D2.2-DK-offshore, June 2020

Design of the upcoming offshore wind tender Thor in Denmark

Process, timeline and preliminary conditions

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Contents

Executive Summary

The report describes the auction for the Danish offshore wind park Thor. It outlines the tender procedure and process, describes the new support scheme, its incentive structure, and the stakeholder engagement process that led to the design. The report also provides conclusions for the potential future projects using this scheme.

The new auction starts with pre-qualifying up to 10 bidders based on economic and financial capacity, and technical and professional ability. They will bid to receive a premium based on the difference between their bid price and the reference price, which is calculated as the average price of the preceding year. The premium is two-sided with different caps set to be paid by the government and the producer. The support period is set to 20 years. The scope has been expanded to include the connection costs, and the capacity can be anywhere between 800 and 1000 MW. The method for developing this new approach included stakeholder involvement via Q&A, bilateral meetings, and a conference held based on a report published on the design of the auction scheme.

The goal of the new remuneration design is to incentivise value creation. It exposes producers to more price fluctuations with the intention to induce a more system-friendly technology design. It should encourage the use of technologies, wind farm layouts and other solutions that would gain a higher average price of electricity by generating electricity when prices are high. This compares with the previous auctions incentivising highest possible total production with no regard to the price of electricity. However, it also means that the premium is updated annually, creating a time lag with potential liquidity implications. The design also includes seizing of premium payment when prices are negative or when a negative premium would turn a positive underlying price negative.

1 Introduction

As part of the Energy Agreement from 2018 the parties decided to establish three offshore wind farms in Danish waters, before 2030. The first of these wind farms is Thor Offshore Wind Farm, with a capacity between 800 and 1000 MW it will be the largest offshore wind farm in Denmark.

An important change has been made in the tender for Thor, namely a new design for the remuneration scheme. The remuneration scheme is a Contract-for-Difference mechanism, where the reference price will be determined annually as the average spot price from the previous year, as opposed to the 'traditional' hourly based Contract-for-Difference that is in place for other offshore wind farms in Denmark. This increases the short term risk for the concession owner in terms of price fluctuations. The rationale behind the change in support scheme is that it should incentivise the concession owner to maximise the market value of production rather than simply maximise output [1]. The rationale is described in more detail below.

In the following we go through the procedure and process of the Thor tender and discuss the new support scheme in more detail.

2 Timeline / Tender Procedure

The tender procedure is a competitive procedure with pre-qualification and negotiation. Candidates applying to participate in the tender must submit a European Single Procurement Document (ESPD) [2]. The ESPD serves as documentation that the candidate fulfils the minimum requirements in respect to:

Remuneration

The concession owner of Thor Offshore Wind Farm can receive aid in the form of a price premium over a 20-year period, commencing when the first kWh is supplied to the collective grid. The subsidy follows a Contracts-for-Difference (CfD) principle. The CfD has been designed with a symmetric two-sided payment. This means that the concession owner receives a premium from the state in years when the bid price is higher than the reference price, and correspondingly pays the state, when the reference price is higher than the bid price. The reference price is determined annually as the simple average of the electricity spot prices in the previous year, running from January 1 to December 31. The spot prices are the hourly spot prices as stated by Nord Pool in the area DK1. That is, the concession owner receives (pays) the difference between the average electricity price from the previous year and the bid price per unit of output. The total subsidy in a given hour is calculated as the product of the price premium and the output for that hour. The total payment from state or concession owner is settled on a monthly basis [1]. This means that if the bid price is e.g. 0.40 DKK per kWh and the average of the electricity price the previous year was 0.30 DKK kWh, then for the following year the concession owner would receive 0.10 DKK per kWh produced. The figures below illustrates the remuneration scheme:

- Economic and financial capacity: The candidate must demonstrate a minimum annual turnover as well as a satisfactory equity to debt ratio OR long term debt rating (see table for exact numbers) [2].
- Technical and professional ability: The candidate must have
    - At least one reference in project development, procurement and management of the construction of largescale offshore wind with a capacity of at least 150MW, within the last five years [2].
    - At least one reference in project development, procurement and management of construction of at least one AC-substation servicing an offshore wind farm completed within the last five years [2].

No more than 10 applicants will be invited to tender. In case more than 10 candidates fulfill the minimum criteria selection will be based on an evaluation of the most relevant references. This evaluation will be based on a consideration of the number of references, and their relevance in terms of functionality and volume. The exact weighting of criteria will be set out in the contract notice and tender material [2].

