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# A market approach for valuing wind farm assets
## Global results

April 2015

# Table of contents

# 1. Foreword

**In recent years investors all over the world have paid increasing attention to the renewable energy industry.**

This trend has translated into rapid renewable energy commercialisation and considerable industry expansion, of which the wind industry is a good example. According to Bloomberg New Energy Finance, investments in new capacity of wind energy rose by 11% to a record of $995bn in 2014 to comprise one third of all investments in renewable energy this year.[1]

With a record-high total of 51 GW installed wind energy capacity in 2014, annual installations were up from 35 GW in 2013. Of the 51 GW, China accounted for more than 23 GW, whereas Europe accounted for 13 GW of new capacity. In 2014 global installed wind capacity reached a total of 369 GW.[2]

The International Energy Agency (IEA) estimates that total onshore wind capacity is expected to have reached 1,130 GW by 2035 and offshore wind capacity will add 190 MW to this. The wind industry's share of global energy generation will increase significantly up to 2040. By then it is expected that wind energy will account for approx. 8% of total electricity generation[3], up from 3% in 2013[4]. In the longer run, IEA has updated the 2050 target of total global electricity originating from wind energy from 12% to 15-18%.[5]

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.

[1] Bloomberg New Energy Finance, "Rebound in Clean Energy Investments in 2014 beats expectations"
[2] Global Wind Energy Council, "Global Wind Statistics 2014"
[3] International Energy Agency, "World Energy Outlook 2014"
[4] Global Wind Energy Council, "Global Wind Energy Outlook 2014"
[5] International Energy Agency, "How2Guide for Wind Energy 2014"

# 2. Executive summary

In the past few years focus on renewable energy has led to high growth in investments in renewable energy assets. Especially wind and solar assets have been exposed to great interest from investors, and the markets expect high growth rates in investments in these assets in the coming decades. Due to the current growth and expectations for these markets, we find it interesting to identify the structure of assets held by wind and solar farm investors and to create suitable methods to value such assets.

This paper addresses how and why multiple regression analyses of wind farm transactions are a good supplement to more comprehensive cash flow models when valuing wind farm assets. Our analyses of onshore 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. Our analysis of offshore wind transactions leads to similar results. However, not surprisingly, we see more value in each stage in offshore projects.

We have performed a similar analysis of solar PV farm assets and we refer to "A market approach for valuing solar PV farm assets" for that analysis.

Since the release of the 6th edition of this analysis in April 2014, we have added additional 48 transactions that are suitable for our analysis of wind farm assets. The sample now totals 280 transactions, including 243 onshore and 37 offshore transactions. The explanatory power of the onshore and offshore model is 95% and 93%, respectively. The precision of our analyses increases as the dataset grows, and this year we have therefore been able to reduce the uncertainty related to the installed capacity multiple for onshore wind assets by 3% compared to the last edition of this paper. The uncertainty in the installed capacity for offshore transactions has been reduced by 21%.

Due to the large size of the dataset, we have been able to perform various in-depth analyses. We have analysed whether the value of installed onshore capacity has changed over time. Our analysis shows an overall decline in installed capacity multiples of EUR 0.4m per MW between the peak in 2008 and 2012. However we also show indications of increasing transaction multiples between 2012 and 2014. This is consistent with reports on increasing construction costs during the past years. Since 2008 the overall decline in the installed onshore capacity multiple has been approx. EUR 0.3m.

Furthermore we have analysed how the age of the wind farm affects the level of the installed company multiple. Our analysis suggests an installed capacity multiple of EUR 1.84m per MW for a newly commissioned wind farm and a discount of EUR 0.07m per MW for each year the wind farm has been operational.

We have tested for geographical differences in prices of onshore assets. We conclude that installed capacity in North America trades at a lower price than the global multiple, while installed capacity in Europe trades at the global multiple. We also find that large variations exist among the European countries. We find that installed capacity in France, Poland and Germany trades at a discount while installed capacity in Spain and the UK trades at a premium compared with the global multiple. Installed capacity in Asia also trades at a discount compared with the rest of the world, while Australia & New Zealand as well as Central & South America trade at a premium.

For transaction details and details on the geographical analysis we refer to "A market approach for valuing wind farm assets – Geographical analysis and transaction details" and the order form on page 23.

