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Unlocking Europe's offshore wind potential

Moving towards a subsidy free industry

April 2018

pwc

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Foreword

2017 was yet again an eventful year for the offshore wind industry with several bids for tender coming in at subsidy free levels in Germany, the Netherlands and Denmark (partly subsidy free). This establishes Europe even more firmly as the global leader in offshore wind, and leading the charge to make offshore wind a cost-competitive technology. Going forward we expect the sector to develop on the basis of its economic advantages.

Additionally, large-scale offshore wind also represents a significant opportunity to decarbonise our energy systems: resources are stable and abundant, and public acceptance is relatively high. Offshore wind resources could make a significant contribution to Europe's energy transition, particularly in North-West Europe. And while subsidies have played a large role in the roll-out of offshore wind to date, many governments are now contemplating phasing out subsidies for the sector in the long to medium term.

While in other regions of the world offshore wind energy has just started to develop, the European offshore wind industry can rely on over 20 years of experience. As of early 2018, there are over 70 main wind farm clusters with a combined capacity of nearly 15 GW fully grid connected across the six European markets covered in this publication. Until 2030 we have identified a project pipeline confirmed by the governments of these countries, which would add a combined 59 GW capacity in those markets. With both Denmark and Belgium yet to confirm further plans, we expect this pipeline to continue to increase.

However, despite recent positive developments in terms of both price and scale, some challenges remain to be overcome in order to capture Europe's full offshore wind potential. While cross-border cooperation is increasing, regulatory regimes for offshore wind remain largely national. As can be seen in this publication subsidy, tender and tax regimes, as well as rules surrounding spatial planning, can all look rather different from one territory to another, and increases the complexity in projects for all stakeholders.

With this publication, we would like to share our views on important market developments in offshore wind, and update you on the market design and the confirmed project pipeline in six key offshore wind territories in Europe. We believe that the prospects for offshore wind in Europe look bright, mainly because of the current project pipeline and overall market developments.

Our advisory, tax and accounting experts specialised in offshore wind work with clients, helping them to be successful throughout the offshore wind project life cycle. You can find examples of our work in this publication. These include identifying cost reduction potentials, regulatory advice or tax, accounting and project management (please refer to our case studies on page 34).
Do not hesitate to reach out to one of our experts to find out more (please refer to their contact details on page 44).

Happy reading,

Jeroen van Hoof

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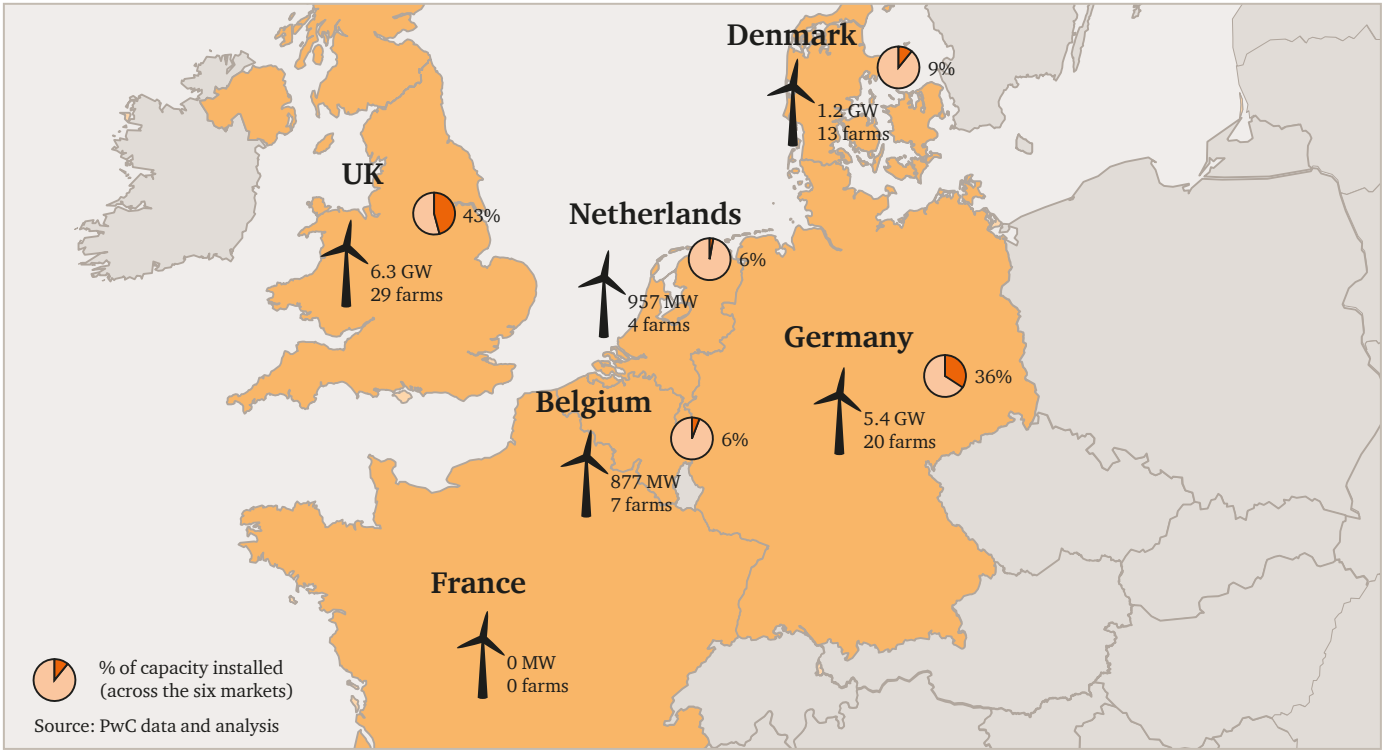
Figure 1. Offshore wind capacity across six European markets in 2016