The candidates who are invited to the tender are expected to follow the following timeline when bidding for Thor offshore wind farm [2], [3]:

- By Q4 2020 a preliminary bid should be submitted. A preliminary bid is a non-binding statement from the tenderer on the offered price pr. kWh and the capacity of the offshore wind farm. The tenderers are furthermore given the opportunity to submit proposals for adjustments to the tender material.
- Shortly after the preliminary bids, bilateral trade negotiations between the Danish Energy Agency (DEA) and the tenderers will take place. The DEA will, based on the negotiations, consider if the tender material should be amended.
- The final tender material is expected to be published in Q3 2021. Then the tenderers should submit their final and binding bid for Thor Offshore Wind Farm.
- The DEA will assess the tenders according to the award criteria and award the project, expectedly in Q4 2021.
- The winner of the concession obtains a license to investigate the site and perform a thorough n Environmental Impact Assessment (EIA). Provided the EIA can be approved, the DEA will issue a construction license.
- The construction of the wind farm must be finished by the end of 2027. In parallel Energinet will build the onshore grid connection allowing for possible first power by Q2 2024.

3 Remuneration scheme

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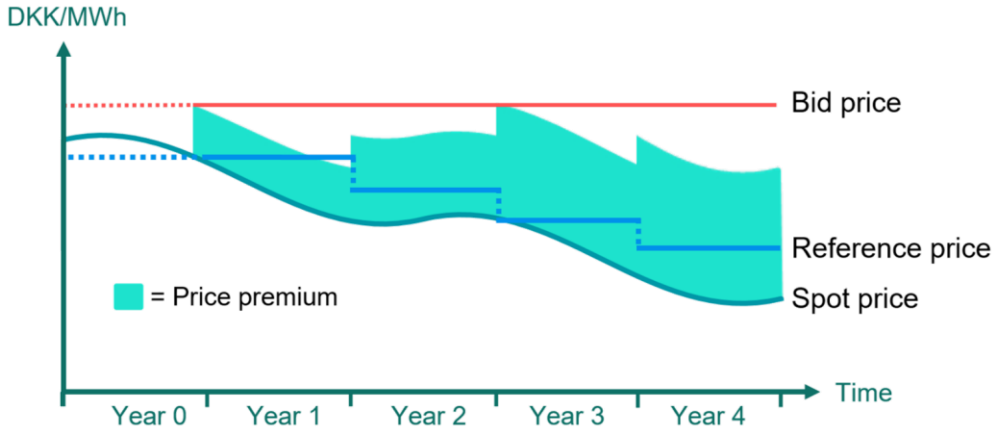

Figure 1: Illustration of the CfD remuneration scheme. The average hourly spot price from the previous year is calculated and the price premium that is paid based on that. [4]

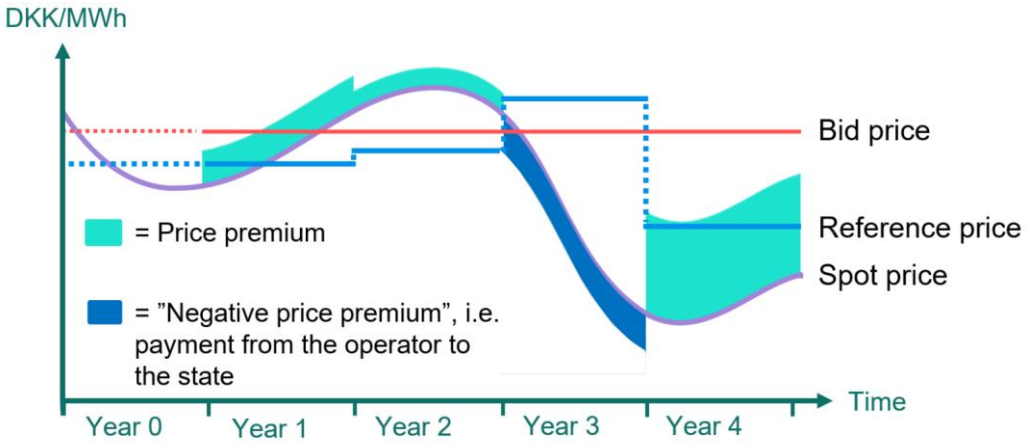

Figure 2: Illustration of the price premium from the state to the concession owner. In year 1 and 2 the average spot price from the previous year is below the bid price, thus a price premium is paid. In year 3 the average spot price is above the bid price and the concession owner must pay to the Danish state. [4]

In order not to encourage electricity production when the electricity price is negative, the price premium will be discontinued in hours where prices are negative in Nord Pool area DK1. Furthermore in years where the concession owner has to pay to the state, the payment by the concession owner is discontinued in hours where the spot price is lower than the 'negative price premium', i.e. the size of the payment from the concession owner. This is to ensure that the concession owner has an incentive to produce electricity [1].