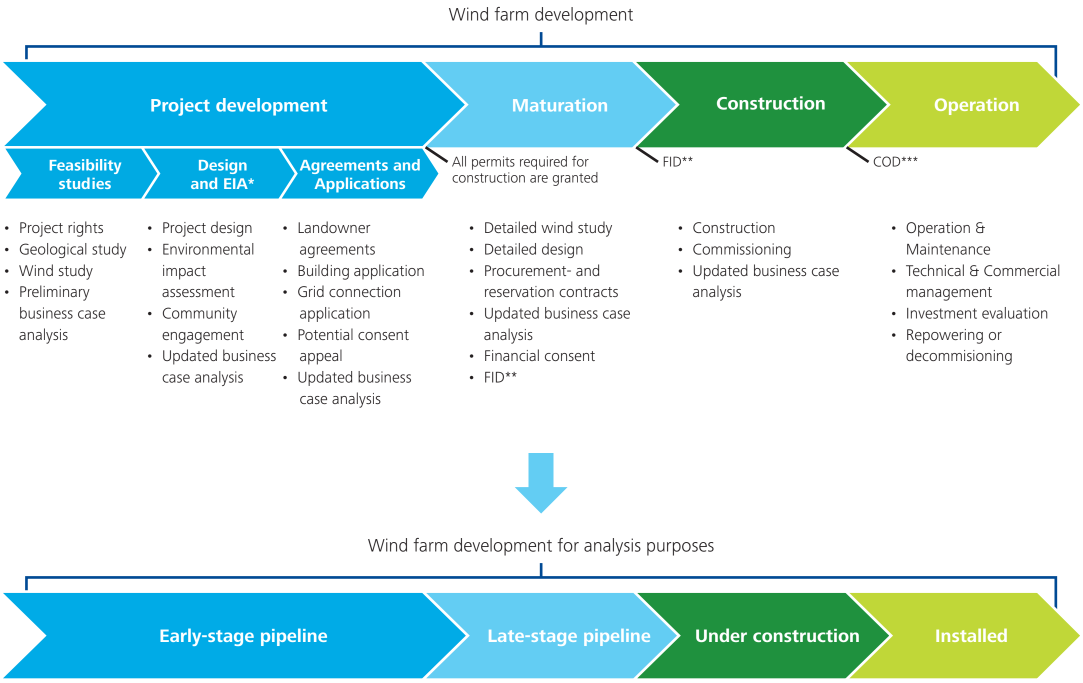
# 3. Methodology

### Introduction

This paper addresses how multiple regression analysis 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 analysis 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.

**Project lifecycle of wind farm assets**




Note: * Environment Impact Assessment, ** Final Investment Decision, *** Commissioning Date. Note that differences will occur between offshore and onshore wind farms and countries.
**Source:** Deloitte analysis

We recognise that transaction prices depend on other factors than capacity, such as age of the wind farm, the surrounding environment, local wind conditions, operating efficiency, power price agreements, local tax rules, subsidies and financing – most of which are country dependent. Therefore 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 on page 23 for 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 2 separate papers – one paper with analyses solely based on transactions in the wind farm industry and one paper solely based on transactions in the solar PV farm industry. The wind analysis is divided into an onshore and an offshore analysis. 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 one 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 also 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. Therefore 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 enterprise value and the total capacity of target's assets divided into the different project stages have been the primary criterias 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 analysis that we have performed. To exemplify the analyses performed, 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. First 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 9 years to secure a sufficient dataset. We have identified 280 wind farm transactions, which we find suitable for our multiple regression analysis. Of these transactions, 243 are transactions of onshore wind assets while 37 are transactions of offshore wind assets.

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

By excluding early stage capacity from the model (1), we find that for onshore wind assets the EV/MW multiples for installed, under construction and late stage capacity are EUR 1.7m, EUR 0.8m and EUR 0.3m. The regression has a coefficient of determination (~ R-squared) of 0.95, which can be interpreted as the analysis having high statistical explanatory power. In other words, 95% of the variation in enterprise value for onshore wind farm assets can be explained by the capacity in each stage of the project lifecycle. Applying these multiples on REC's assets yields a base case value of the wind farm assets of EUR 860m. The results of the analysis are summarised in the table below.

**Regression and valuation of wind assets**

| EURm | Late stage | Under construction | Installed |
|---|---|---|---|
| **EV/MW coefficient[1]** | **0.3x** | **0.8x** | **1.7x** |
| Significance (p-value) | 0.0 | 0.0 | 0.0 |
| Upper 95% | 0.3x | 0.9x | 1.7x |
| Lower 95% | 0.2x | 0.7x | 1.6x |
| **REC wind MWs** | **800** | **400** | **200** |
| REC wind EVs | 208 | 321 | 331 |
| **REC total EV** | | | **860** |

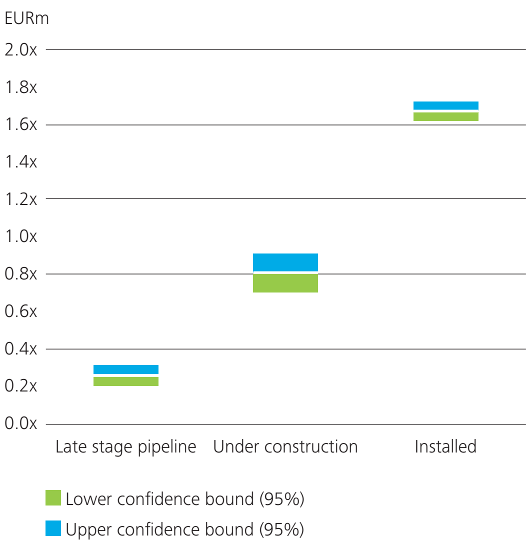
[1] Transactions (n): 243, R-square: 0.95
**Source:** Deloitte analysis

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 onshore wind assets are EUR 1.6m, EUR 0.7m and EUR 0.2m for installed, under construction and late stage capacity while the upper boundaries for the EV/MW multiples are EUR 1.7m, EUR 0.9m and EUR 0.3m for installed, under construction and late stage capacity.

The precision of our onshore EV/MW estimates has increased on last year's edition of our analysis, which is mainly attributed to the increasing size of the data. For instance the uncertainty of the installed capacity multiple for onshore wind farms has been reduced by 3% since the last edition of this analysis. The uncertainty intervals of the estimated EV/ MW multiples are illustrated in the figure below.

**Uncertainty intervals for onshore stage-multiples**




**Source:** Deloitte analysis

We apply the lower and upper boundaries in the valuation of REC's wind farm assets to determine a lower and an upper value. The table 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 approx. EUR 750-950m with 95% certainty. These estimates are approx. 12% lower/higher compared with the base case value.

