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A Market Approach for Valuing Offshore Wind Farm Assets

Global results

9th Edition · August 2017

1. Introduction

The renewable energy sector keeps attracting investors from all over the world

While overall investment activity in the renewable energy sector went down, 2016 was a record-breaking year for offshore wind. Offshore wind experienced the most positive year of all technologies in the renewable energy sector, with investment commitments reaching $30 billion in 2016, up by 41% on 2015. This improvement is due to more attractive project and construction economics, resulting from bigger turbines and greater construction efficiency[1].

Global new investments in clean energy were $288 billion in 2016, down by approx. 12% from $329 billion in 2015. Installed wind power also went down from 63 GW in 2015 to 56.5 GW in 2016. The 7 largest financings of renewable energy investments in 2016 were all in offshore wind power in Europe, with Chinese offshore wind power deals following just behind.

In 2016, global installed wind capacity reached 486.7 GW[2]. Of the total global installed capacity, the 2 largest markets, Europe and China, accounted for almost 75%, with 161 GW and 204 GW, respectively[2].

The International Energy Agency (IEA) estimates that total wind capacity is expected to reach approx. 1,350 GW by 2040.
By 2040, IEA expects offshore wind power capacity in the EU to exceed 65 GW, accounting for one fifth of the overall wind power capacity in that region (estimated at 336 GW). In China, IEA expects total offshore wind capacity to reach nearly 50 GW by 2040, accounting for approx. 12.5% of total installed wind capacity in China (estimated at 399 GW)[3]. Europe and China will still be the biggest markets followed by the US and India. IEA has updated the 2050 target of total global electricity originating from wind energy from 12% to 15-18%[4]. Since the wind market has grown at high speed and as growth is expected to continue, we have found it interesting to examine how the market values onshore and offshore wind farm assets.

Due to significant investments in renewable energy assets, we find it interesting to identify prices paid by investors across technologies and project lifecycles. This paper addresses how multiple regression analyses of transaction multiples can be used as a benchmarking tool to support a more comprehensive valuation based on a cash flow model when valuing offshore wind farm assets.

[1] Bloomberg New Energy Finance, Press release "Record $30BN year for offshore wind but overall investment down", 14 February 2017
[2] Global Wind Energy Council, "Global Wind Statistics 2016"
[3] International Energy Agency, "World Energy Outlook 2016"
[4] International Energy Agency, "How2Guide for Wind Energy", 2014

2. Executive summary

In 2016 costs of offshore wind energy decreased significantly while transaction prices increased

Costs of energy decreased significantly
Offshore wind assets have undergone tremendous progress in the last few years and have already surpassed the 2020 industry targets for levelised cost of energy (LCOE) mainly due to increased market competition, deployment of new technology and decreased cost of capital. The rapid decrease in LCOE for new offshore wind projects contradicts the slight increase in estimated installed capacity multiple. However, the transactions most recently added to our data sample have been developed under previously and more favourable subsidy regimes. As the majority of offshore wind farm divestments happen close to or after commissioning, and due to the extensive development and construction time, the most recent tenders will not be included in our data sample.

In April 2016 the lowest bid yet was achieved on an offshore wind power project in Europe[1]. 2 bids were made at zero euros, thus receiving only the wholesale power price and precluding subsidies from operations. Successful bidders in Germany, Denmark and the Netherlands receive a free onshore and offshore grid connection and connecting sub-sea cable. This means that the projects will still receive a one-off subsidy in the construction of the wind farms. Nevertheless, this is indeed an important milestone for renewable energies.

Transaction prices increased slightly
Since the release of the 8th edition of this analysis in April 2016, we have added 7 transactions that are suitable for our analysis of offshore wind farm assets. The sample now totals 45 transactions, and the explanatory power of our model is 91%.

The installed capacity wind farm multiple has increased from 4.6x in the 8th edition, to 4.7x in this 9th edition. Multiples for under construction capacity and late stage capacity have remained at 1.9x and 0.2x respectively.

Our analyses of offshore wind farm transactions have led to the conclusion that installed capacity, capacity under construction and capacity in late stage pipeline affect the enterprise value of transactions significantly. Additionally, we have concluded that investors in wind farm assets do not assign any significant value to capacity in early stage pipeline.

