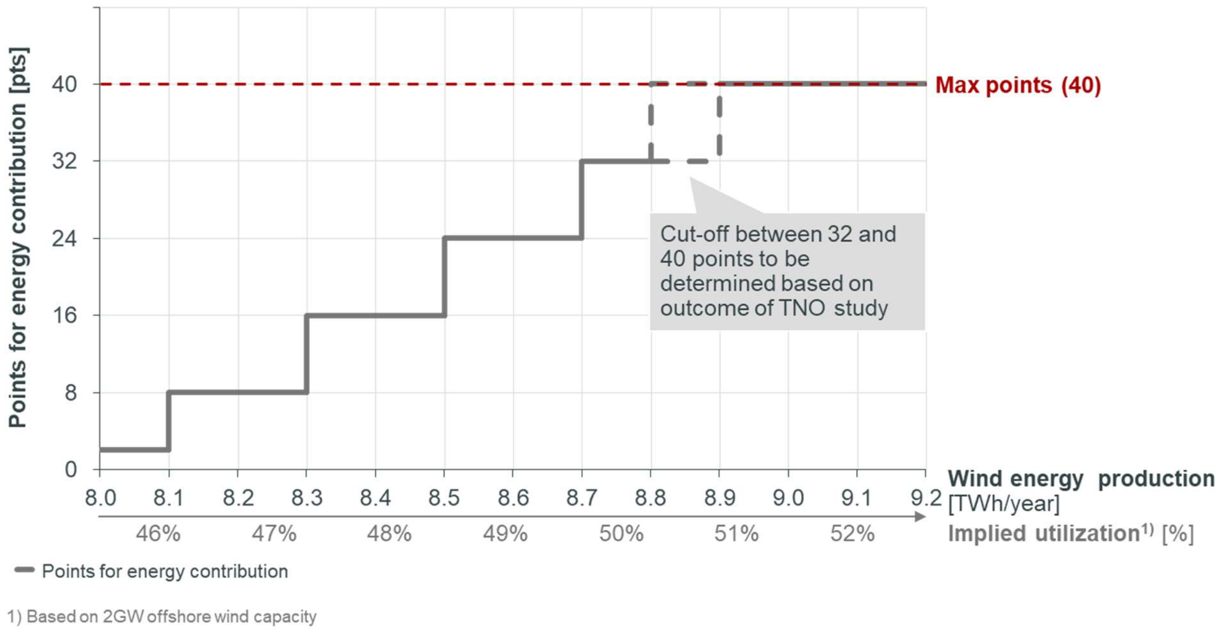


Figure 12: Graph showing how offshore wind developers can score points in the energy contribution category of the IJVER Alpha and Beta offshore wind sites.

4.1.4 International Responsible Business Conduct (IRBC)

The Dutch government has included an IRBC category in the Alpha and Beta tender criteria. A total of 40 points are to be earned based on compliance with IRBC principles. These principles include but are not limited to: identifying human rights and environmental risks, the integration of societal responsible business in policy and management systems, monitoring of IRBC measures and results achieved across the offshore wind value chain and the effectiveness thereof. The tender criteria outline 3 possible manners of scoring points: becoming a member of the IMVO covenant, becoming a member of an initiative similar and equally comprehensive as the IMVO covenant, and self-due diligence. The IMVO covenant is the Dutch government's agreement of choice when it comes to IRBC. Choosing self due diligence scores significantly fewer points (max 18 instead of 40). Table 9 summarizing this is presented below.

	Points scored per solution		
	Member of IMVO covenant	Member of a similar initiative to IMVO	Self due diligence
Integration of societal responsible business in policy and management systems	6	6	3
Identification of human rights- and environmental risk across the value chain	7	7	3
Avoidance, finalization or mitigation of negative impact on human life and the environment across the value chain	7	7	3
Evaluation and monitoring of measures to prove effectiveness of IRBC measures	6	6	3
Annually reporting about IRBC measures and results across value chain	7	7	3
Providing access to recovery and redress	7	7	3
Total	**40**	**40**	**18**

Table 9: Table showing how offshore wind developers can score points in the IRBC category of IJVER Alpha and Beta.

4.1.5 Circularity

Reporting on the degree of wind farm circular design, construction, exploitation and decommissioning is a scoring criteria in IJVER Alpha and Beta. These reports are to be submitted as part of the tender bid. 40 points are awarded for transparent reporting on several different categories surrounding circular design, the use of alternative materials and the greenhouse gas footprint of the proposed wind farm. Note that points are awarded for reporting and the actual degree of circularity does not impact scoring. Table 10 below summarizes the circularity categories and what needs to be reported on to score points.

Category	Subcategory	Reporting on	Points
1.Circularity Design Windfarm	Circularity of wind farm	Amount of secondary materials used (kg, %)	10
	Circularity in repairs of wind farm	Amount of secondary materials used(%)	5
	Life cycle waste	Amount of waste generated (kg) and potential for re-use & recycling (%).	5
2.Use of alternative materials	Critical and strategic materials	Amount of critical and strategic materials (kg, %)	3
	Lifetime extension critical materials	Life extension, re-use and recycle potential of critical materials	3
	Green steel	Amount of green steel used (kg, %)	3
	Balsawood	Amount of balsawood used (kg, %)	3
	Alternative biological materials	Amount of alternative biological materials used (kg, %)	3
3.Greenhouse Gas Footprint	/	Greenhouse gas footprint based on Greenhouse Gas Protocol (kg)	5

Table 10: Table showing the parameters offshore wind developers need to report on to score points on the circularity category for IJVER Alpha and Beta.

4.1.6 IJVER Alpha – Ecology

The ecology category has been split up into 6 distinct goals. These are laid out in the following 6 subheadings. The ecology category forms the heart of the IJVER alpha tender and is the most heavily weighted of the scoring categories at 180 points out of a total of 400. A common complaint from offshore wind developers participating in the previous HKW tender was that the tender criteria were not objective/specific enough. The Dutch government has attempted to address this by adding suggested activities to each goal and subgoal which help developer score points in their bids. All of the solutions in this category must also be supported by the following reports: a scientifically substantiation report, a research plan, a collaboration plan, a data management plan and a conclusion & discussion plan.

Goal 1: Measures to reduce negative impacts on birds, bats and marine species

Goal one is centered around the reduction of negative impacts that an offshore wind farm is suspected to bring about on the local ecosystem. A host of different subgoals are assigned different KPI's which a prospective developer must demonstrate it will achieve by committing to implementing both proven solutions as well as promising new ones. These solutions range from the configuration of the wind farm and wind turbine characteristics (minimum tip height, cut in speed, etc.) to noise reduction during the construction phase. 5 types of species have been targeted in particular: birds, bats, marine mammals (particularly porpoises), shellfish and fish. Negative impacts on flying species like birds and bats are to be addressed through wind turbine characteristics such as the minimum tip height, blade visibility and the shutdown on demand of turbines when the density of flying creatures exceeds a certain threshold. These solutions must be placed on a certain % of wind farm turbines to score points. See Table 11 below for more details. Detrimental impacts for marine mammals on the other hand are to be tackled by reducing the number of porpoise disturbance days resulting from the piling of the monopile bases that will host the wind turbine. Porpoise disturbance days are calculated in the following manner:

1. Set a noise threshold (140dB in IJVER Alpha)
2. Model and calculate the area where this limit is exceeded to determine the disturbed area.
3. Multiply this area by the average density of porpoises in this area to determine the number of disturbed porpoises.
4. Multiply this by the number of days that pile driving/hammering occurs to determine the number of porpoise disturbance days.