**Wind asset valuation uncertainty**

| EURm | Late stage | Under construction | Installed |
|---|---|---|---|
| **Upper EV/MW multiple** | **0.3x** | **0.9x** | **1.7x** |
| REC wind MWs | 800 | 400 | 200 |
| REC wind EVs | 256 | 364 | 343 |
| **REC upper EV** | | | **963** |
| **Lower EV/MW multiple** | **0.2x** | **0.7x** | **1.6x** |
| REC wind MWs | 800 | 400 | 200 |
| REC wind EVs | 159 | 278 | 319 |
| **REC lower EV** | | | **756** |

**Source:** Deloitte Analysis

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 uncertainty will diminish. However the other part of the uncertainty interval will not. Value is created within the different stages of development and that 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 onshore wind farm assets. The confidence intervals from the multiple regression are also illustrated.

### Early stage
During the early stage of the project the value increase is relatively low, i.e. the change in enterprise value is small. There are some costs related to wind testing, securing land, planning, etc., but they are not substantial. However, when dealing with offshore projects, there are significantly higher capex related to these preliminary analyses.

### Late stage
During the late stage the value of the project increases as project developers obtain project permits from local authorities and secure turbines and debt financing. As the value in this stage increases, we expect greater variation in transaction prices. The greater variation is due to greater differences between the value created for projects that have just entered the late stage and projects that are close to enter the under construction stage.

### Under construction stage
Most of the value appears to be created in the under construction stage, presumably because the majority of project costs occur in this stage. This is also reflected in the results as this stage exhibits the widest uncertainty interval. This underpins one of the general drawbacks with relative valuation models compared with for example cash flow models. For instance, projects in which the wind turbines have been paid for will acquire a multiple near the upper bound of our construction stage interval

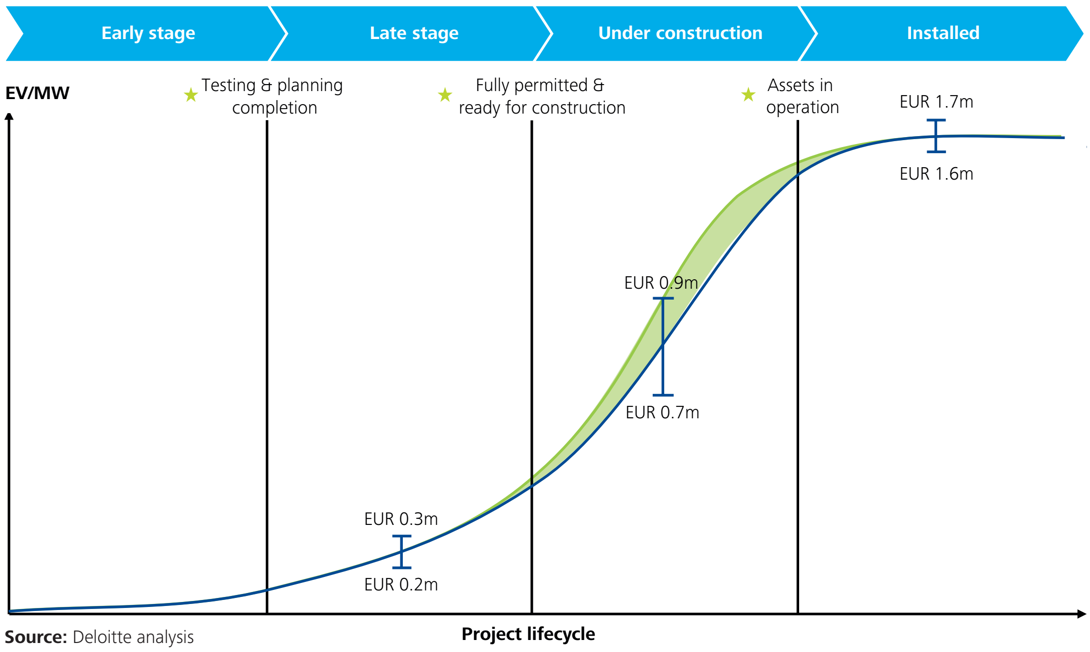
and vice versa. The hatched area in the figure shows how potential large differences in accrued capex in the under construction stage affect this multiple.

### Installed MWs

Upon completion, the project reaches its highest multiple. There are still differences in transaction prices which can be explained by other factors than capacity, such as age of the wind farm, local wind conditions, operating efficiency, power price agreements, local tax rules, subsidies and financing.

For offshore projects, sea depth and distance to shore are also significant factors. As mentioned above, the EV/MW multiple for installed capacity is subject to least uncertainty.