1. Offshore wind market update – Europe

Two record years for the European offshore wind market

Continued strong pipeline for offshore wind in Europe

In 2017 the strong upward trend for offshore wind power in Europe continued. An additional 2.8 GW came online in the six European markets for offshore wind that make up this study: Belgium, Denmark, France, Germany, the Netherlands and the UK. Of this, more than half (1.5 GW) came into operation in Germany, followed by 690 MW in the UK, including 30 MW floating offshore wind, 600 MW in the Netherlands, 165 MW in Belgium and a 2 MW pilot for floating offshore wind at Saint-Nazaire in France. In those markets the cumulative total installed and grid connected capacity in early 2018 was close to 15 GW.

The UK still has the largest offshore wind capacity in Europe with 6.3 GW online capacity in February 2018, and accounting for 46% of total installed capacity in the six markets in scope. Germany comes at a second place with 36% of installed capacity. Other European markets (not included in this publication), are Sweden, Finland, Ireland, Norway, Portugal, Spain and Turkey.

Likewise, in 2017 the trend of rapid cost reduction in the sector also continued. Several recent regulatory changes in Europe's main offshore wind markets have enabled cheaper offshore wind power and installation of large-scale projects. Indeed, 2017 saw the first subsidy-free bids in competitive tenders in Germany, the Netherlands and partially in Denmark.

In view of this other European markets are following suit in order to keep up with market developments. Belgium reduced its subsidy levels in 2017 from €129.8 two years ago to €79 for three remaining concessions, and a reform of the electricity market in the UK promises to continue to support cost reduction. In France, a third tender in 2017 was based on a so called 'competitive dialogue', but a 2018 proposal by the French government to cut subsidies for projects tendered in 2012 and 2014, failed to win political support in the Senate. Those projects will therefore now go ahead with the initial feed-in tariff awarded at ca. €200/MWh (see country profiles for more details).

Against this backdrop, developers will face a new reality of merchant projects in 2018, as capital costs are also falling dramatically. As reflected in the increasing success of zero-subsidy projects, governments' financial support seems to no longer be required for offshore wind projects. As a result thereof, corporate power purchase agreements are expected to become the major value driver in future offshore wind projects. Later in the game, once the risk profile of offshore wind farms decreases, institutional money may also enter the market. Chapter three of this publication offers a more detailed overview in respect of these developments.

Outside European waters

Europe, is still leading with the development and installation of offshore wind technology, but offshore wind has started to gain momentum also outside Europe.

In Asia, China has seen the strongest development in the past two years. Offshore wind capacity in China increased by 64% from 2015 to 2016, making it the world's third largest market after the UK and Germany, and ahead of Denmark (former third place). Limited potential for new onshore wind development in the Northern and Western regions of China has pushed developers to move offshore, and technology has steadily improved, with some domestic manufacturers developing bigger turbines to harness the wind potential offshore.

Taiwan is set for a new boom with the president's reiteration of the target to source 20% of electricity from renewables by 2025, and the official target for offshore wind is set at 3 GW. This pipeline is however likely to increase, as one developer alone recently revealed its ambition to install 520 MW of offshore wind in Taiwanese waters by 2020, and reaching 2.6 GW by 2025.

Japan has a strong project pipeline with some 2.5 GW offshore wind power projects under various stages of development, among which the 60 MW Yasuoka project is likely to start construction in 2018. South Korean offshore wind industry, which was stalled for a few years, but is now moving forward with 90-120 MW planned to be installed by 2019.

On the other side of the Atlantic, US offshore wind energy is at last becoming a reality. 13 offshore wind projects on both coasts and in the Great Lakes are under various stages of development, and the US Department of Energy's roadmap for wind power envisages offshore wind to provide 2% of US electricity demand in 2030 and 7% in 2050.

[1] Wind Europe (2018), Offshore Wind in Europe - Key trends and statistics 2017.