Having the reference price be the simple average of electricity prices from the previous year means that the subsidy is based on past electricity prices, which exposes the concession owner to risk from current price fluctuations. The fact that the concession owner is exposed to the risk from these short-term price fluctuations may lead to higher offered bids which in turn leads to higher cost of the support scheme.

In order to reduce the risk for the state and the concession owner, the total net value of the remuneration payments has been capped for both the state and the concession owner. The state's cap for payments to the concession owner is 6.5 billion DKK and the concession owner's cap for payments to the state is set at 2.8 billion DKK in total, and independent from the capacity that the wind park will have [1].

The rationale of the Danish Energy Agency (DEA) for using the average of the electricity price of the previous year as the reference price is that the concession owner should be incentivised to maximise the market value of the delivered electricity rather than the quantity of the delivered electricity. That is, the price mechanism has been set from a belief that this should incentivise the concession owner to consider design solutions for their wind farms that maximise the market value of the delivered electricity, especially in periods with low wind resource. Such design solutions could e.g. be choosing turbine types that feature lower specific capacity, i.e. larger rotors in relation to generator size, or to adjust wind farm layout, amongst others to produce more full load hours and with a different pattern than the currently dominating turbine types, leading to relatively more production in hours with higher market prices. This is, because high value periods occur in Denmark mostly at times when other wind farms do not produce (much). Such incentive is new in comparison to the hourly-based 'traditional' CfD where the concession owner is incentivised to maximise the quantity of the electricity delivered.

In this respect, it is worth considering the scope for wind farms to optimise production. Once established, the wind farm should obviously maximise production whenever the marginal production cost are below the current electricity price. Such incentive is reasonably well achieved by discontinuing the CfD support at negative spot prices already. The incentive is hence targeted mostly towards technology choices for the design and layout of the wind farm in the project development stage (i.e. before entering the auction). The related optimisation options and optimal choices, however, depend highly on the available technology at the time of bidding on the one hand, and the expected technological development as well as future system characteristics, on the other. To find an optimal match is highly uncertain. Also, we find that this technology choice incentive is achieved as soon as the reference price is being averaged over a reasonable period of time, leaving the wind farm exposed to short-term price variations. For this, it may not be necessary to go back a full year for the averaging, a month or quarter may be equally suitable. Furthermore, some consideration should be given to liquidity constraints. When the premium is set on a yearly basis, high electricity prices in one year would lead to a low premium for the concession owner in the whole next year. A drastic fall in prices in that year could then lead to liquidity issues over a time horizon that may be costly or even problematic for some firms. Some of these concerns could be alleviated by setting the premium for shorter averaging periods at a time (e.g. monthly), as this may create less risk for the concession owner without fundamentally changing the incentive to maximise market value. The shifted annual averaging may have other advantages, e.g. in relation to plannability, but it may come at the cost of slightly higher CfD bids due to the increased risk. It remains subject to further research in how far this design has an overall positive or negative effect on society.

4 Stakeholder involvement process of auction design

The Thor tender was agreed upon in the 2018 Energy Agreement [5]. The wind park was first announced by the Danish Energy Agency in late February 2019[1] and interested parties were invited to a market dialogue on the tendering procedure in September 2019[2].

The DEA and Energinet held a conference and bilateral meetings with interested market players as a part of a market dialogue on the Thor tender. The market dialogue served three main purposes [6].

1. To collect input and reactions to the proposed elements of the tender.
2. To clarify a range of issues.
3. To make valuable adjustments to the tender.

These should facilitate a smoother process, a more informed way of proceeding for all parties and ultimately align expectations, according to the DEA [3].

The market dialogue conference was based on a report published before the conference. The report [3] contained an outline of the main topics in the tender condition, as well some questions for the interested parties. The report contained an outline of the timeline for the project, conditions for pre-qualification, support scheme and award criteria, penalty for defective performance, compliance with the deadline for completing the windfarm, capacity of the wind farm and designated area for construction, offshore grid connection, onshore facilities and point of connection as well as process responsibilities concerning the environmental assessments. Based on these topics, the DEA asked for input from the interested parties to ensure that the tendering procedure reflect current market conditions and the most efficient risk allocation between the state and developer.