**Lifecycle/value creation for onshore wind farm assets**



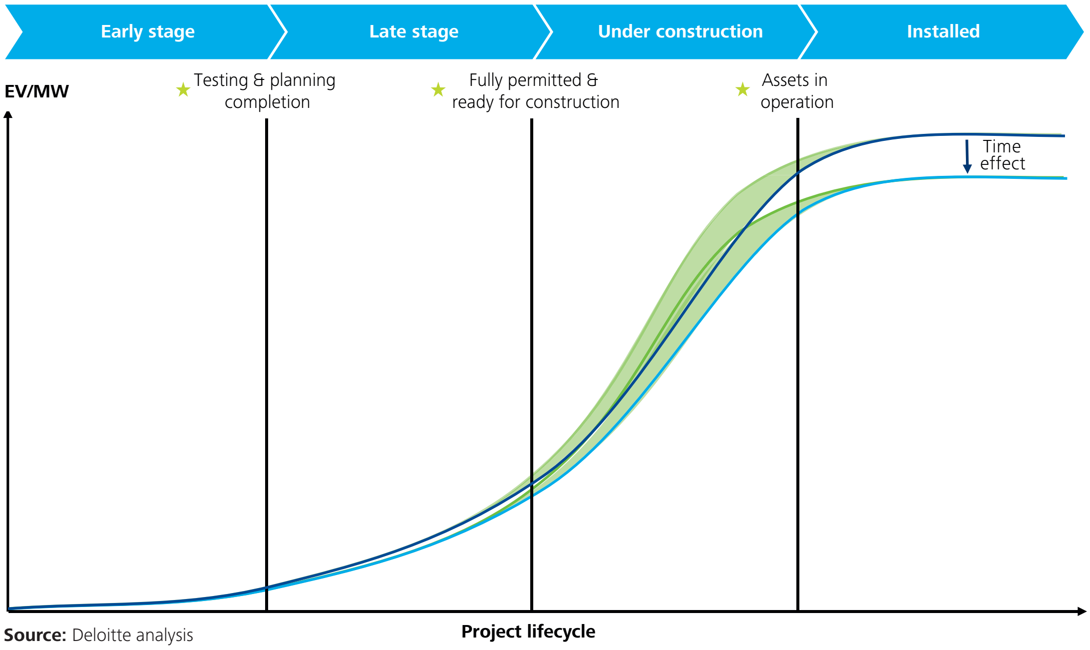

**Source:** Deloitte analysis

## Time analysis

The size of the dataset on onshore wind transactions has enabled further analyses. More specifically we have analysed whether transaction prices have changed over time.

Reports on the wind farm industry show that construction costs related to onshore wind farm assets have been declining over our sample period of 9 years. However during the past year project costs have displayed an increasing trend. We therefore find it interesting to investigate a potential time pattern in transaction multiples. As the onshore industry matures, it seems sound that supply chain improvements and technological progress will make the lifecycle curve shift to lower levels. We believe that transaction multiples should find lower levels as the development of the market pushes down development and construction costs. The figure below illustrates this.

**Lifecycle/value creation for onshore wind farm assets**



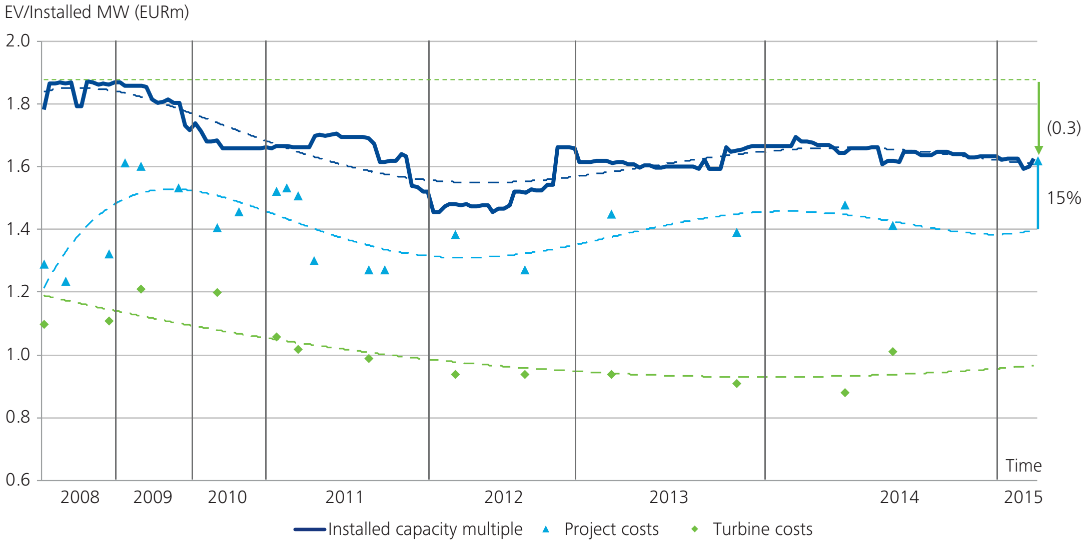

**Source:** Deloitte analysis

To investigate a potential time effect, we have applied a rolling regression analysis. This method uses the latest 60 transactions on forward running dates by constantly substituting the oldest transaction with a newer transaction. By running 184 regressions, each with 60 transactions, we create a picture of how the installed capacity multiple has developed since 2008. We find that the multiple for installed capacity has dropped by approx. EUR 0.3m from the highest level of EUR 1.9m per MW to the current level of EUR 1.6m per MW. This is a relative decrease on last year's edition of this analysis where the installed capacity multiple was approx. EUR 1.7m per MW.

The figure below illustrates our findings. The dark blue line illustrates the trend in EV per MW installed capacity. The values on the time axis represent the announcement date of the latest of the 60 transactions included in the relevant capacity multiple. Consequently the first point on the dark blue line represents the multiple based on 60 transactions with the most recent one occurring in August 2008. To illustrate the relation between transaction multiples and development costs, we have included average project costs per installed MW (the light blue triangles) as well as illustrated the development in turbine costs (the light green squares). The average project- and turbine cost follows the same trend as the transaction multiples. The analysis suggests that the developer premium on onshore wind farm assets lies in the range of 10-20% of project costs.

While the level of the installed capacity multiple has varied during the past 9 years, the latest estimated multiple is at a level similar to that of our overall analysis, which means that the results of the initial regression analysis on the overall dataset seems to be consistent with the current level of the installed capacity multiple.