Figure 2. Three main types of tender schemes for offshore wind

Increasingly countries chose for Plug-and-Play

	Greenfield Origination	*Development Zones*	*"Plug-and Play"*
Allocation	• Unsolicited application; first come, first choice	• Tender process; equal access opportunity	• Centralised auction process; lowest bid wins
Typical features of tender	• Select area of available seabed and need to apply for development rights • Obtain site data, approvals, etc. and proceed	• Government releases development zones in controlled way • Some data and approvals mey be provided • Tenderers select and develop sites within allocated zones	• Government selected site • Price based allocation • Necessary permits, EIA[2]. site data and transmission access provided to tender
Typical responsibility developer	• Site selection • Capacity estimation and delivery • Approvals and permits • FEED and detailed design	• Site selection (within zone) • Capacity delivery (within bounds) • Detailed design (within bounds)	• Capacity delivery • Detailed planing
Key success factors	• Local development process and regulation knowledge • Understanding of local environment and conditions: identify best available areas before others	• Ability to canvas zone and maximise use of site within it • Front End Engineering and Design (FEED) and detailed design capability • In some cases, may be able to select development partners after tender has been won	• Lowest price tender • Thorough and unqualified bid • Strong/exclusive relationships with key vendors and supplier • Effective upfront consortium partnerships with close collaboration during tenders

Source: Strategy& analysis

In March 2017, Statoil and the US Bureau of Ocean Energy Management (BOEM) agreed a lease off the shore of New York. The lease comprises an area of 321 km2 that could potentially accommodate more than 1 GW of offshore wind.

Bigger and better

In 2017, offshore wind farms continued to grow both in terms of capacity, and in terms of size of the components and the wind farm itself. Over the past ten years, the average wind farm in Europe has increased remarkably in size - from an average capacity of 79.6 MW in 2007 to 493 MW for offshore wind farms under construction in 2017. However, some projects are significantly bigger than this, as demonstrated by Ørsted's (former DONG) 1.2 GW Hornsea One project. This project is the largest offshore wind farm to reach Final Investment Decision (FID) to date, and construction has started in 2018.

Likewise, the capacity of turbines has grown dramatically - by 102% over the past decade. In the past year, the average capacity of newly installed turbines increased by 23%, and the average turbine in Europe now has a capacity of 5.9 MW.[2] In line with this GE recently announced that it will launch a giant 12 MW wind turbine for use offshore. The turbine stands 260 metres tall - almost as tall as the Eiffel Tower - and is expected to generate 45% more electricity than the largest models currently in service. The new turbine is planned to be deployed starting in 2021.

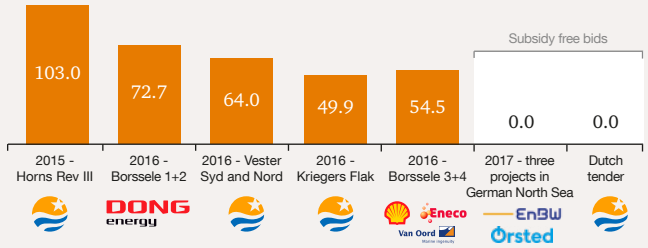
At the same time wind farms are also moving further and further away from shore with an average water depth of 27.5 metres for grid connected wind farms in 2017. The average distance to shore was 41 kilometres.[3] In 2017 the first floating wind farm in the world was installed and already feeds power to the grid. Hywind Scotland has an average water depth twice as deep as that of other bottom-fixed offshore wind farms where work was carried out in 2017.

All those developments reflect a rapid pace of technological development in both the bottom-fixed and floating wind sector, which we expect to continue to be a driver in the coming years. Larger windmills will deliver greater capacity and reliability, and the potential at sea levels greater than 50 metres will be developed. In this context, Norway and Japan are the two markets that are leading the way in developing floating structures.

[2] Wind Europe (2018), Offshore Wind in Europe - Key trends and statistics 2017.

[3] Wind Europe (2018), Offshore Wind in Europe - Key trends and statistics 2017. This is a slight decrease from 2016. Yet the overall long-term trend is increasing.