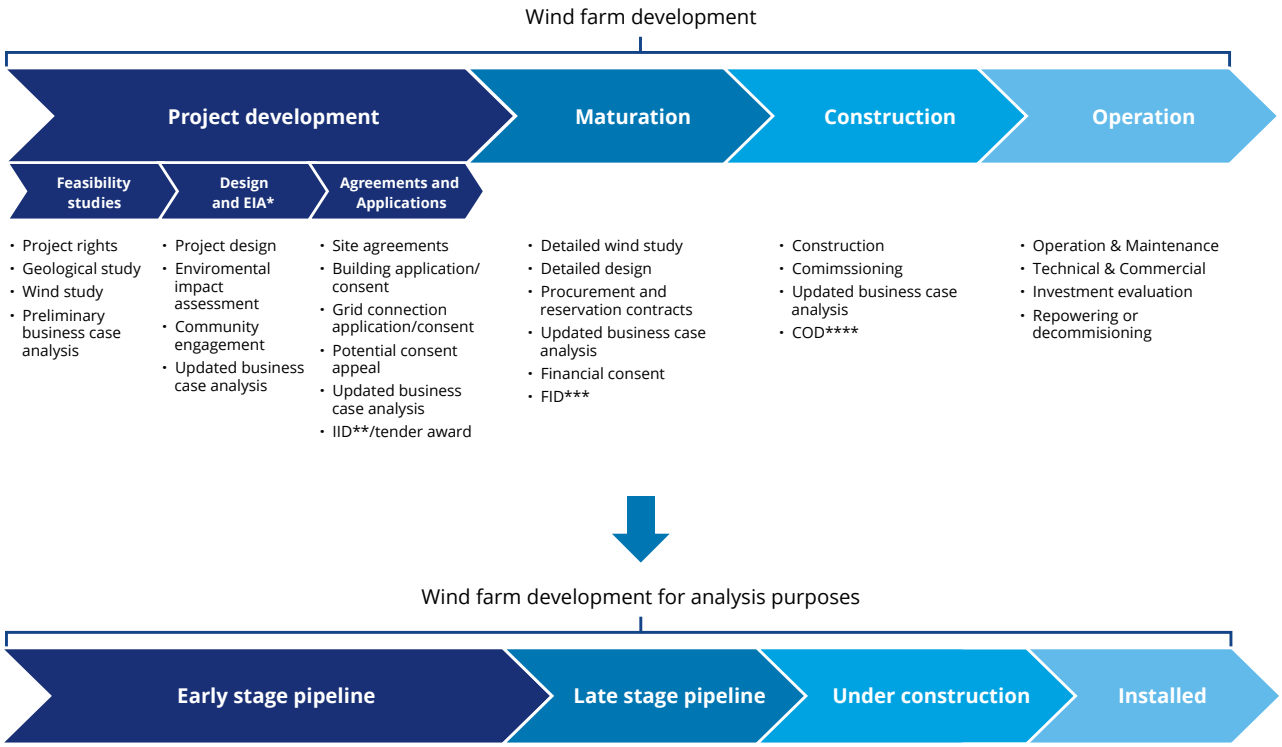
Offshore wind assets have undergone tremendous progress in the last few years and have already surpassed the 2020 industry targets for levelised cost of energy (LCOE)

[1] http://www.dongenergy.com/en/media/newsroom/company-announcements-details?omxid=1557851
[2] https://www.gov.uk/government/statistics/energy-trends-section-6-renewables

3. Methodology

Introduction

This paper addresses how multiple regression analyses of transaction multiples can be used as a benchmarking tool to support a more comprehensive valuation based on a cash flow model. We present the technical considerations underlying the analyses followed by practical examples that illustrate how the results can be applied from a valuation perspective. From our point of view, one of the main challenges is the determination of the market value of wind capacity in different stages of the project lifecycle. We define a project lifecycle for wind farms as illustrated in the figure below.