**Time effect on installed capacity multiple**




**Source:** Deloitte analysis, Clean Energy Pipeline (CEP) and Bloomberg New Energy Finance (BNEF)

## Age analysis

The increasing amount of data has enabled us to perform further detailed analyses. More specifically we have investigated how the age of the wind farm affects the level of the installed capacity multiple. Assuming an operational lifetime of 20-25 years, the rationale behind the analysis is that the remaining cash flows from a wind farm decrease as the wind farm gets older. A wind farm project should therefore reach its highest value at the commissioning date and from there the value should decrease as the wind farm operates throughout the years. In our analysis this effect would materialise in a lower installed capacity multiple for old wind farms when comparing to young or newly commissioned wind farms.

To enable the analysis we have collected data on the wind farm commissioning date in 78 transactions[1]. An average installed capacity multiple of 1.68 implies that the sample is representative to the overall dataset.

Our analysis is based on the following regression model (3), in which we have included an "age" variable calculated as the difference in years between the transaction date and commissioning date of the transacted wind farms. The results of the analysis are summarised in the table below.

(3) $EV/MW_{Installed\ capacity} = \alpha + \beta_1 \cdot age_{wind\ farm}$

**Age regression results**

| EURm/MW | Coefficient | p-value |
|---|---|---|
| Intercept | 1.84 | 0.0 |
| Age[1] | (0.07) | 0.0 |

[1] Transactions (n): 78, R-square: 0.16

Our analysis suggests an installed capacity multiple of EUR 1.84m per MW for a newly commissioned wind farm. The installed capacity multiple then declines by EUR 0.07m per MW per operational year. These results indicate that the wind farm has a value of zero after approx. 27 years, which is in line with the expected lifetime of a wind farm of 20-25 years, taking into account a positive net scrap value of the assets after the operating period. The regression has a coefficient of determination (~ R-squared) of 0.16, which may be interpreted as 16% of the variation in the installed capacity multiple being explained by variations in age of the wind farm. Some of the remaining variation in the installed capacity multiple may be explained by other factors, such as local wind conditions, operating efficiency, power price agreements, local tax rules, subsidies and financing.

Below we have estimated the value of REC, given that REC's installed capacity has been operational for 5 years. This yields a total value of REC of EUR 830m.

**Regression and valuation of wind assets**

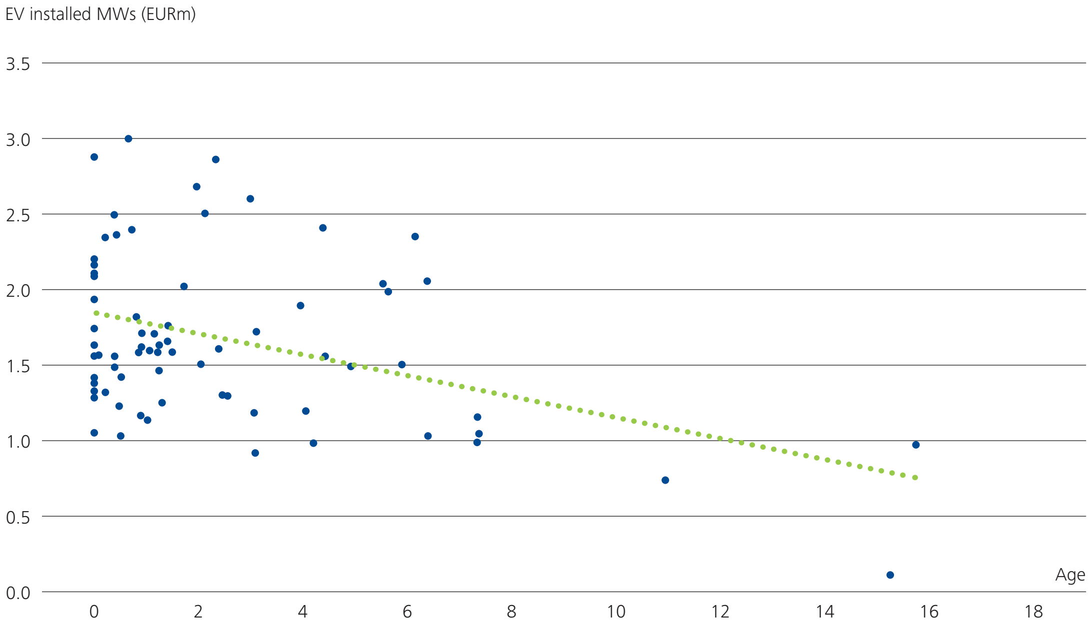
| EURm | Late stage | Under construction | Installed | Age (5 years) |
|---|---|---|---|---|
| EV/MW coefficient[1] | 0.3x | 0.8x | 1.8x | (0.07)x |
| Significance (p-value) | 0.0 | 0.0 | 0.0 | 0.0 |
| REC wind MWs | 800 | 400 | 200 | 200 |
| REC wind EVs | 208 | 321 | 369 | (67) |
| **REC total EV** | | | | **830** |

[1] Transactions (n): 78

[1] The 78 transactions are adjusted for outliers and include transactions with only installed capacity, in order to adjust for disturbance caused by the late stage and construction stage capacities.

The figure below shows the installed capacity multiple and age of the 78 transactions in this analysis. Note that only 3 transactions have an age above 8 years at transaction date. These 3 transactions may disturb the general picture, and estimating model (3) without these 3 wind farms yields an age coefficient significant at a 86% confidence level. In general we expect the analysis to become stronger as more transactions with larger time intervals are added to the sample.