Figure 3. Bid price offshore wind
(excluding grid connection costs) €/MWh

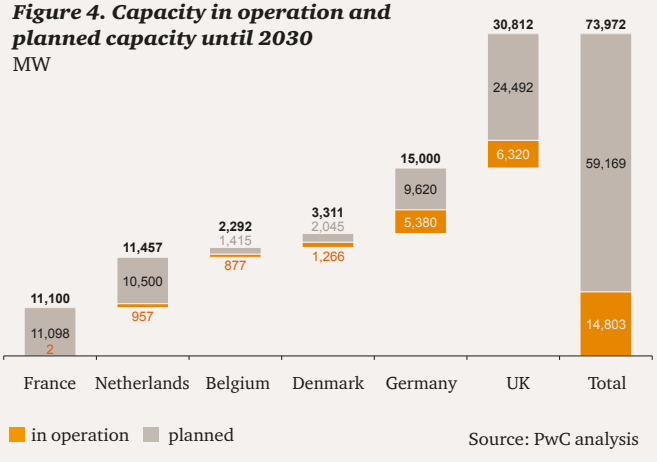


Source: PwC analysis

Decommissioning begins

At the same time as new capacity is being installed the first decommissioning projects in offshore wind also began in 2016. In Sweden, Vattenfall dismantled five wind turbines with a total capacity of 10 MW which made up the Yttre Stengrund wind farm in Kalmar Sund, and in September 2017 DONG Energy (Ørsted) decommissioned Vindeby, the world's first offshore wind farm in Denmark. Nuon (Vattenfall), decommissioned four offshore wind turbines that made up the Lely offshore wind farm in the Netherlands. The 10 MW Beatrice demonstration wind farm in the UK, and the German 5 MW Hooksiel projects were also dismantled in 2016.

Figure 4. Capacity in operation and planned capacity until 2030
MW



Source: PwC analysis

The future for offshore wind looks bright

As mentioned above regulatory changes have played a positive role in supporting the large-scale take-off of offshore wind power. Recent years have seen a change in the way most countries award subsidies for offshore wind, driven by the need to increase competition and push down costs of offshore wind. A number of European countries that support offshore wind, like Denmark and the Netherlands, now use competitive tenders in which companies bid for offshore sites. In those systems, permits are granted simultaneously (what we refer to as a "plug-and-play" model, please see figure 1) which lowers developing time and costs. Germany is in the process of changing to a tender based system as well, with an interim system in place in the transition years 2021-2025. Until 2020 the current system will still be in place and after 2026 the competitive tender system will ultimately be in place.

Rapid cost reduction

Offshore wind has been on a strong cost reduction pathway in the past years. Both the rollout of competitive tender schemes, and improved economics, resulting from bigger turbine sizes and better construction knowhow have supported recent cost reductions. Additionally, the past decline in commodity prices (most notably steel), as well as low interest rates gave cost reduction a further push. As both steel prices and interest rates recover those factors will be less favourable in the future, but we believe that the structural changes in the cost of offshore wind will outbalance this effect. In fact, in 2015, compared to 2010 levels, only 7.5% of the cost reduction potential for offshore wind originated from of external factors such as those mentioned above.[4] As the cost reduction curve has proven to be even steeper than predicted in 2015, we do not see higher interest rates or steel prices as an impediment to further cost reductions.

A strong project pipeline

The record breaking developments in offshore wind in the past two years show that the technology has taken huge strides in terms of cost-effectiveness. This proves its reliability and performance in becoming a competitive alternative to conventional energy sources. As the industry matures and the trust in offshore wind as a cost competitive technology increases, we foresee an increase in government support across Europe, and thus for the pipeline of projects to grow even more.