Note: * Environment Impact Assessment, ** Initial Investment Decision, *** Final Investment Decision, **** Commissioning Date.
Source: Deloitte analysis

We recognize that transaction prices depend on other factors than capacity, such as age of the wind farm, operating costs, local wind conditions, operating efficiency, power price agreements, local tax rules, subsidies and financing – most of which are country dependent. Hence, we also test for geographical effects and refer to "A market approach for valuing wind farm assets – geographical analysis and transaction details" and the order form at the bottom of that analysis.

Since wind and solar farm assets have different characteristics, and since offshore wind farm assets differ from onshore wind farm assets, we perform 3 separate analyses in 3 separate papers - 2 papers with analyses solely based on transactions in the offshore and onshore wind farm industries respectively and 1 paper solely based on transactions in the solar PV farm industry. The approach yields "clean" multiple estimates for the different stages of the project, and it indirectly implies that in our analyses we assume that there is no interaction effect between holding a portfolio containing more than 1 kind of these assets. The multiple regression analysis is a market-based valuation approach as it is based on data from historical transactions.

In the analyses, we disaggregate transactions into the different project stages as illustrated in the figure above. This disaggregation makes it possible to apply the multiple regression approach and gives us the possibility of assigning separate multiples to each stage of the project. The reason for applying the multiple regression approach is that it allows us to estimate EV/MW multiples for the capacity in each stage of the project lifecycle.

The quality of a multiple regression analysis is critically dependent on the quality of the underlying dataset. Hence, the data collection process becomes important to ensure sufficient and reliable data. It is our experience that collection of data is one of the main challenges when using statistical analysis. The accessibility of EV and the total capacity of target's assets divided into the different project stages have been the primary criteria for including transactions in our analyses.

Below we give a more thorough introduction to the multiple regression analyses and present the underlying technical considerations of the analyses we have performed. To exemplify the analyses, we use a fictive company named Renewable Energy Company (REC) throughout the paper to illustrate how a multiple regression can be applied for valuation purposes. REC has wind farm assets in different lifecycle stages as illustrated in the table below.

The following sections 4 and 5 are structured in the same way. We present the findings of the regression analysis, followed by practical examples that illustrate how the results can be applied from a valuation perspective.

Renewable Energy Company (REC)

MWs	Early stage	Late stage	Under construction	Installed
Wind farms	1,600	800	400	200
Total	**1,600**	**800**	**400**	**200**

Source: Deloitte analysis

Identification of data and choice of method

Our analysis of the value of wind farm assets is based on transactions over the past 10 years to secure a sufficient dataset. We have identified 372 wind farm transactions, which we find suitable for our multiple regression analysis. Of these transactions, 327 are transactions of onshore wind assets. The remaining 45 transactions are transactions of offshore wind assets covered in this analysis.

Our analyses derive from the following regression model (1) which we have performed on onshore and offshore transactions. Based on this model, we find that installed capacity, capacity under construction and capacity in late stage affect the EV of onshore wind farm assets significantly. In addition, based on this model, we can conclude that early stage capacity has no meaningful effect on the EV (multiple close to nil) in onshore wind farms. Our analysis of offshore wind transactions leads to similar results. Hence, the early stage multiple has been excluded from the following analyses.

(1) $EV = \alpha + \beta_1 \cdot MW_{installed} + \beta_2 \cdot MW_{under\ construction} + \beta_3 \cdot MW_{late\ stage} + \beta_4 \cdot MW_{early\ stage}$

4. Transaction analysis

By excluding early stage capacity from model (1) we find that for offshore wind assets the EV/MW multiples for installed capacity, capacity under construction and capacity in late stage are EUR 4.7m, EUR 1.9m and EUR 0.2m. The regression has a coefficient of determination (~ R-squared) of 0.91. In other words, 91% of the variation in EV for offshore wind farm assets can be explained by the capacity in each stage of the project lifecycle. The installed capacity multiple has increased by EUR 0.1m on last year's edition. This result is rather counterintuitive, as the industry has been expecting lower offshore wind energy costs in the last years as well as significant decreases have been projected towards 2020.

Applying these multiples on REC's assets (assuming now that all REC assets are offshore wind assets) yields a base case value of the offshore wind farm assets of EUR 1,911m. The results of the analysis are summarised in the table below.