The dialogue resulted in a Q&A-report [6]. Based on the questions and feedback from the interested market participants the tender material will be reconsidered, and the final binding tender material will be published in Q3 2020.

[1] Press release (in Danish): https://presse.ens.dk/news/danmarks-stoerste-havvindpark-skal-ligge-i-nordsoeen-360442
[2] Invitation to market dialogue: https://en-press.ens.dk/news/invitation-to-market-dialogue-on-thor-offshore-wind-farm-380307

5 Timeline of the stakeholder involvement process

Leading up to meetings with potential tenderers and investors, the DEA sent out a report called "Invitation to dialogue - The tendering procedure for Thor Offshore Wind Farm project" [3], that outlines the tendering procedure and support scheme.

- On November 25 a conference was held in Copenhagen to discuss the topics outlined in the invitation to dialogue report [3].
- On November 26-29 bilateral meetings, based on the invitation to dialogue report [3], were held.
- On December 3, there was a deadline to submit questions (later published anonymously alongside the respective answers) by e-mail to a general mail DEA mail address.
- The meetings resulted in a Q&A report [6], where the DEA published their answers to the questions to the tendering procedure and support scheme. The report was published on February 7, 2020.

6 Details of the preliminary auction design

Below, we describe the preliminary auction design, as published by the DEA on March 31, 2020 [2].

Design elements	Description
Name of the auction	Thor
Auction format	Following the publication of the final tender material, the tenderers offer their final binding bid stating a capacity between 800 and 1000 MW. There was a prequalification round followed by a final bid round.
Eligible technologies and participation technologies	Offshore wind energy
Auction procedure	Static sealed bid auction. A preliminary technical dialogue between potential bidders and the contracting authority was carried out.
Pre-qualification requirements	• Bidders must demonstrate an annual overall turnover (in IFRS: "revenue") of minimum 26.4 billion DKK (calculated as an average of the latest three financial years available), corresponding to approximately 3.5 billion EUR. • The bidder must have an equity ratio (total equity/total assets x 100) of 20% or above in the most recent annual report/financial statement OR a current long term debt rating of BBB- or above (Standard & Poors and Fitch) and/or Baa3 or above (Moody's) or an equivalent current rating from another reputable international credit rating agency. • Up to five references of development, procurement and management of construction regarding offshore wind farms, at least one with a minimum size of 150 MW installed capacity commissioned in the past five years. At least one reference of development, procurement and management of at least one offshore AC-substation servicing an offshore windfarm completed within the last five years.
Auction volume	The offshore wind farm must have a total capacity of min. 800 MW and max. 1000 MW.
Pricing rule	Pay as bid
Award procedure	The concession will be awarded to the tenderer quoting the lowest price, if the expected subsidy cost of the bid over the 20-year period, is lower than 3.7 billion DKK, regardless of the final amount of capacity (800-1000 MW). However, in the event that no bids results in total subsidy costs, which are within the budget evaluation threshold, there is a chance that a bid can still be accepted. Such a bid can only be successful if accepted by the parties to the Energy Agreement of June 2018, and thus, there is a risk that the tender will not be accepted if the

	political parties behind the energy agreement evaluate that the costs will be too high. If there are two or more bids with the exact same bidding price, and these are the best bids, the bid with the highest capacity (MW) will be chosen. If there are two or more bids with the exact same bidding price and the exact same capacity, and these are the best bids, the winning bidder will be chosen through lottery.
Price limits	The Danish Energy Agency reserves the right to cancel the tendering procedure without awarding the Concession Agreement, if there is objective reason to do so. It could be that the political parties behind the Energy Agreement of June 2018 deem the price too high.
Support period	The subsidies will be granted for a 20-year period. This period will commence from the time of the last commissioned turbine delivering the first kWh and no later than 31 Dec 2027, but with the possibility that the subsidy period can begin sooner if the concession winner should wish so.
Favourable treatment of specific actors	Not part of the auction design.
Realisation time limit	Energinet will build the onshore connection allowing for first power by Q2 2024. The last turbine must be connected to the grid by the end of 2027
Exceptions, special rules	Not part of the auction design.
Form of support auctioned	The concession owner of Thor Offshore Wind Farm will receive subsidies in the form of a price premium from the Danish State for a 20-year period. The subsidies will be granted in accordance with a Contract-for-Difference. It is a two-way CfD with caps on both the Danish State's payment to the concession owner and the concession owner's payment to the Danish State.