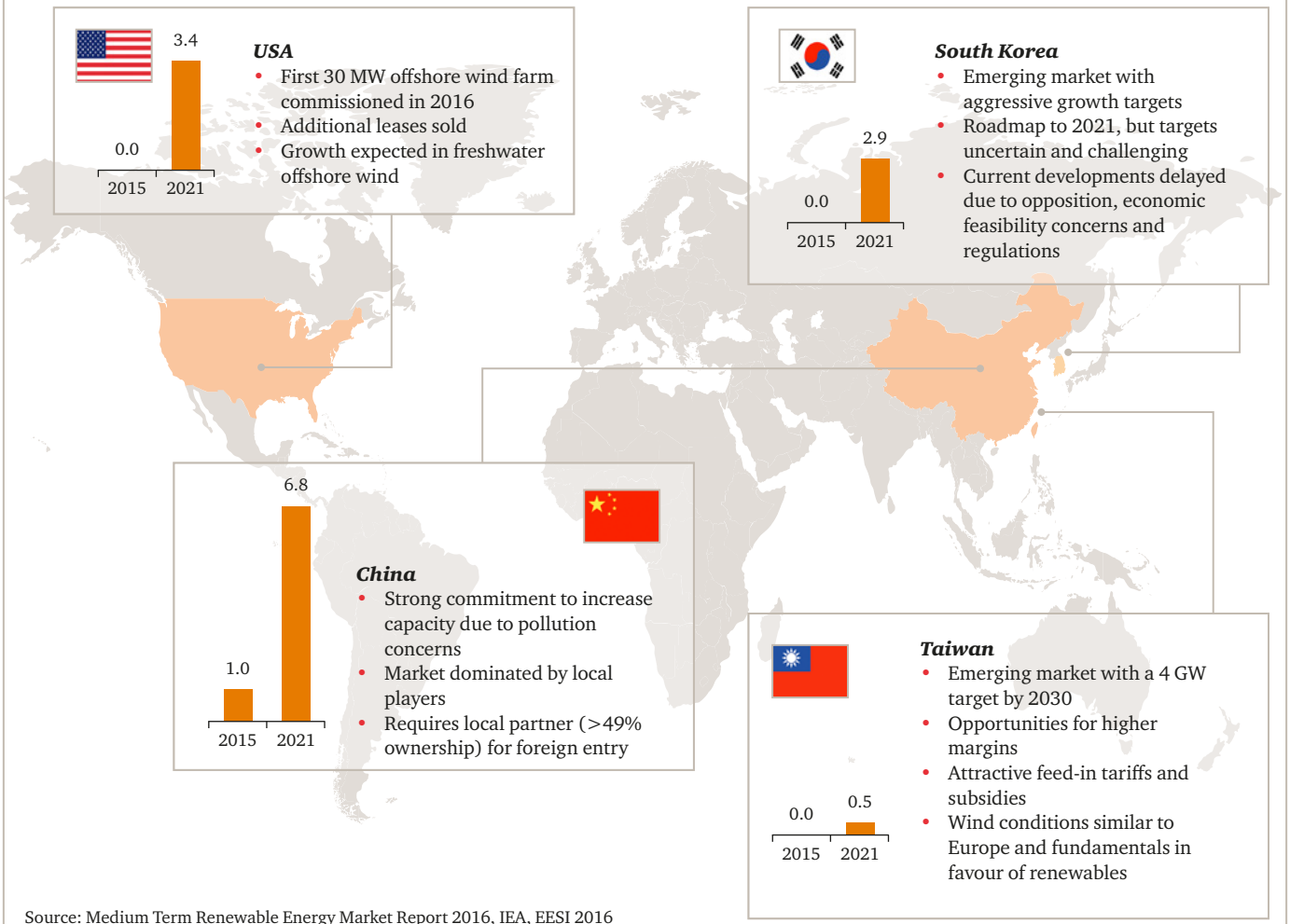
In fact some governments (most notably Germany and the Netherlands) have already announced a project pipeline post 2020, due to the favourable conditions outlined above. According to our assessment of confirmed and planned projects, we expect overall total capacity, in the key European markets covered in this publication, to grow close to 74 GW by 2030 (please refer to figure 4 for the planned pipeline per country).

[4] See TKI Wind op Zee, (2015): http://tki-windopzee.nl/files/2015-10/151028-tki-offshore-wind-cost-reduction-final-stc.pdf, for more details.

Notably though, additional plans are likely to be announced in due time both in Belgium and Denmark, meaning that this number could yet increase.

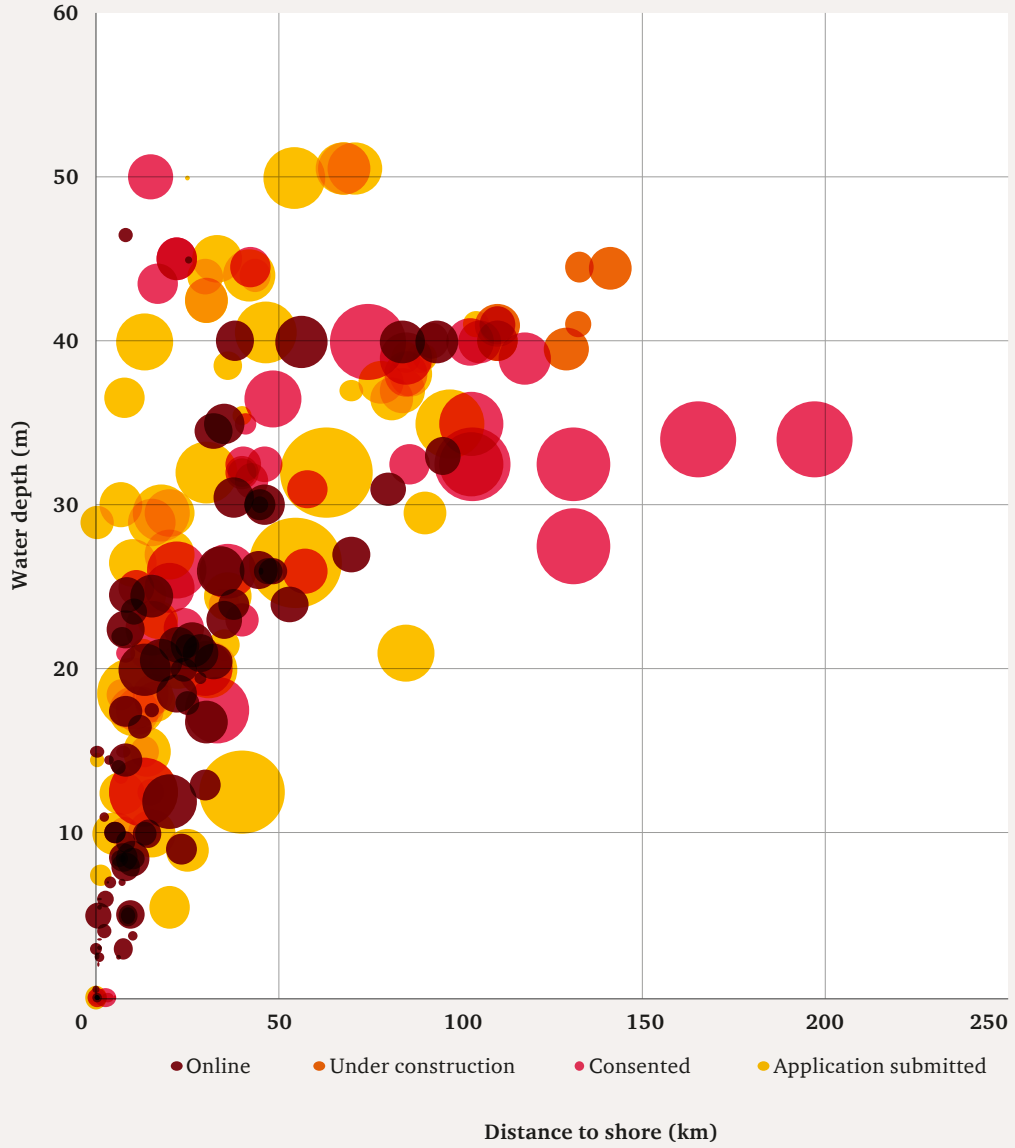
At the global level, the offshore wind market is set to experience significant growth due to the global push to reduce carbon emissions following the Paris climate agreement. Outside of Europe, we see potential for China, Taiwan, South Korea and the US to all become promising markets (please refer to figure 5).