**Age and installed capacity multiples of 78 onshore wind farms**




**Source:** Deloitte analysis

# 5. Offshore 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 4.5m, EUR 1.7m and EUR 0.2m. The regression has a coefficient of determination (~ R-squared) of 0.93. In other words, 93% of the variation in enterprise value 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 0.3m since last year's edition. This result is rather counterintuitive as the industry has been expecting lower offshore wind energy costs for the past 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 1,714m. The results of the analysis are summarised in the table below.

Due to a rather limited dataset of only 37 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[5] 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** | **1.7x** | **4.5x** |
| Significance (p-value) | 0.1 | 0.0 | 0.0 |
| Upper 95% | 0.5 | 2.4 | 4.9 |
| Lower 95% | 0.0 | 1.0 | 4.0 |
| | | | |
| **REC wind MWs** | **800** | **400** | **200** |
| **EV/MW coefficient[1]** | **0.2x** | **1.7x** | **4.5x** |
| REC wind EVs | 142 | 681 | 891 |
| **REC total EV** | | | **1,714** |
| | | | |
| Weighted average | 0.2x | 1.8x | 4.2x |
| REC wind EVs | 188 | 703 | 833 |
| **REC total EV** | | | **1,724** |
| | | | |
| Median | 0.2x | 2.2x | 4.6x |
| REC wind MWs | 187 | 861 | 911 |
| **REC total EV** | | | **1,959** |

[1] Transactions (n): 37, R-square: 0.93
**Source:** Deloitte analysis

[5] 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.

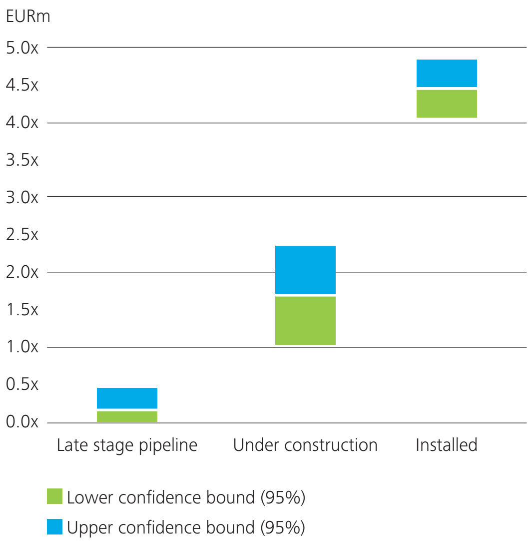
A multiple regression analysis is subject to uncertainty, just like any other valuation method. One advantage of statistical models compared with other models is that the uncertainty is easier to quantify. The uncertainty can be expressed by the statistical term "standard error". The standard error is 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 4.0m, EUR 1.0m and EUR 0.0m for installed, under construction and late stage capacity. The upper boundaries for the EV/MW multiples are EUR 4.9m, EUR 2.4m and EUR 0.5m for installed, under construction and late stage capacity. The low significance of the late stage multiple is reflected in a wide interval for this multiple measured in percentage relative to the coefficient. Therefore 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 weighted average multiples are EUR 4.2m, EUR 1.8m and EUR 0.2m per MW for installed, under construction and late stage capacity, while the median multiples are EUR 4.6m, EUR 2.2m and EUR 0.2m per MW. These estimates support the multiples from our regression

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 has been reduced by 21% since the last edition of this analysis. The uncertainty intervals of the estimated EV/MW multiples from our regression are illustrated in the figures above and below.

**Uncertainty intervals for offshore stage-multiples**




**Source:** Deloitte analysis

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 approx. EUR 1,200-2,300m. These estimates are approx. 31% lower/higher compared with the base case value.

**Offshore wind farm valuation uncertainty**

| EURm | Late stage | Under construction | Installed |
|---|---|---|---|
| **Upper EV/MW multiple** | **0.5x** | **2.4x** | **4.9x** |
| REC wind MWs | 800 | 400 | 200 |
| REC wind EVs | 391 | 952 | 972 |
| **REC upper EV** | | | **2,315** |
| | | | |
| Lower EV/MW multiple | 0.0x | 1.0x | 4.0x |
| REC wind MWs | 800 | 400 | 200 |
| REC wind EVs | 0 | 410 | 809 |
| **REC lower EV** | | | **1,219** |