Finally, shellfish are to be protected by reducing habitat loss and the barrier effect resulting from offshore wind activities. The barrier effect describes how animal species see offshore wind infrastructure as an obstacle and adapt regular movements (migration / foraging / etc.) to avoid this. A summary of the specific KPI's for each subgoal is given in Table 11 along with the individual number of points that can be scored.

Subgoals	Suggested measures and monitoring	KPI for max points	Max points
Reduction of collision casualties, habitat-loss and barrier effect based on EIA	• Configuration of wind farm, number of turbines, rotor-diameter, cut-in-speed, rotation speed, shape, tip hight • Monitoring, knowledge sharing on flight-hight, habitat-loss and barrier effect, transparency in calculation of reduction	Reduction of >30%	24
Reduction of light disturbance of windturbines and ships in construction, maintenance exploitation	• Usage of Nautical Detection Light System (NDLS) and Aircraft Detection light system (ADLS), special lighting from ships, other measures to reduce light disturbance	Application of NDLS and ADLS in minimal 75% of farm	6
		Reduction of light disturbance from ships	4
Reduction of collision casualties by use of improved visibility of turbineblades	• Measures to improve visibility of blades (e.g. black blades, UV, violet, etc.) or financial investment for future visibility measures	Improve visibility of >75%	12
Knowledge building on effectivity and validation of start-stop measures	• Reporting on which, count of bird species and count of collision casualties at stand still and operation • Radars, and other systems in an appropriate configuration 50% within farm and 50% outside of farm, long-term monitoring (min. 10 years) in all times of day and seasons	Configuration >50% coverage	18
Reduction of collision casualties of local seabirds	• Implementation of a shutdown on demand/ local curtailment system in wind farm including type of artificial intelligence, radar, sensor system, curtailment plan (speed, occurrence and effectivity) and choice for location of positioning (wind farm coverage)	Application on >75% of wind turbines	14
Reduction of pressure factors marine mammals	• Reduce pressure factors during construction to bring down porpoise disturbance days • Reduce pressure factors during exploitation to bring down porpoise disturbance days	Minimization of porpoise disturbance days to maximum 70,000	24
Total			**102**

Table 11: Table showcasing the subgoals and their respective points distribution of ecology goal 1: reduction of negative impacts on birds, bats and marine species.

Goal 2: Measures to restore underwater nature and stimulate diversity of benthos

Goal 2 is centered around fostering reef building and the ecology of the sea floor. Here, it recommends addressing this by creating artificial habitat for cod and the ross worm. Additionally, points can be scored by experimenting with nature friendly cable crossings that would benefit the aforementioned species. Table 12 below showcases the specific subgoals and KPI's to achieve as well as the weighting of these subgoals.

Subgoals	Suggested activities	KPI for max points	Max points
Measures to strengthen naturally-occurring reef-building, reef-habituating and reef-visiting species on and around offshore wind turbines	• Experiment with 3 different ways to create an artificial habitat for cod and affiliated biodiversity, and the Ross worm	Application on at least 75% of wind turbines	12
Nature-friendly cable intersections	• Experiment with 3 different material types of erosion protection covering of cable intersections that improve conditions for cod and affiliated biodiversity, and the Ross worm	Application on at least 50% of the cable intersections	6
Total			**18**

Table 12: Table showcasing the subgoals and their respective points distribution of ecology goal 2: restoring underwater nature and stimulating biodiversity of benthos.

Goal 3: Contribute to solving knowledge gaps around offshore wind related electromagnetic field (EMF)

Goal 3 is directed at resolving knowledge gaps around the effect of the electromagnetic field associated with high power flow across the seabed on surrounding species. Rather than implementing a particular solution, the KPI here is to set up a rigorous research proposal to study the effects of EMF on cartilaginous fish (sharks, rays, etc.), flatfish species and harbor porpoises. Table 13 below displays the breakdown of goal 3.

Subgoals	Suggested activities	KPI for max points	Max points
Increase knowledge about the effects of electromagnetic fields on the behaviour of the species in focus	Write and execute a research proposal on the effects of EMF from in-park cabling during the operational phase of the park.	Write and execute research proposal for cartilaginous fishes	4
		Write and execute research proposal for flatfish	4
		Write and execute research proposal for porpoises	4
Total			12

Table 13: Table showcasing the subgoals and their respective points distribution of ecology goal 3: solving knowledge gaps on the impact of EMF on marine species.

Goal 4: Contribute to solving knowledge gaps around migrating bat species

Goal 4 is centered on (migrating) bats, specifically on resolving knowledge gaps on their behavior and the impact offshore wind development has on the species. Points are awarded for bat detection coverage using technologies such as telemetry and thermal cameras. Table 14 shows the breakdown of goal 4.

Subgoals	Suggested activities	KPI for max points	Max points
Increase knowledge on: 1) Flight behaviour 2) Collision casualties and barotrauma 3) The size of migrating bat populations	Write and execute a research proposal for 3 projects for installing and conducting research with: 1) 360 degrees telemetry network on outer turbines of park 2) 360 degrees bat detectors at 3 different heights on outer turbines of the park 3) Combination of 360 degrees thermal cameras and 360 degrees bat detectors on 10 turbines across the plot	Execute activity 1, 2 and 3	18
Total			18

Table 14: Table showcasing the subgoals and their respective points distribution of ecology goal 4: solving knowledge gaps around migrating bat species.

Goal 5: Contribute to the program "Nature Reinforcement in the North Sea"

The Dutch government has set up the program "Nature Reinforcement in the North Sea" (MONS) with the goal of identifying how the evolving use of the North Sea influences the North Sea ecosystem [22]. This includes the generation of energy in the North sea and therefore offshore wind energy. Goal 5 prompts developers to pledge upwards of 20 million euros to this program to score maximum points. This is shown in Table 15 below.

Subgoals	Suggested activities	KPI for max points	Max points
Contribution to nature reinforcement within and outside of the wind farm	Financial contribution to government steered "Programma Natuurversterking in de Noord Zee", "Program Nature reinforcement in the North Sea"	Investment of minimum EUR 20 m	12
Total			12

Table 15: Table showcasing the subgoals and their respective points distribution of ecology goal 5: contributing to the "Nature Reinforcement in the North Sea" program.

Goal 6: Invest in reduction of collision casualties, habitat loss and the barrier effect

Goal 6 is also an investment-based goal, encouraging developers to pledge upwards of 11 million euros in alternative solutions addressing the reduction of collision casualties, habitat loss and a barrier effect (see Table 16 below). These solutions must be scientifically demonstrated to have a positive impact.

Subgoals	Suggested activities	KPI for max points	Max points
Asset related innovation measures aimed at reduction of collision casualties, habitat loss and barrier effect	• Contribution to goal with measure that has not previously been named or financial investment in measures with plan • Measures need to tackle described challenges, **have scientific foundation**, societal relevance is proven	Measures worth minimum EUR 11 m	18
Total			18

Table 16: Table showcasing the subgoals and their respective points distribution of ecology goal 6: investing in additional solutions addressing negative impact mitigation.

4.1.7 IJVER Beta – System Integration

The second of the IJVER sites is dominated by what is labelled in this paper as the system integration category. This includes an electricity offtake commitment and a commitment to develop significant offshore solar production. The next subcategories explain these requested commitments in more detail. 168 points in total are to be earned in this category, depending on the capacity of offtake and offshore solar development. These offtake solutions as well as the offshore solar PV capacity would need to be constructed within 60 months of the wind farm permit becoming irrevocable.