Figure 5. Selected high growth markets (Installed Capacity, GW)



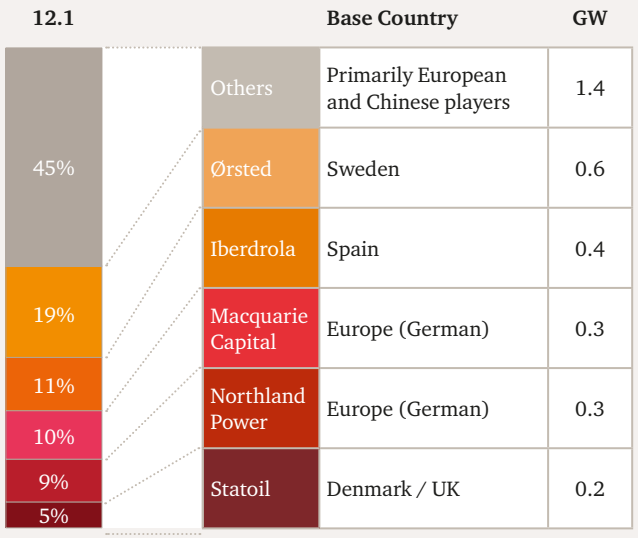
Source: Medium Term Renewable Energy Market Report 2016, IEA, EESI 2016

Figure 6. Field development remoteness
All known developments, global



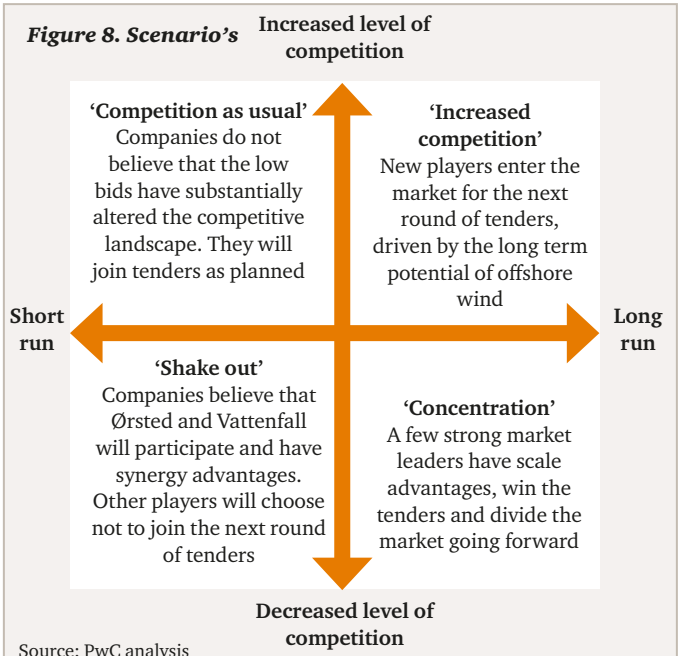
Source: WindEurope

Figure 7. Top 5 Offshore Wind Developers
(share of annual installations in 2017)



Source: Strategy& analysis

Figure 8. Scenario's



Source: PwC analysis

...but complexity is increasing and competition intensifying

As the offshore wind market matures, wind farms have to be developed in deeper waters or further from shore, which has increased the complexity of projects. Moreover, an increasing number of potential investors, including financial and institutional investors, are now competing for the projects available (as mentioned before, increasingly through competitive tendering procedures). In 2017, European offshore wind projects continued to bring in more financial investors. The financial services industry, including infrastructure funds, pension funds, asset managers and diversified financial services now own 35% of the capacity traded in 2017, compared to 27% in 2016.[5] This means increased price pressures on developers, but the added complexity also puts more pressure on investors and requires a well-structured and fully optimised bid in order to win projects, and execute them in a timely manner. Since zero-subsidy projects are yet to be realised, the first projects to come online in the years to come will be crucial to assess the actual viability of those projects.