**Source:** Deloitte Analysis

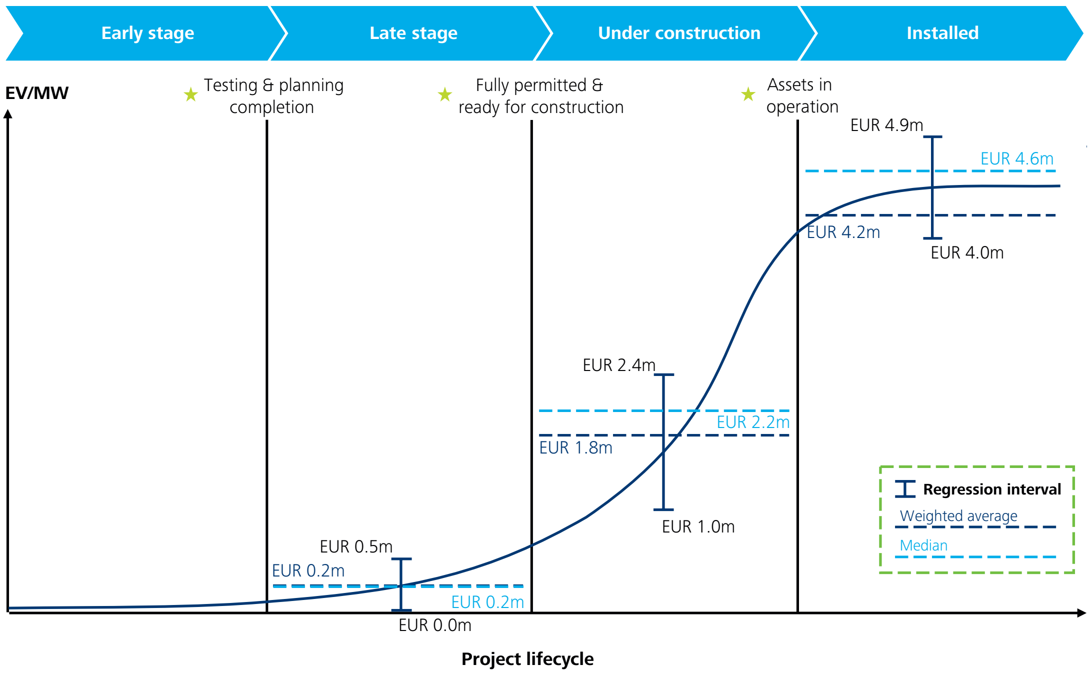
The uncertainty of the EV/MW multiples consists of statistical uncertainty and general value creation uncertainty. Among other things, the statistical uncertainty relates to the size of the dataset, and as we add more transactions to the dataset, some of this will diminish. However the other part of the uncertainty interval will not. Value is created within the different stages of development and that 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.

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.

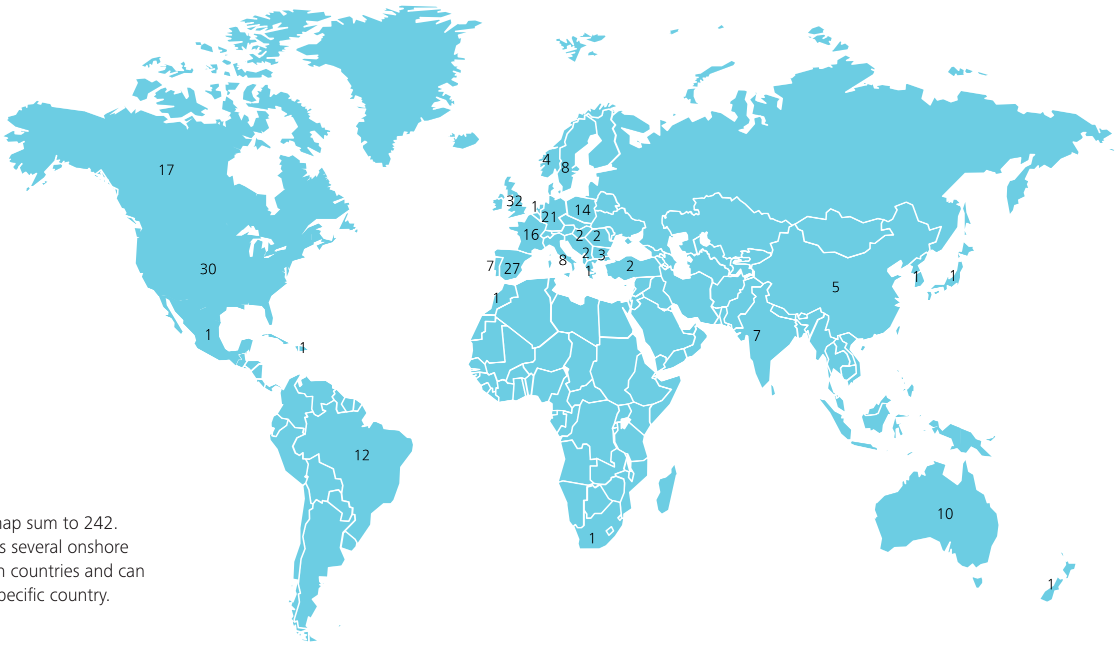
**Uncertainty intervals for offshore stage-multiples**




**Source:** Deloitte analysis

# Appendix A:
# Summary of transaction data from the onshore wind farm industry

**Onshore wind farm transactions**




Note: The transactions on this map sum to 242. The missing transaction concerns several onshore wind farms in different European countries and can therefore not be assigned to a specific country.