Electricity Offtake

The Dutch government wants developers to commit to securing significant offtake capacity of their own to avoid congesting the onshore electricity grid during peak production times. This offtake must be on land and must increase electricity demand within the Netherlands. Points earned increase from an initial 15 points at 200MW by 15 points for every additional 100MW of electricity offtake a developer secures, up to a maximum of 150 points at 1000MW of offtake. This stepwise awarding of points is shown graphically in Figure 13 below.

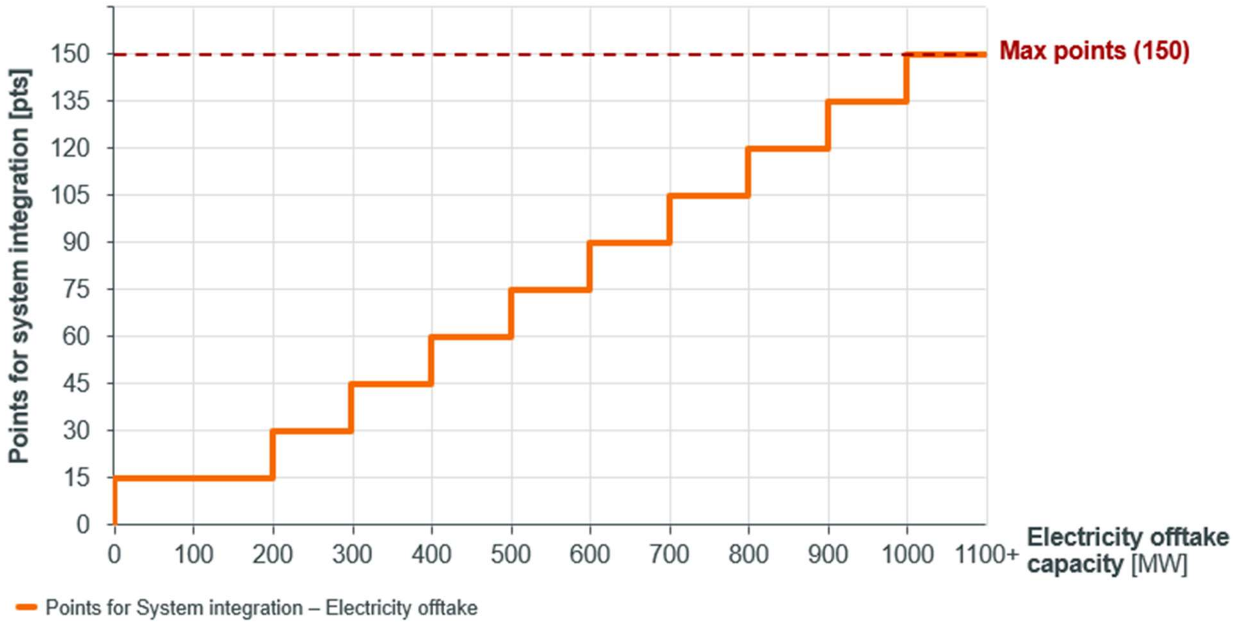


Figure 13: Graph showing how offshore wind developers can score points by securing electricity offtake. Maximum points are earned when solutions proposed reach an offtake capacity of 1000MW.

Offshore Solar PV

The offshore solar segment of the system integration category is straightforward: developers are rewarded for the capacity of offshore solar that they include in their development plans. Points are once again earned in stepwise fashion, starting at 4 points from 20MW of capacity realized and growing to 18 points with 100MW of offshore solar capacity realized. Another condition is that these installations must have a lifespan of at least 10 years in the rough North Sea conditions. Figure 14 below shows the points awarded versus offshore solar capacity step function outlined by the Dutch government.

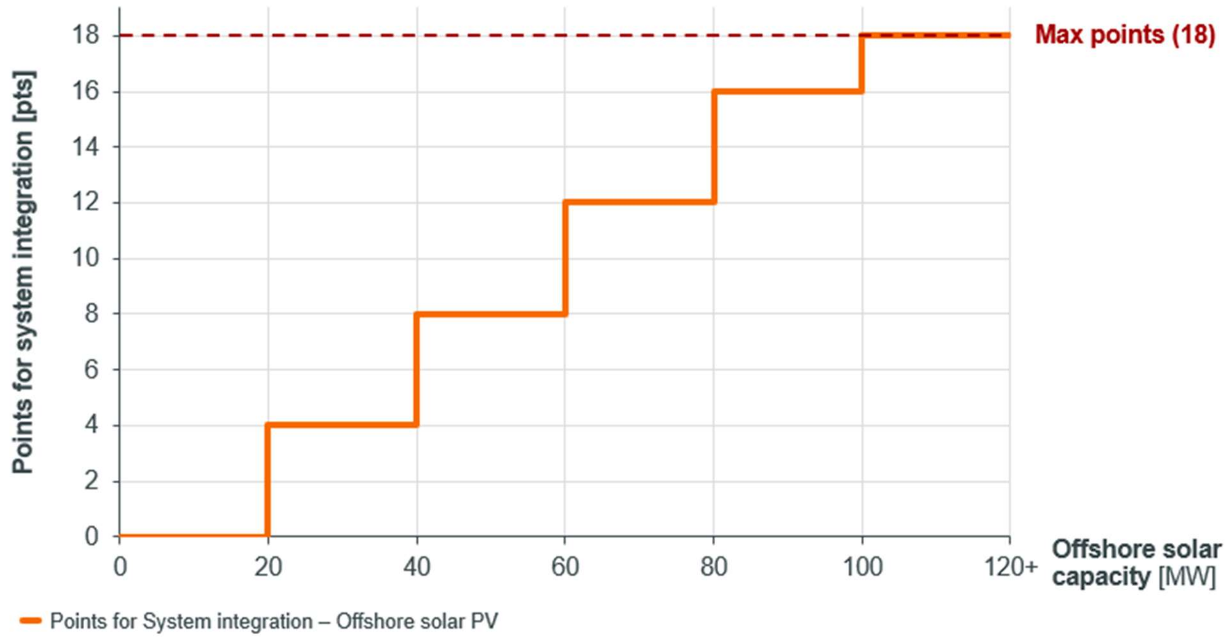


Figure 14: Graph showing how offshore wind developers can score points by including offshore solar development as a part of their bid. Maximum points are earned when solutions proposed reach a peak capacity of 100MW.

4.1.8 IJVER Beta – Porpoise Disturbance

As in goal one of the IJVER Alpha ecology category, IJVER Beta includes a scoring category on mitigating harbor porpoise disturbance days. Please refer to that section in this paper for the definition of harbor porpoise disturbance days. Maximum points (12) are scored for keeping disturbance days down below 70,000 reducing in diminishing stepwise fashion until 120,000 days upon which 0 points are scored. Figure 15 shows this graphically.