Due to a rather limited dataset of only 45 offshore transactions, our offshore regression analysis is subject to more uncertainty than our onshore analysis. In addition, the relatively larger variation in the size of offshore wind farms compared to onshore wind farms will skew the regression analysis such that the large wind farms dictate the regression estimates of the multiples.

As the offshore dataset is characterised by many of the transactions concerning capacity in only 1 stage[1] of the project life cycle, we have calculated weighted average and median multiples for the different development stages. The valuation of REC with the weighted average and median multiples is illustrated together with the regression-based valuation in the table below.

Regression and valuation of offshore wind farm assets

EURm	Late stage	Under construction	Installed
EV/MW coefficient[1]	**0.2x**	**1.9x**	**4.7x**
Significance (p-value)	0.0	0.0	0.0
Upper 95%	0.5	2.9	5.1
Lower 95%	0.0	1.0	4.2
REC wind MWs	**800**	**400**	**200**
EV/MW coefficient[1]	**0.2x**	**1.9x**	**4.7x**
REC wind EVs	196	779	936
REC total EV			**1,911**
Weighted average	**0.3x**	**2.1x**	**4.3x**
REC wind EVs	210	848	865
REC total EV			**1,923**
Median	**0.3x**	**2.2x**	**4.4x**
REC wind MWs	222	861	872
REC total EV			**1,954**

1 Transactions (n): 45, R-square: 0.91
Note: The weight in the weighted average of price multiples is given by the capacity in the individual transaction.
Source: Deloitte analysis

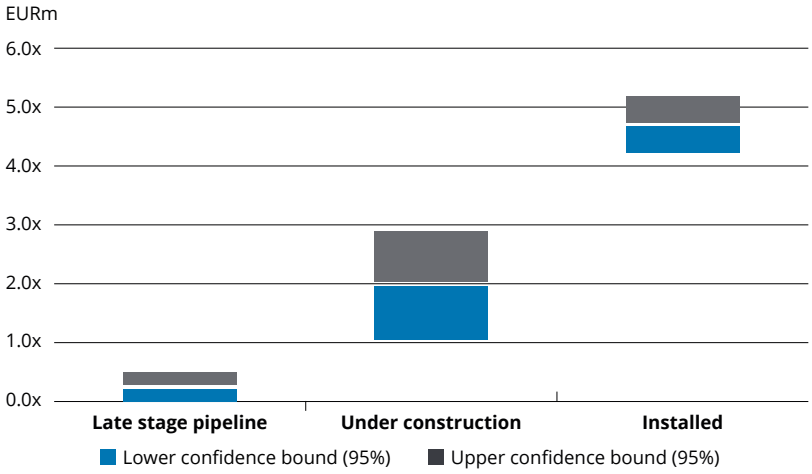
[1] All transactions that involve more than 1 stage also involve early stage capacity. However, the early stage multiple can be set at nil according to our regression analysis.

A multiple regression analysis is subject to uncertainty, just like any other valuation method. One advantage of statistical models compared with other models is that the uncertainty is easier to quantify. The uncertainty can be expressed by the statistical term "standard error". The standard error is calculated for each EV/MW multiple and can be used to determine a lower and upper boundary, i.e. a value interval at a certain confidence level. Our analysis is based on a 95% confidence level. This can be interpreted as the EV/MW multiple estimate being within this interval with 95% confidence.

The lower boundaries for the EV/MW multiples on offshore wind assets are EUR 4.2m, EUR 1.0m and EUR 0.0m for installed, under construction and late stage capacity, respectively. The upper boundaries for the EV/MW multiples are EUR 5.1m, EUR 2.9m and EUR 0.5m for installed, under construction and late stage capacity, respectively. The low significance of the late stage multiple is reflected in a wide interval for this multiple measured in percentage relative to the coefficient. Hence, we have set the lower boundary at nil in order to preserve the economic meaning of this multiple. To narrow down the intervals of the multiples, more transactions are needed.

The precision of our offshore EV/MW estimates has increased on last year's edition of our analysis, which is mainly attributed to the larger dataset that is now available. For instance the uncertainty of the installed capacity multiple for offshore wind farms was reduced by 15% in last year's edition. Additionally, in this year's edition, the uncertainty has decreased by 12%. The uncertainty intervals of the estimated EV/MW multiples from our regression are illustrated in the figures on the right and below.