| | | 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** | **243** | **2** | **1,442** | **153** | **18,615** | **77** | **4,825** | **20** | **10,349** | **43** | **21,534** | **89** |
| **Geography** | | | | | | | | | | | | |
| Europe | 155 | 2 | 1,442 | 127 | 10,879 | 63 | 1,454 | 14 | 5,420 | 32 | 7,234 | 50 |
| Non-Europe | 88 | 2 | 1,128 | 114 | 7,736 | 55 | 3,370 | 15 | 4,929 | 56 | 14,300 | 53 |
| North America | 47 | 2 | 1,128 | 205 | 4,683 | 92 | 2,702 | 57 | 2,799 | 63 | 11,296 | 198 |
| Australia & New Zealand | 11 | 17 | 915 | 145 | 1,458 | 83 | 142 | 11 | 16 | 8 | 130 | 7 |
| Central & South America | 15 | 9 | 680 | 140 | 1,042 | 53 | 378 | 8 | 1,925 | 131 | 2,648 | 55 |
| Asia | 14 | 7 | 114 | 55 | 555 | 38 | 149 | 7 | 190 | 15 | 200 | 7 |
| Poland | 13 | 2 | 270 | 59 | 374 | 29 | 102 | 8 | 1,198 | 92 | 119 | 9 |
| France | 16 | 6 | 597 | 133 | 1,504 | 94 | 114 | 7 | 383 | 24 | 1,164 | 73 |
| Germany | 21 | 5 | 567 | 83 | 1,206 | 57 | 141 | 7 | 33 | 2 | - | - |
| Spain | 27 | 5 | 1,442 | 184 | 2,355 | 87 | 208 | 8 | 2,116 | 78 | 3,600 | 133 |
| UK | 33 | 4 | 541 | 130 | 1,918 | 58 | 55 | 2 | 709 | 21 | 540 | 16 |
| **Year** | | | | | | | | | | | | |
| 2005 | 1 | 25 | 25 | 25 | 26 | 26 | - | - | - | - | - | - |
| 2006 | 10 | 5 | 1,442 | 241 | 894 | 89 | 434 | 43 | 1,752 | 175 | 5,204 | 520 |
| 2007 | 20 | 5 | 990 | 203 | 1,727 | 86 | 1,240 | 62 | 634 | 32 | 6,233 | 312 |
| 2008 | 40 | 5 | 1,150 | 83 | 1,421 | 36 | 350 | 9 | 1,751 | 44 | 2,024 | 51 |
| 2009 | 20 | 3 | 785 | 203 | 2,220 | 111 | 368 | 18 | 1,528 | 76 | 3,696 | 185 |
| 2010 | 15 | 5 | 320 | 84 | 743 | 50 | 88 | 6 | 22 | 1 | 162 | 11 |
| 2011 | 29 | 4 | 680 | 127 | 2,064 | 71 | 399 | 14 | 1,441 | 50 | 540 | 19 |
| 2012 | 29 | 5 | 1,128 | 175 | 2,387 | 82 | 410 | 14 | 569 | 20 | 1,273 | 44 |
| 2013 | 43 | 2 | 1,011 | 180 | 4,147 | 96 | 741 | 17 | 1,087 | 25 | 1,133 | 26 |
| 2014 | 31 | 2 | 734 | 159 | 2,487 | 80 | 795 | 26 | 1,542 | 50 | 1,256 | 41 |
| 2015 | 5 | 2 | 327 | 122 | 500 | 100 | - | - | 24 | 5 | 14 | 3 |

**Source:** Deloitte analysis

# Appendix B: Regression output – onshore wind farm analysis

### Summary output

| Regression statistics | |
|---|---|
| R Square | 0.95 |
| DF | 240 |
| Observations | 243 |

| | Coefficients | Standard error | t Stat | P-value | Lower 95% | Upper 95% |
|---|---|---|---|---|---|---|
| Intercept | - | - | - | - | - | - |
| Installed | 1.654 | 0.030 | 55.124 | 0.000 | 1.595 | 1.713 |
| Under constr. | 0.803 | 0.055 | 14.518 | 0.000 | 0.694 | 0.911 |
| Late stage | 0.260 | 0.031 | 8.434 | 0.000 | 0.199 | 0.320 |

**Source:** Deloitte analysis

# Appendix C: Regression output – onshore age analysis

**Summary output**

| Regression statistics | |
|---|---|
| R Square | 0.16 |
| DF | 76 |
| Observations | 78 |

| | Coefficients | Standard error | t Stat | P-value | Lower 95% | Upper 95% |
|---|---|---|---|---|---|---|
| Intercept | 1.844 | 0.070 | 26.196 | 0.000 | 1.706 | 1.982 |
| Age | (0.067) | 0.018 | (3.800) | 0.000 | (0.102) | (0.032) |

**Source:** Deloitte analysis

# Appendix D:
# Summary of transaction data from the offshore wind farm industry

**Offshore wind farm transactions**


**Source:** Deloitte analysis

| | Obs | EV in EURm | | | Installed MWs | | Under constr. MWs | | Late stage MWs | | Early stage MWs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min. | Max. | Average | Total | Average | Total | Average | Total | Average | Total | Average |
| **Overall** | **37** | **12** | **3,124** | **628** | **4,425** | **120** | **1,481** | **40** | **5,204** | **141** | **8,156** | **220** |
| **Geography** | | | | | | | | | | | | |
| Denmark | 3 | 202 | 1,609 | 760 | 773 | 258 | - | - | - | - | - | - |
| Germany | 14 | 12 | 1,443 | 568 | 1,105 | 79 | 400 | 29 | 1,833 | 131 | 2,956 | 211 |
| Netherlands | 1 | 29 | 29 | 29 | - | - | - | - | 1,050 | 1,050 | - | - |
| UK | 19 | 42 | 3,124 | 683 | 2,547 | 134 | 1,081 | 57 | 2,321 | 122 | 5,200 | 274 |

**Source:** Deloitte analysis

# Appendix E:
# Regression output – offshore wind farm analysis

**Summary output**

| Regression statistics | |
|---|---|
| R Square | 0.93 |
| DF | 34 |
| Observations | 37 |

| | Coefficients | Standard error | t Stat | P-value | Lower 95% | Upper 95% |
|---|---|---|---|---|---|---|
| Intercept | - | - | - | - | - | - |
| Installed | 4.453 | 0.208 | 21.364 | 0.000 | 4.044 | 4.862 |
| Under constr. | 1.702 | 0.346 | 4.920 | 0.000 | 1.024 | 2.380 |
| Late stage | 0.178 | 0.158 | 1.123 | 0.135 | (0.133) | 0.489 |

**Source:** Deloitte analysis

# Order form for geographical analysis and transaction details

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