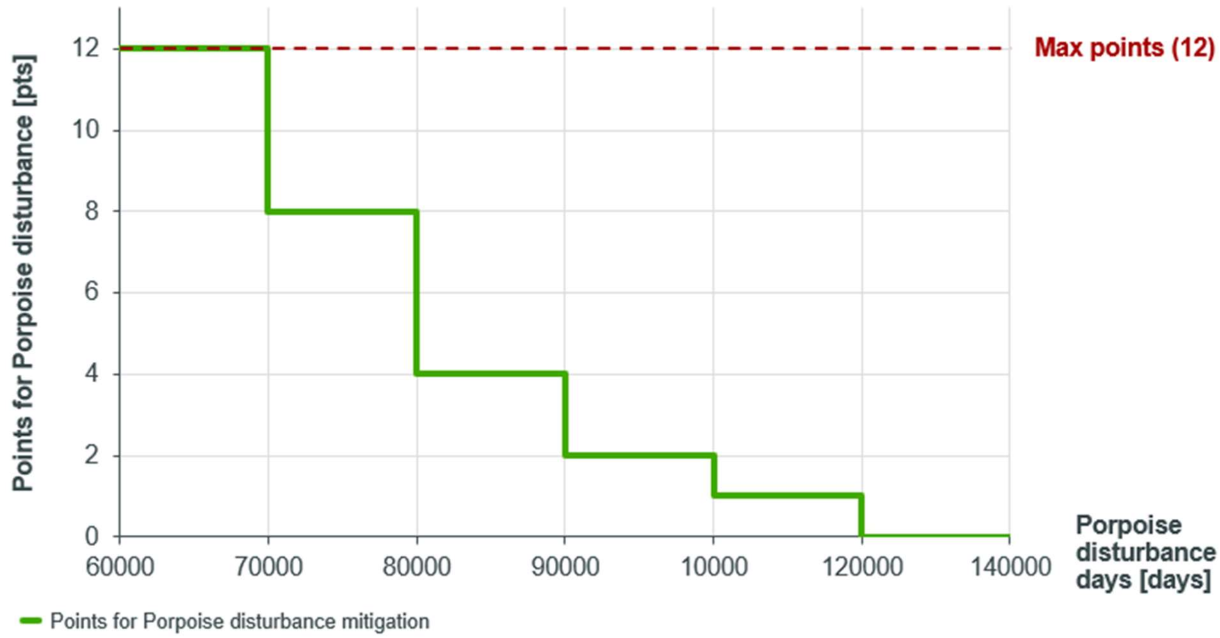


Figure 15: Graph showing how offshore wind developers can score points by mitigating harbor porpoise disturbance days. Maximum points are earned when disturbance days are limited to 70,000 across the wind farm construction phase.

Summary

The most important details for the different scoring categories for IJVER Alpha and IJVER Beta are summarized in Figure 16 below.

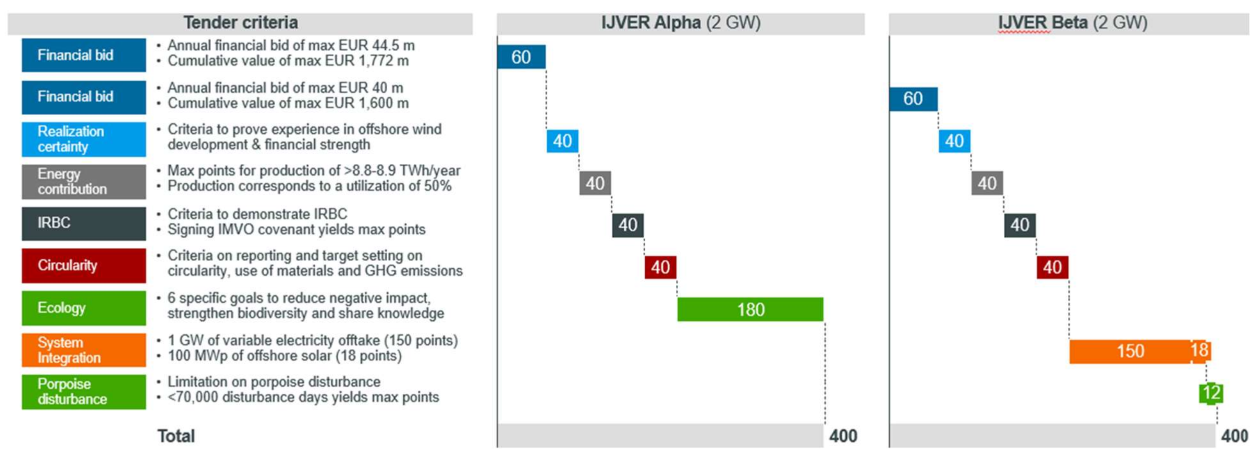


Figure 16: Summary of IJVER draft tender criteria and the associated points distribution.

4.2 Changes Final IJVER tender criteria

In July 2023, the government released the updated final tender criteria for the IJVER Alpha and Beta offshore wind tenders. The most significant changes are highlighted in this section.

4.2.1 Financial Bid

The most significant of the changes came in the financial bid. The maximum scoring financial bid was upgraded from 40 million euros per year to 420 million euros per year – an increase by more than a factor of 10. The number of points awarded for the financial bid remains the same, at 60. The magnitude of this change is highlighted in Figure 17 below. The financial bid is now identical for both Alpha and Beta sites.