We apply these lower and upper boundaries in the valuation of REC's wind farm assets to determine a lower and an upper value. The figure below illustrates the uncertainty of REC's capacities in different stages of development. Based on these upper and lower boundaries, our analysis indicates that the value of REC's wind farm assets lies within the interval of EUR 1,233 - 2,617m. These estimates are approx. 35% lower/higher compared with the base case value.



Source: Deloitte analysis

Offshore wind farm valuation uncertainty

EURm	Late stage	Under construction	Installed
Upper EV/MW multiple	**0.5x**	**2.9x**	**5.1x**
REC wind MWs	800	400	200
REC wind EVs	419	1,168	1,030
REC upper EV			**2,617**
Lower EV/MW multiple	**0.0x**	**1.0x**	**4.2x**
REC wind MWs	800	400	200
REC wind EVs	0	390	843
REC lower EV			**1,233**

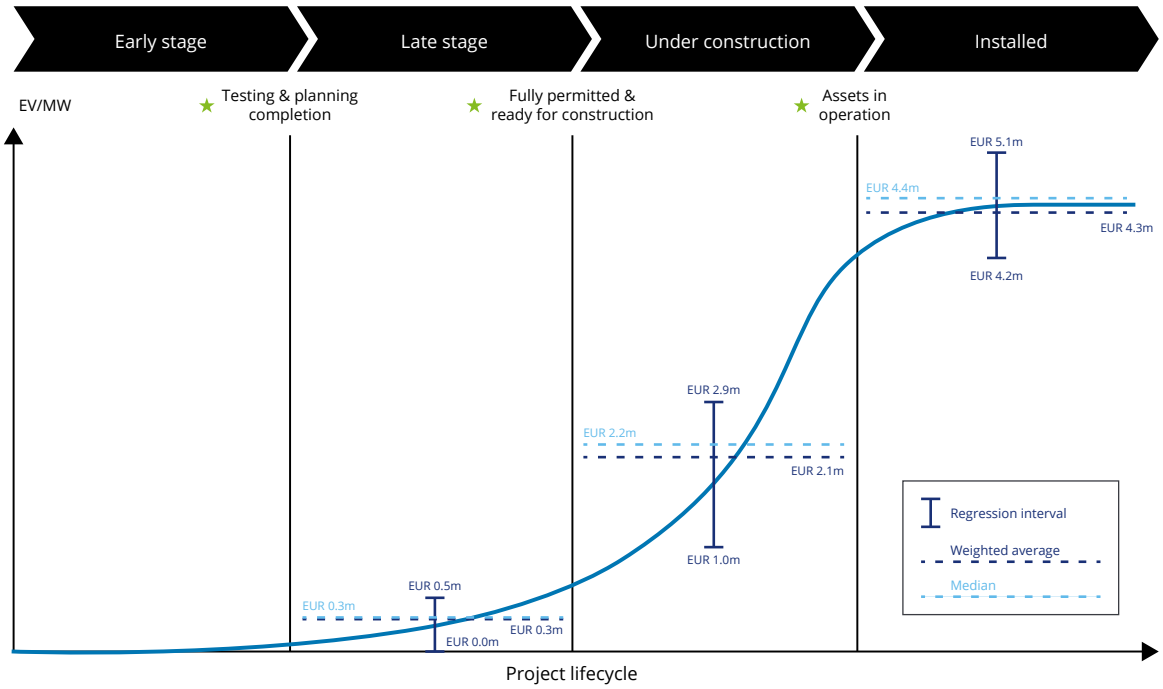
The uncertainty of the EV/MW multiples consists of statistical uncertainty and general value creation uncertainty. Among other things, the statistical uncertainty relates to the size of the dataset, and as we add more transactions to the dataset, some of this will diminish. However, the other part of the uncertainty interval will not. Value is created within the different stages of development and this creates a price interval for the EV/MW multiples. In particular, the value of a project under construction is highly dependent on the amount of project costs accrued by the developer, which is also emphasised by the relatively higher uncertainty of this multiple.