7 Conclusions and lessons learnt

The report covered a new auction method for allocating offshore wind development rights with an expanded scope and a two-sided CfD-like remuneration scheme. The new scheme shifts some of the risks from the government to the producers through exposing them to short term market price volatility. It also extends the support period to 20 years, which decreases risk exposure, though is also introduces a cap on overall support payments. The new auction design was created through market engagement via the publishing of a report, a conference, Q&A and bilateral meetings.

The auction scope now includes the developer-led construction and ownership of the full connection infrastructure until the onshore connection point. We consider this a move towards cost-effective allocation.

In the new scheme, the size of the premium is calculated as the difference between the bid price and the average electricity price of the preceding year. This shifts intra-year price volatility to the producer. Some risk is, however, mitigated by the increased duration of the support scheme. The transfer of risk from intra-year price volatility to the producers should encourage value creation through choosing wind park layouts that capture more wind when electricity prices are high. This could also encourage an increased diversity in wind farm designs if the method was used for auctions beyond the Thor wind park. The optimisation potential is reduced by the uncertainty of estimating the optimal setup and is likely smaller in the short term where the available turbine technology is fixed. The enhanced flexibility in capacity choice (as compared to previous auctions), with allowed wind part capacity being between 800 and 1000 MW, may increase optimisation flexibility.

The effects from the trend of the electricity price over the course of a year may be considered a side effect of the fact that the updates to the baseline are calculated annually. It shifts the risk associated with price trends over the course of a year from the government to the producer. It could create liquidity problems for the producers especially in the case in the case of multi-year trends, where the producers might earn less than expected for many years in a row. Reducing the averaging period would decrease the likelihood of liquidity problems for the investors. However, it would also narrow the scope of optimising the wind farm for, for example, seasonal variability, if monthly or quarterly averaging periods were used.

As with previous schemes, the premium is not paid out for hours when electricity prices are negative, which is relevant to avoid distortions in market bidding through misleading incentives. Due to the new situation of potentially negative premiums in certain years, the mechanism was updated so that premium payments are also seized when a negative premium would turn an otherwise positive electricity price negative. We find this to adequately address the otherwise potentially arising issues of less-than-efficient production from the wind park.

Overall, we conclude that the new design incentivises the optimisation of the layout and technology choice for wind farms to better match grid and market requirements in the short term. If the new design will lead to different technology choices and at the same time can deliver on the expectations for very low support cost, remains to be seen.

References

[1] Danish Energy Agency, »Subsidy scheme and other financial issues for Thor OWF,« 2020. [Online]. Available: https://ens.dk/sites/ens.dk/files/Vindenergi/subsidy_scheme _and_other_financial_issues_31march2020.pdf.

[2] Danish Energy Agency , »Tender for Thor OWF: Expected tender procedure and conditions for participation,« 2020. [Online]. Available: https://ens.dk/sites/ens.dk/files/ Vindenergi/tender_procedure_and_conditions_for_participating_31march2020.pdf.

[3] Danish Energy Agency, »Invitation to dialogue - The tendering procedure for Thor Offshore Wind Farm project,« 2019. [Online]. Available: https://ens.dk/ sites/ens.dk/files/Vindenergi/invitation_to_dialogue_-_thor_2019_002.pdf.

[4] T. K. Jensen, »Market dialogue on Thor call for tender: Subsidy scheme and award criteria,« 25 November 2019. [Online]. Available: https://ens.dk/sites/ens.dk/files/ Vindenergi/3_subsidy_scheme_and_award_criteria.pdf. [Senest hentet eller vist den 8 June 2020].

[5] E. o. f. Klima, »Energy Agreement,« 29 June 2018. [Online]. Available: https://en.kefm.dk/ media/12307/energy-agreement-2018.pdf. [Senest hentet eller vist den 5 June 2020].

[6] Danish Energy Agency, »Report on Q&A for Nov. 2019 market dialogue concerning Thor offshore wind farm tender conditions,« 2019. [Online]. Available: https://ens.dk/ sites/ens.dk/files/Vindenergi/qa_market_dialogue_on_thor_tender_7feb2020_final.pdf.

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

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

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