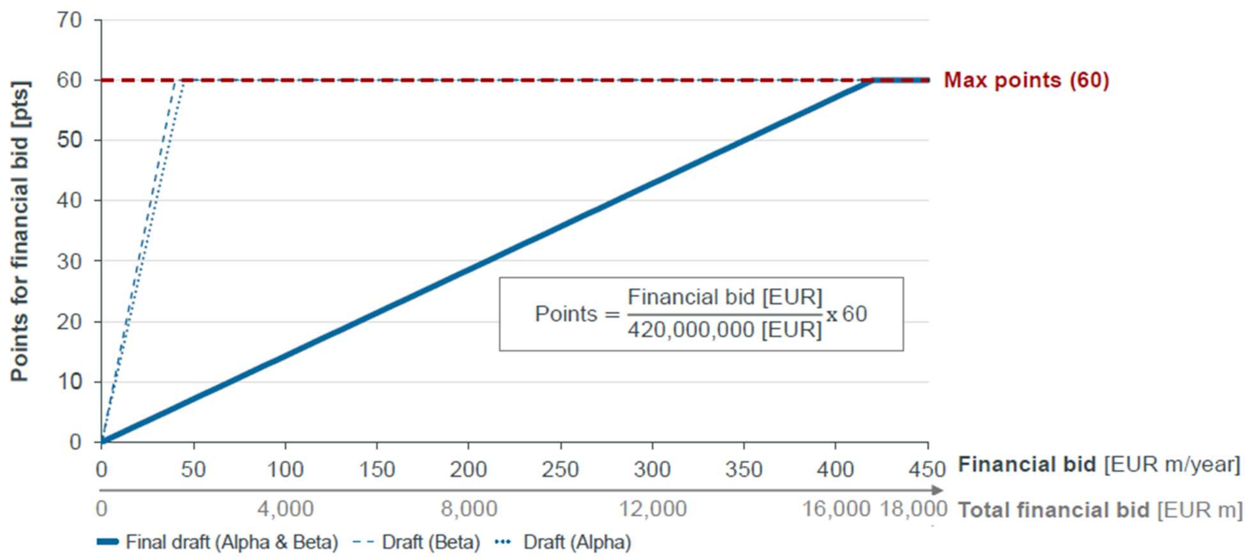


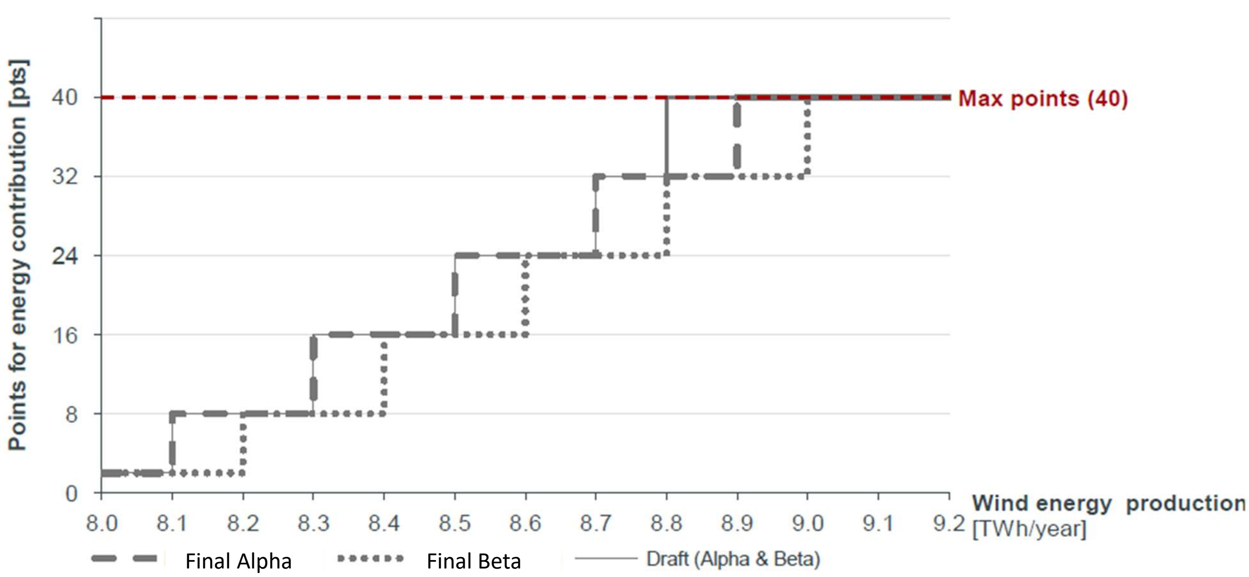
Figure 17: Figure showing the updated financial bid in the final IJVER tender criteria.

4.2.2 Realization Certainty

No changes were made to the realization criteria category.

4.2.3 Energy Contribution

With the conclusion of TNO's study into the available wind resources in both sites, the required energy contribution to score the maximum 40 points was upgraded from 8.8/8.9 TWh to 8.9 TWh for site Beta and from 8.8/8.9 TWh to 9.0 TWh for site Alpha.



4.2.4 IRBC

The IRBC category was changed to include all entities involved in the offshore wind value chain. These are: the development partner, the project management partner, wind turbine supplier, wind turbine installer, O&M partner, foundation supplier, foundation installer, inter array cable supplier and inter array cable installer.

4.2.5 Circularity

Circularity criteria were restructured, with 3 points of the 5 taken away from reporting on the project greenhouse gas footprint and allocated to the circular design of the wind farm (20 → 23 points). A point was also taken away from the use of alternative materials (15 → 14) and used to motivate knowledge sharing of circular strategies within wind farm development. Additionally, only the circularity of the wind farm and list of critical materials must now be provided before the bid award. All other reporting may occur after the bid is won, reducing the initial reporting work of the developers.

4.2.6 IJVER Alpha – Ecology

The content of the ecology category was altered in the final IJVER Alpha tender criteria. Total awarded points remained the same at 180. The category was re-ordered into 3 goals from the initial 6, with an extra 4th goal on knowledge sharing of the measures that will be implemented to satisfy the ecology tender criteria (worth 1 point). See Table 17 for a high-level overview of this new structure. For details on the new ecology category, refer to Appendix 1. The first 3 goals encompass the same subgoals as before, with the following exceptions:

- Harbor porpoise disturbance days requirements were made more stringent, reducing the limit for scoring maximum points from 70,000 days to 55,000 days.
- Research and monitoring of migrating bat species has been removed from the tender criteria. Points previously allocated here were redistributed to goal 1: reduction of negative environmental impact, which now holds 124 of the 180 points.

Goals	Key focus	Points
1 Reduction of negative environmental impact	Mitigation of collisions, habitat loss, barrier effect, light disturbance and pressure factors for bird species and harbor porpoises in IJVER and Bruine Bank nature reserve	124
2 Increasing positive impact by restoration underwater nature	Implementation of nature-inclusive design on top of measures required as stated in the site decision and investment in nature reinforcement	27
3 Contribution to research and innovation	Contributing to knowledge, research and innovation to mitigate negative ecological impacts and strengthen positive ecological effects	28
4 Knowledge sharing	Summarizing measures to be implemented and publishing summary 6 months after permit has become irrevocable	1
Total		**180**

Table 17: Table showing the updated high level structure of the IJVER Alpha ecology category.

4.2.7 IJVER Beta – System Integration

Electricity Offtake

The number of points for the electricity offtake category was reduced from an initial 150 points to 139 points (see Figure 18), with an additional point granted for a summary of electricity offtake commitments to be shared with the government within 6 months after being awarded the irrevocable permit.

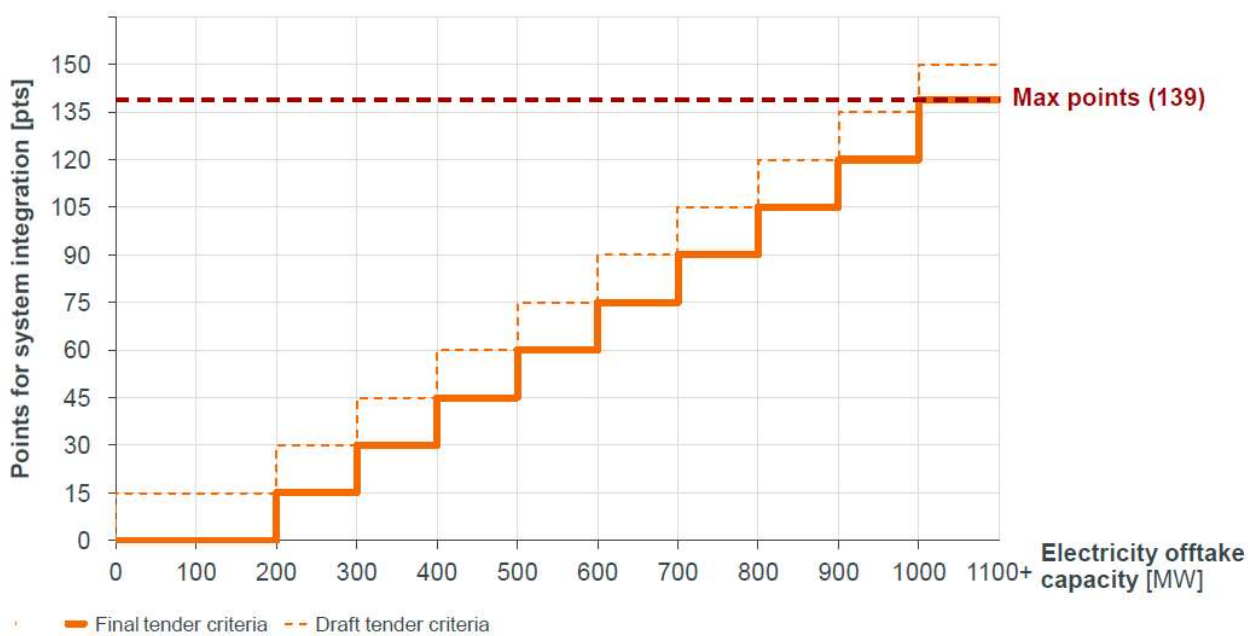


Figure 18: Figure showing the new points allocation for offtake solutions as detailed in the final IJVER Beta tender criteria.

An additional note by the Dutch government stipulated that these solutions would need to be in place by 72 months after the permit becomes irrevocable, up from 60 months in the draft tender criteria.

Offshore Solar PV

Offshore Solar PV criteria have been significantly relaxed. The maximum number of points has been increased from 18 to 20, and the required offshore solar capacity to do so is halved to 50MW peak from 100 MW peak. This is shown in Figure 19 below.