The figure below illustrates the development of the EV/MW multiple during the project lifecycle of an offshore wind farm asset. The confidence intervals from the multiple regression as well as the weighted average and median multiples for the different stages are illustrated by the dark-blue and the light-blue dotted lines.

The weighted average multiples are EUR 4.3m, EUR 2.1m and EUR 0.3m per MW for installed, under construction and late stage capacity, respectively, while the median multiples are EUR 4.4m, EUR 2.2m and EUR 0.3m, respectively, per MW. These estimates support the multiples from our regression.

Note that the estimated transaction multiples for offshore wind farms differ significantly from those found in the onshore industry. Offshore wind farms trade at higher multiples than onshore wind farms. This is due to higher offshore wind farm capex that projects need to recoup through higher tariffs and larger productions.

The higher capex in offshore wind projects relative to onshore wind project is due to a number of reasons. There are some fundamental differences between onshore and offshore wind farms. The reasons for the higher offshore wind farm capex are larger and more expensive foundations, difficult installation environment and higher transport costs, primarily driven by rentals of large vessels. Furthermore, the offshore wind industry is still maturing. This means that technological elements for harsh offshore conditions are still being tested and developed, while also the offshore supply chain is developing to match the needs of the industry.



Source: Deloitte analysis

5. LCOE development

For long, a leveraged cost of energy (LCOE) of EUR 100 per MWh has been the threshold for the offshore wind industry. In 2012, Crown Estate set out a LCOE target of EUR 115 per MWh (GBP 100 per MWh) by 2020[3], a target that was adopted as the industry target. However, DONG Energy, 1 of the largest players in the industry, set a target of EUR 100 per MWh by 2020[4].

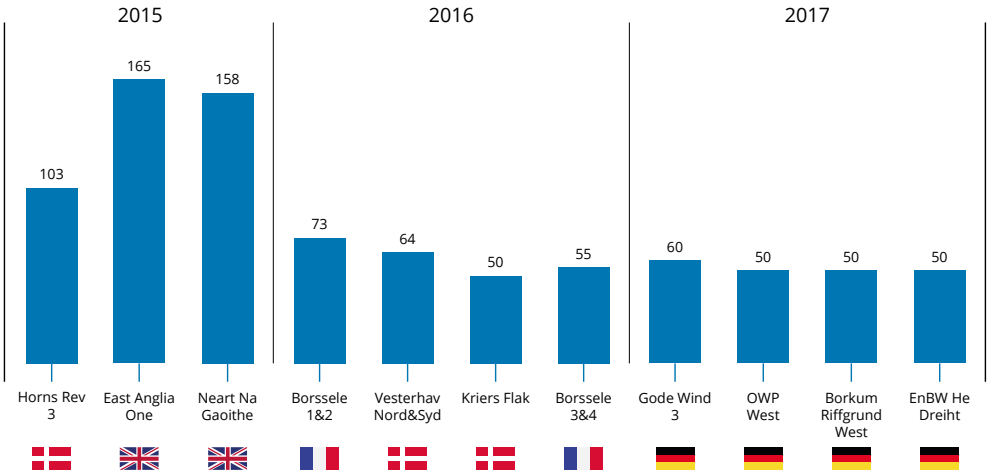
The International Renewable Energy Agency[5] expects that the global weighted average LCOE for offshore wind will realise a reduction of 35% by 2025 compared to 2015, bringing the global weighted average LCOE to EUR 108 per MWh.

However, recent tenders in the major European offshore wind markets (see illustration below) have shown that the EUR 100 per MWh threshold has already been surpassed. In the most recent German tenders, 3 out of 4 projects were awarded zero subsidy and will receive no subsidy additional to the market power price. These projects receive only the free offshore grid connection and connecting sub-sea cable as a 'construction subsidy'.

Projects Gode Wind 3, OWP West and Borkum Riffgrund West are planned to be commissioned in 2024, while EnBW he Dreiht is expected to be commissioned in 2025.

Additionally, studies[6] find that UK offshore wind farm projects reaching final investment decision (FID) in 2015-2016 achieved an average LCOE of EUR 109 (GBP 97) per MWh, surpassing the 2020 target set out by Crown Estate.