The new kids on the block

As project complexity and risks increase, new players enter the offshore wind development market. The recent consecutive bids in the Netherlands and Denmark show that the competition is increasing among big players. Oil and gas companies are increasingly interested in the offshore wind market due to a good strategic fit, as these companies both have solid offshore capabilities and also need to decarbonise their activities. For example, Shell's success in the Dutch tender illustrates the interest and ability of oil and gas companies to enter the offshore wind market. Similarly in the UK side, Statoil delivered the 30 MW Hywind Scotland project, the world's largest floating wind farm and has recently changed its name to Equinor to reflect its move away from oil only. Continuing on its own low carbon trajectory, in late 2017 DONG Energy announced the sale of the Oil & Gas division and that they aim to be fully out of power generation by fossil fuels by 2023, and changed its name to Ørsted (DONG was an acronym for Danish Oil and Natural Gas).

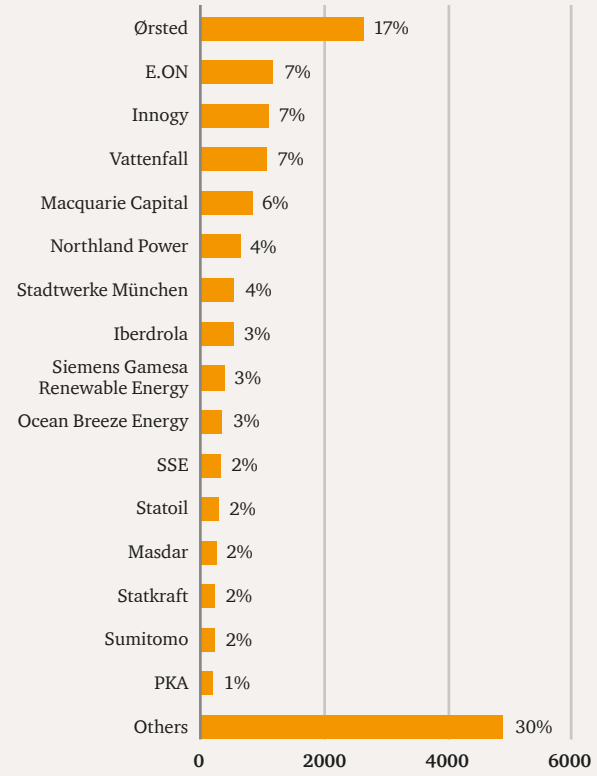
We foresee four different scenarios in an environment of heightened competition for wind farm developers. In the short-term, there may be a shake-out – driven by the recent low bids – whereby competitors are put off by the low bids and choose not to take part in the next rounds of tenders. Alternatively companies may choose to participate in tenders as planned, while bearing in mind the new price trends. However, in the long-term there may be either a market concentration whereby only a few strong market leaders have the capacity and scale advantages to win tenders as the high risk and capital investment needed can be a barrier to market entry. In an alternative scenario new players enter the global market driven by the long-term potential for offshore wind and overall market growth.

[5] Wind Europe (2018), Offshore Wind in Europe - Key trends and statistics 2017.

Which long term scenario will play out remains to be seen. Generally, in a market with high-cost capital projects, market concentration occurs and limits activities to a small number of market leaders. Who will become these future market leaders we believe will depend on two key factors: 1) the ability of players to innovate in order to lower costs and outbid competition, and 2) on project delivery excellence (contracting, supply chain cooperation and risk control). In order to win companies must actively and consciously work to improve those two capabilities.

So far, we observe that competition seems to intensify and the market share of the top five owners of installed capacity in Europe decreases. Ørsted, E.ON, Innogy, Vattenfall and Macquarie Capital own 42% of all installed capacity in Europe which is a decrease compared to the end of 2016, as new players enter the market.

Figure 9. Owner's share of installed capacity.