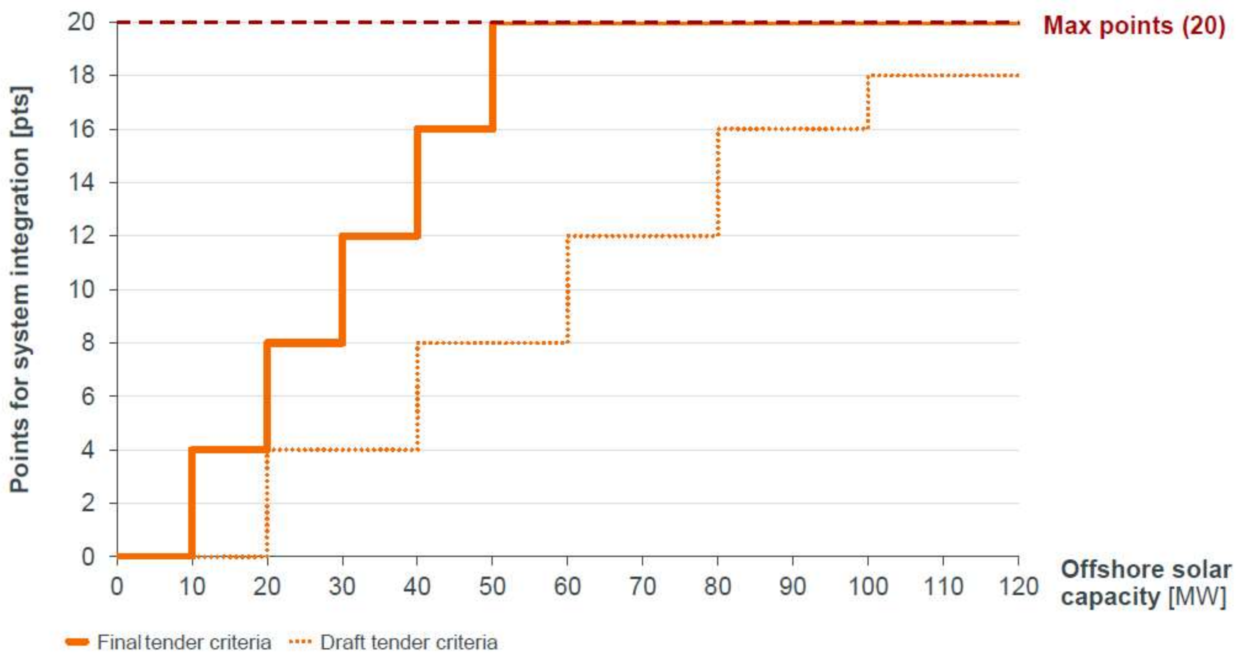


Figure 19: Figures showing the updated IJVER Beta final tender criteria on offshore solar capacity.

4.2.8 Porpoise Disturbance

As in goal 1 of the ecology category of IJVER alpha, the porpoise disturbance criteria has been made more stringent. To score maximum points, porpoise disturbance days need to be limited to below 55,000 days over the construction period of the wind farm. The number of points to be earned here is also increased significantly, from 12 to 20 points.

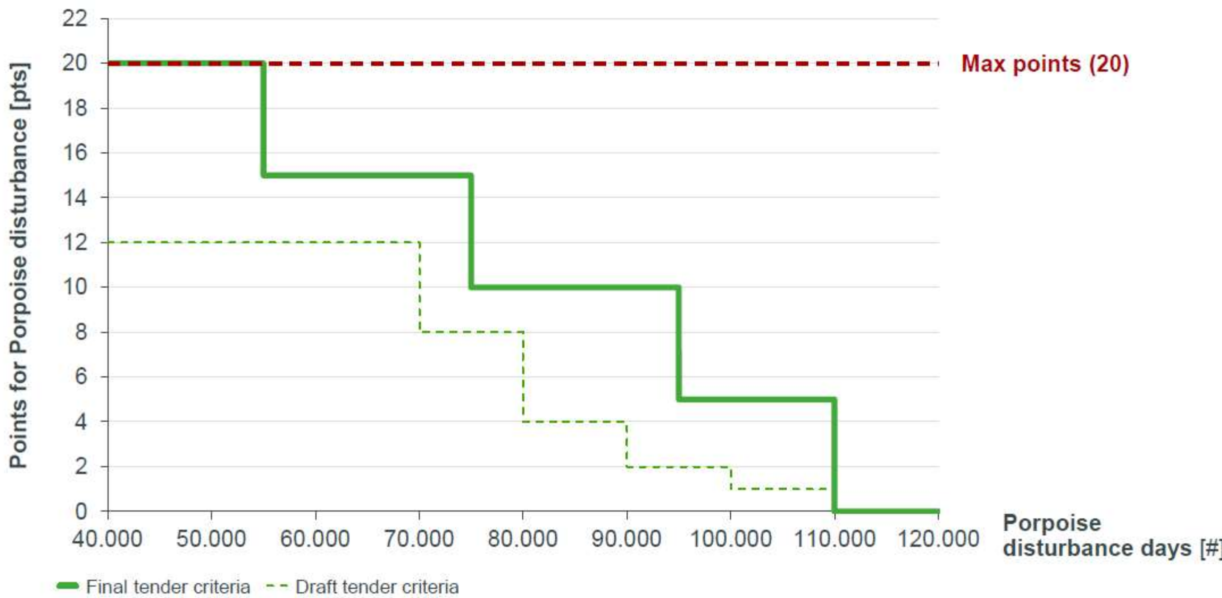


Figure 20: Figure showing the updated Final IJVER Beta porpoise disturbance days tender criteria.

Summary

Figure 21 below serves to provide an overview of the most important changes outlined in the sections above and shows a summary of the final IJVER tender criteria as well as the final points breakdown.

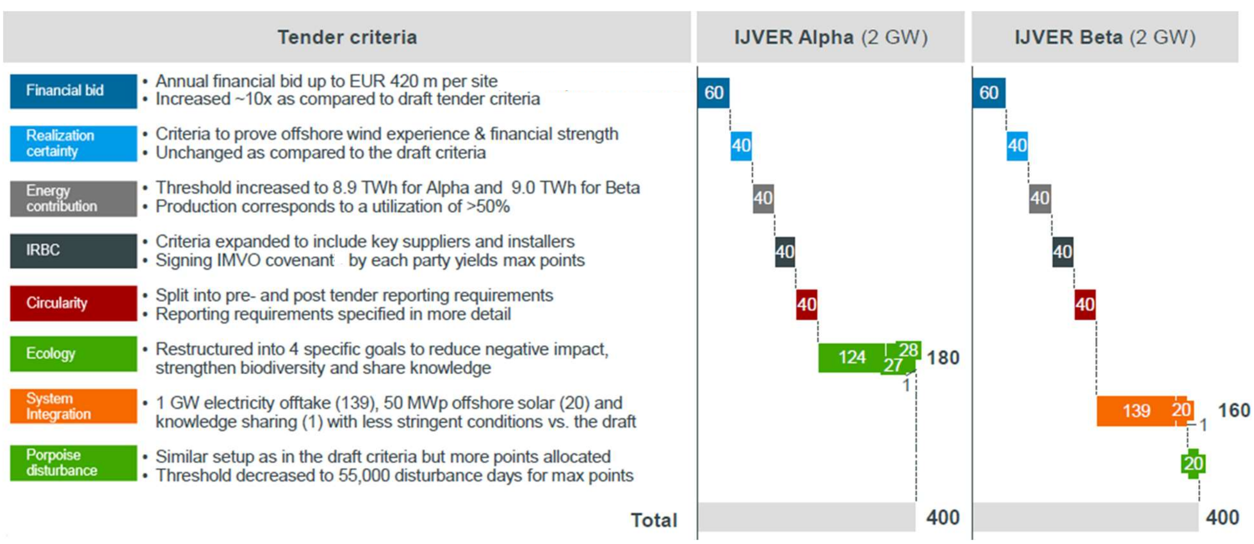


Figure 21: High level view of the final IJVER Alpha and Beta tender criteria with points breakdown and comment on the main changes from the draft tender criteria.