The rapid decline in LCOE is primarily caused by 3 main drivers. Firstly, intensified market competition among developers to win the limited amount of tenders, leading to intensified demand for cost cutting throughout the supply chain. Secondly, the rapid development of larger and more effective turbines which are the single largest sources of cost reduction[7]. Thirdly, as the risk of offshore wind farm projects is reduced, investors gain confidence with technology, lowering the cost of capital available for offshore wind farm projects.



Note: Dutch and Danish prices do not include transmission
*German tender prices includes an assumed power price of 50 EUR/MWh
Source: 4C Offshore, company homepages

[3] The Crown estate, "Offshore Wind Cost Reduction – Pathways Study", May 2012
[4] http://www.dongenergy.com/en/media/newsroom/news/articles/dong-energy-wins-tender-for-dutch-offshore-wind-farms
[5] IRENA, "The Power to Change: Solar and Wind Cost reduction Potential to 2025", June 2016
[6] Catapult Offshore Renewable Energy, "Cost Reduction Monitoring Framework", 2016
[7] Catapult Offshore Renewable Energy, "Cost Reduction Monitoring Framework", 2016

6. Appendix A: Summary of transaction data from the offshore wind farm industry

Offshore wind farm transactions

Source: Deloitte analysis

		EV in EURm			Installed MWs		Under constr. MWs		Late stage MWs		Early stage MWs	
	Obs.	**Min.**	**Max.**	**Average**	**Total**	**Average**	**Total**	**Average**	**Total**	**Average**	**Total**	**Average**
Overall	**45**	**12**	**3,799**	**748**	**6,012**	**134**	**1,984**	**44**	**7,534**	**167**	**7,806**	**173**
Geography												
Denmark	3	188	1,609	756	773	258	-	-	-	-	-	-
Germany	14	12	1,700	702	1,681	120	330	24	1,513	108	2,606	186
UK	26	42	3,799	810	3,558	137	1,654	64	3,543	136	5,200	-
Netherlands	1	29	29	29	-	-	-	-	1,050	1,050	-	-
France	1	451	451	451	-	-	-	-	1,428	1,428	-	173
Netherlands	1	29	29	29	-	-	-	-	1,050	1,050	-	-
France	1	451	451	451	-	-	-	-	1,428	1,428	-	173

Source: Deloitte analysis

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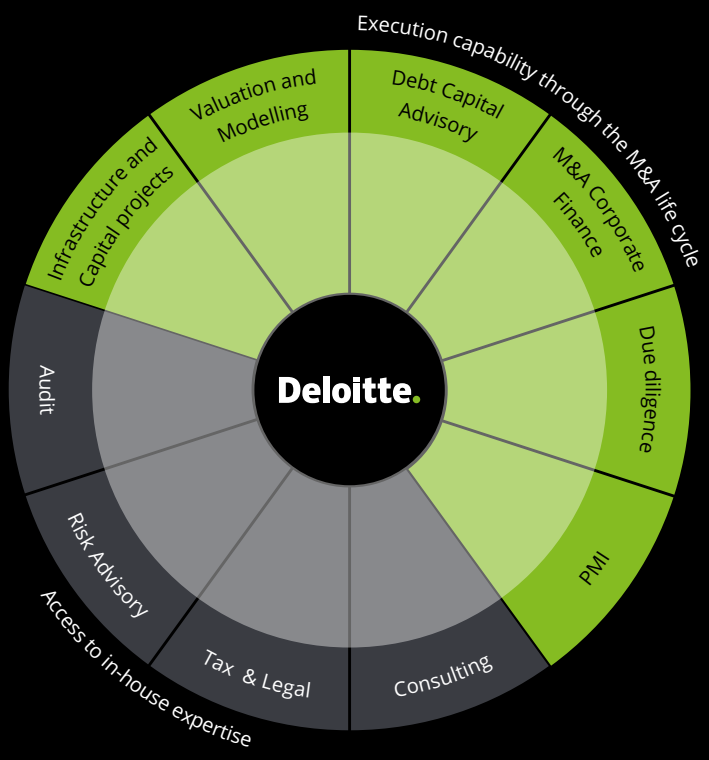

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