5. Discussion

The discussion of this paper focuses on the evolution of the IJVER tender criteria from end March to end July and the implications of the final tender criteria. The most significant changes are expanded upon, and their motivation discussed.

5.1 Financial Bid

The financial bid represents 15% of the total points to be earned in both IJVER tenders. From draft to final tender criteria, the maximum scoring bid is increased by a factor of 10. This 10-fold increase in the financial bid makes it 10 times more expensive to score points in the financial bid category. The (non-discounted) cost per point for the financial bid of site Beta was raised from 26 million euros per point to 280 million euros per point. This theoretically encourages developers to prioritize other, cheaper scoring solutions in the ecology, system integration, circularity, etc. categories. On the 12th of July, 2 weeks before the final IJVER tender criteria were released, neighbouring country Germany held its biggest offshore wind auction to date. 7GW of new capacity was tendered in an uncapped financial auction tendering model for a record setting total financial bid of 12.6 billion euros for a lease lasting 20 years. This equates to about 1.8 billion euros per GW. In the Dutch draft tender criteria, the average price per GW was roughly 845 million euros per GW, and this for a lease lasting 40 years. This is under the assumption that the maximum bid is reached in the Dutch tender. The implication of this is that the Dutch government would receive significantly less money from offshore wind activities than their German neighbours. It is likely that the Dutch government observed developer's appetite for the German offshore wind auctions and upgraded their own financial bid cap to capitalize on this whilst at the same time making other, more time intensive objectives such as ecology and system integration more attractive. This hypothesis is supported by the UK Scotwind tender undergoing a similar financial bid reform after the German auction. Under the final tender criteria, the Dutch government could potentially collect 33,6 billion euros in financial bid revenue if the max bid is achieved in the winning bid. It is important to note that the Dutch government has communicated it does not expect this to happen.

Integrated energy companies TotalEnergies and bp were the two winners of the German auction, sharing the leased out offshore wind acreage. This is significant, as traditional offshore wind players such as Orsted and RWE were unable to compete and publicly denounced this uncapped financial bid style of tendering [30]. If the financial bid category of IJVER ends up being the differentiating criteria, a similar scenario could unfold in the Netherlands. This is possible as the Dutch government has clearly communicated that they aim to make tender criteria and their scoring more objective, making it clear what it takes to score maximum points in the different categories. This is in combination with significant appetite from affluent oil and gas companies looking to reach their 2030 decarbonization targets.

5.2 Realisation Certainty

The criteria outlined for realisation certainty encourage the forming of consortia amongst developers. This is particularly true for new players in the offshore wind development market such as TotalEnergies, Equinor, etc.

Teaming up with experienced technical and knowledge partners allows for the scoring of maximum points in this category. Roadmap 2023 and 2030 are time constrained, and realisation certainty of projects is key if the government aims to meet climate commitments. This is why they attach points to a developer's ability to realise an offshore wind project.

5.3 Energy Contribution

An energy contribution of 8.9 TWh and 9.0 TWh for IJVER Alpha and Beta respectively represents a capacity factor of approximately 51% for a wind farm capacity of 2GW. Given that statistics of Dutch offshore wind show the average capacity of offshore wind farms back then amounted to 39% [24], this is a significant step up. Developers will need to rely on wind farm configuration optimization and potentially overplanting of the offshore wind farm. Overplanting refers to constructing wind turbines with a combined capacity exceeding 2GW to make sure energy contribution points can be maximized. In HKW, all top-ranking developers managed to score maximum points in the energy contribution category.

5.4 IRBC

On March 6th of this year, the Dutch government has signed the IRBC for the Renewable Energy Sector, committing to stringent human rights and due diligence practices [2]. They aim to make the IRBC the universal standard of responsible business conduct in the country, explaining the inclusion in the IJVER tender Criteria. This also explains why self-due diligence scores limited points and their preferred IMVO covenant solution automatically scores maximum points. Requiring not only developers but also other parties along the value chain to commit to IRBC for renewable energy helps the Dutch government in enforcing a universal RBC standard across the board. Developers such as Shell, Orsted, RWE, Eneco and Vattenfall were already part of the IMVO covenant and will have to agree on the approval of new entrants. This is a new criteria that was not included in the HKW tender criteria.

5.5 Circularity

The circularity criteria in the Dutch IJVER tender does not require any degree of circular design to score points. Rather, it requires detailed reporting on specified topics. It is likely that the Dutch government is gathering information to understand the current state of the market and circularity within offshore wind. It enables them to set future targets that are both ambitious and achievable. This is different from some other EU offshore wind countries such as France and Denmark, which have also included a scoring circularity category in their tender criteria but do reward developers for the extent to which they include circularity in their bids. This is a new criteria that was not included in the HKW tender criteria.

5.6 Ecology (Including Porpoise Disturbance Days)

By assigning most points of the Alpha tender to ecology promoting solutions, the Dutch government makes clear its stance on offshore wind development. Offshore wind should not come at the cost of the environment. By clarifying how points can be scored from the already more objective IJVER Alpha draft criteria, it is made more likely that several offshore wind developers will score maximum points in this category. Next to demanding concrete solutions (visibility increases, start-stop measures, reef restoration, …) the tender criteria also request initiatives to solve ecological knowledge gaps in the context of offshore wind construction (effect of EMF, etc.). Additionally, monitoring of solutions is rewarded, allowing for the gaining of knowledge regarding the impact of solutions. This multi-faceted approach enables both ecological protection/restoration as well as the development of potentially new solutions in the future. Regarding porpoise disturbance days, the significantly reduced maximum point scoring limit will push developers to commit to quiet piling techniques for monopile installations.

5.7 System Integration

To score maximum points here, a combined 1GW of non-grid offtake solutions need to be included in the bid. This will stimulate investment in 100+MW electrolysers, such as those put forward by RWE for in their HKW winning bid [5], as well as storage technologies (batteries, compressed air storage, heat storage, etc.). When the windfarm generates more than a threshold value of power, these solutions need to come online, diverting excess electricity away from the grid. The threshold is defined as the offshore grid capacity (2GW for IJVER) subtracted by the committed to offtake capacity (1GW for maximum points in SI category). This is shown graphically in Figure 22. Whilst the Dutch government has very ambitious offshore wind targets, the onshore grid is not yet developed enough to accommodate for this much variable renewable electricity. This is the government's response to avoid future grid congestion.

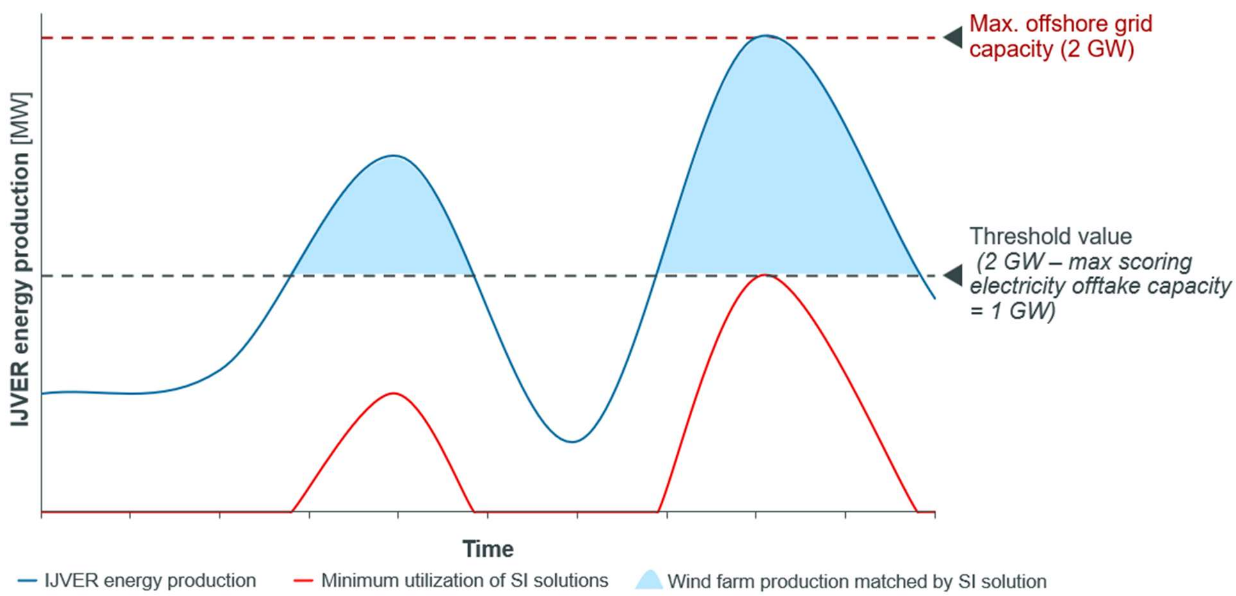


Figure 22: Figure showing how offtake solutions would activate when the threshold value committed to by developers is exceeded.

Solar PV (offshore and onshore) has a different production profile to offshore wind. By developing both in tandem, the issue of variability of offshore wind energy would be somewhat mitigated. Offshore solar PV criteria were significantly relaxed from the draft criteria, halving and now earning developers more points. This is most certainly the result of feedback/appeal from developers, who communicated a lack of confidence in offshore solar PV's technological readiness for 100MW production. Most of the world's current floating solar PV is on reservoirs and lakes, not on the open ocean. The North Sea is notoriously rough and realizing an offshore floating solar farm with a life expectancy of 10 years in those conditions will be very expensive. As of now, this technology is in the pilot project phase, with the largest pilots approaching 5MW.

6. Conclusion

The Netherlands has committed to large-scale offshore wind development to meet its climate commitments. Instrumental to this was their regulatory and tendering framework overhaul in the years 2013-2016. This allowed for the streamlining of development in such a way that interim targets are consistently met. Currently, the comparative assessment tender model is the model of choice for the Dutch government. It combines a financial bid with more qualitative scoring criteria.

The latest Dutch offshore wind tender follows in the footsteps of its predecessor HKW. It is an extensive comparative assessment with criteria centered around protecting the North Sea ecology and stimulating integration of offshore wind energy into the Dutch energy. It is a more objective iteration of the relatively open ended HKW tender, giving clarity into what the government is looking for in each of the scoring categories. In response to proven appetite of oil and gas companies to invest in securing renewable energy projects, the government has also attached a significant financial component to the bid. This combination could lead to the financial bid being the differentiating category. If this is the case the Dutch tender will follow in the footsteps of the German one earlier this July where the highest bidder is awarded the offshore permit.

Recommended future study:

- Studying the results of the IJVER tender once it concludes in quarter 1 of 2024. What ended up being differentiating?
- The direction of future tenders identified in Figure 7. What tendering model do they adopt? Does a financial auction model prevail over that of a comparative assessment?
- Cross country analysis: a study looking into tender regimes in other EU countries with offshore wind ambitions: Germany, Denmark, Norway, UK, France.

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Appendix

Appendix 1: Detailed updated Ecology category in final Alpha tender criteria

Goal 1: Measures to reduce negative impacts on birds, bats and marine species

Subgoals	Suggested measures and monitoring	KPI for max points	Max points
Reduction of collision casualties in exploitation phase based on EIA	• Configuration of wind farm, number of turbines, rotor-diameter, cut-in-speed, rotation speed, shape, tip height	Reduction of >30% for each bird species during the full wind farm lifetime	20
Reduction of habitat loss based on EIA	• Configuration of wind farm, number of turbines, rotor-diameter, cut-in-speed, rotation speed, shape, tip height	A yearly expected reduction of bird casualties due to habitat loss of each bird species during full lifetime	16
Reduction of barrier effect based on EIA	• Configuration of wind farm, number of turbines, rotor-diameter, cut-in-speed, rotation speed, shape, tip height	An expected reduction barrier effect for each bird species during full wind farm lifetime	12
Install ADLS on all turbines in the wind farm	• Application of ADLS is required on the full wind farm (previously only 75%)	Application of ADLS is required on the full wind farm (previously only 75%)	12
Increase blade visibility	• Implement measures or reserve financial resources to increase visibility of wind turbine blades	Implementation of measures on minimum 75% of the turbines	16
Implement shut-down on demand system	• Application on number of WTG not restricted to minimum 75%, free number of choice	Implement shutdown on demand effectively on a representative number of turbines	16
Reduce porpoise disturbance days during construction	• Adjust wind farm design and/or installation technique to reduce number of porpoise disturbance days	Reduce maximum porpoise disturbance days during construction to maximum 55,000	20
Reduce pressure factors during exploitation	• Reduction of sailing speed, usage of quieter ships, adjusting planning such that underwater noise impact is minimized	Execution of 3 specifically mentioned measures	12
Total			124

Goal 2: Measures to restore underwater nature and stimulate diversity of benthos

Subgoals	Suggested measures and monitoring	KPI for max points	Max points
Strengthening underwater nature building upon nature-inclusive design requirements in Site Decision	• Create habitats for target species by use of foundation, erosion protection and potentially cable crossings by implementing 3 different measures • Measures must be in addition to the regulations on nature-friendly building in the site decisions for Alpha	Application on at least 75% of wind turbines	15
Contribution to nature-reinforcement within and outside of wind farm	• One-time financial investment in North Sea nature-reinforcement program from Ministry of Agriculture, nature and food quality • Payment is executed on 1 February 2025 or 1 June 2025 depending on date permit irrevocable	Financial investment of at least EUR 20 m	12
Total			27

Goal 3: Contribute to knowledge, research and innovation to reduce negative impact and strengthen positive impact of IJVER Alpha and future wind farms in the Dutch North Sea

Subgoals	Suggested measures and monitoring	KPI for max points	Max points
Contribute to the solution of knowledge gaps around negative impact of EMF of infield-cables in wind farm	• Measure strength of electromagnetic fields at different configurations of infield-cables in the wind farm • Substantiate choice for cable configurations and variations	Execute measure and monitor accordingly	13
Reduce negative environmental effects and/ or strengthen positive effects of IJVER Alpha and future wind farms in the Dutch North Sea	• Contribute to stated goal by investing in innovative measures not yet implemented for other goals or Site decision requirements • At time of demonstration the innovation needs to have showcased a pilot with a prototype in operational environment (TRL 7)	Financial investment of EUR 5-11 m	15
Total			28

Goal 4: Knowledge sharing

Subgoals	Suggested measures and monitoring	KPI for max points	Max points
Permit holder shares a summary of all measures that will be implemented in IJVER Alpha	• Latest 6 months after the permit has become irrevocable the permit holder publishes a summary of all implemented measures and research that will be conducted	Publication of summary	1
Total			1