Source: WindEurope

2. Corporate PPAs

Developments within the offshore wind industry

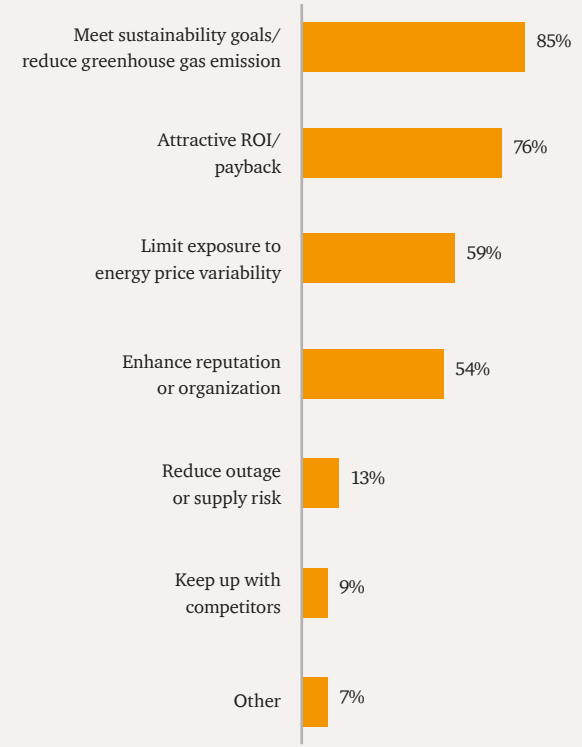
In 2018 offshore wind developers are facing a new reality of corporate procurements of renewable energy. The zero-subsidy bids in Germany and the Netherlands last year are part of an ongoing trend whereby capital costs fall in all markets and companies are increasingly looking into merchant projects. In the offshore wind energy this is a new development which is gathering pace.

Corporate procurement is usually established through corporate Power Purchase Agreements ("PPAs"), which are contracts whereby an industrial user purchases electricity directly from the energy producer, cutting out the utilities as the middleman. The contracts typically contain the commercial terms of the purchase of renewable energy, such as the contract period, delivery date, point of delivery, volume, price and product. Corporate PPAs are often extensive contracts and usually include advanced price mechanisms.

The upcoming of the corporate procurement mainly originates from the United States (US). According to Bloomberg New Energy Finance, 2.8 GW of "clean energy" PPAs were signed by corporates in the US in 2017 - more than half of a total global corporate PPA volume of 5.4 GW. As such, the US is currently the centre of the global corporate PPA market and within the US itself corporate PPAs are becoming an important element of the country's renewables market. The question remains whether Europe will be following these developments. The increasing number of zero-subsidy projects in Europe (e.g. Germany, the Netherlands and partially Denmark) and a recent five-year power purchase agreement between Royal Dutch Shell and a UK solar farm are promising signs of the way to go. Corporate PPAs are also becoming increasingly popular in subsidised projects, like for example the Dutch 140 MW onshore wind project Krammer and Bouwdokken.

The increase of corporate PPAs has been fuelled by lower prices for renewables, new options for procurement, and companies seeking to cut their carbon footprint and more directly contribute to the transformation of the energy infrastructure. Companies have pursued renewable energy due to both sustainability and financial considerations. Many of the pioneers - and largest purchasers - have been large technology firms and data centre operators like Google, Microsoft, Facebook, and Apple. Alongside these tech firms, there is an increasing interest from retailers. These 'pioneer' companies saw an opportunity to lower their costs, reduce electricity price risks, and reduce their carbon emissions, while protecting and/or enhancing their corporate reputation.

Drivers of intent to purchase*



*Respondents were asked to list their "top 3" reasons

In a 2016 PwC survey, respondents were asked to select their top three drivers of intent to purchase renewables. The results are included in the graphic below, which shows that sustainability goals, attractive return on investment, lower energy price variability and reputation enhancements were the main drivers of intent.

Virtual PPAs

Alongside lower prices, another prominent driver of the increase in corporate renewable procurement has been the development and expansion of a financial innovation: the Virtual PPA ("VPPA"), also known as the financial or synthetic PPA.

In a typical VPPA, the corporate signatory agrees to pay a fixed price for electricity from a renewable energy project, and retains the renewable attributes (the RECs), but never actually receives the electricity for the project. Instead, the developer sells the electricity directly to the grid at the open market price. A VPPA is a "contract for differences": if the market price is below the VPPA price, the signatory pays the developer the difference, and if the market price is above the VPPA price, the developer pays VPPA signatory.

VPPAs enable companies to procure renewable energy in a more flexible manner than standard PPAs, where the company is the direct off taker of the power. Most companies have limited on-site and local options for renewable generation, with on-site PPAs typically ranging in capacity from hundreds of kilowatts to a few megawatts.

Through VPPAs, companies can get access to projects located anywhere in the country in the scale from tens to hundreds of megawatts. For this reason, the majority of capacity contracted to date by corporates has come from VPPAs. Furthermore, as opposed to unbundled renewable energy credits (RECs), VPPAs allow the corporate signatory to take credit for causing new renewable energy to come online (known as "additionality"), and also to lock in a long term, stable price for energy.

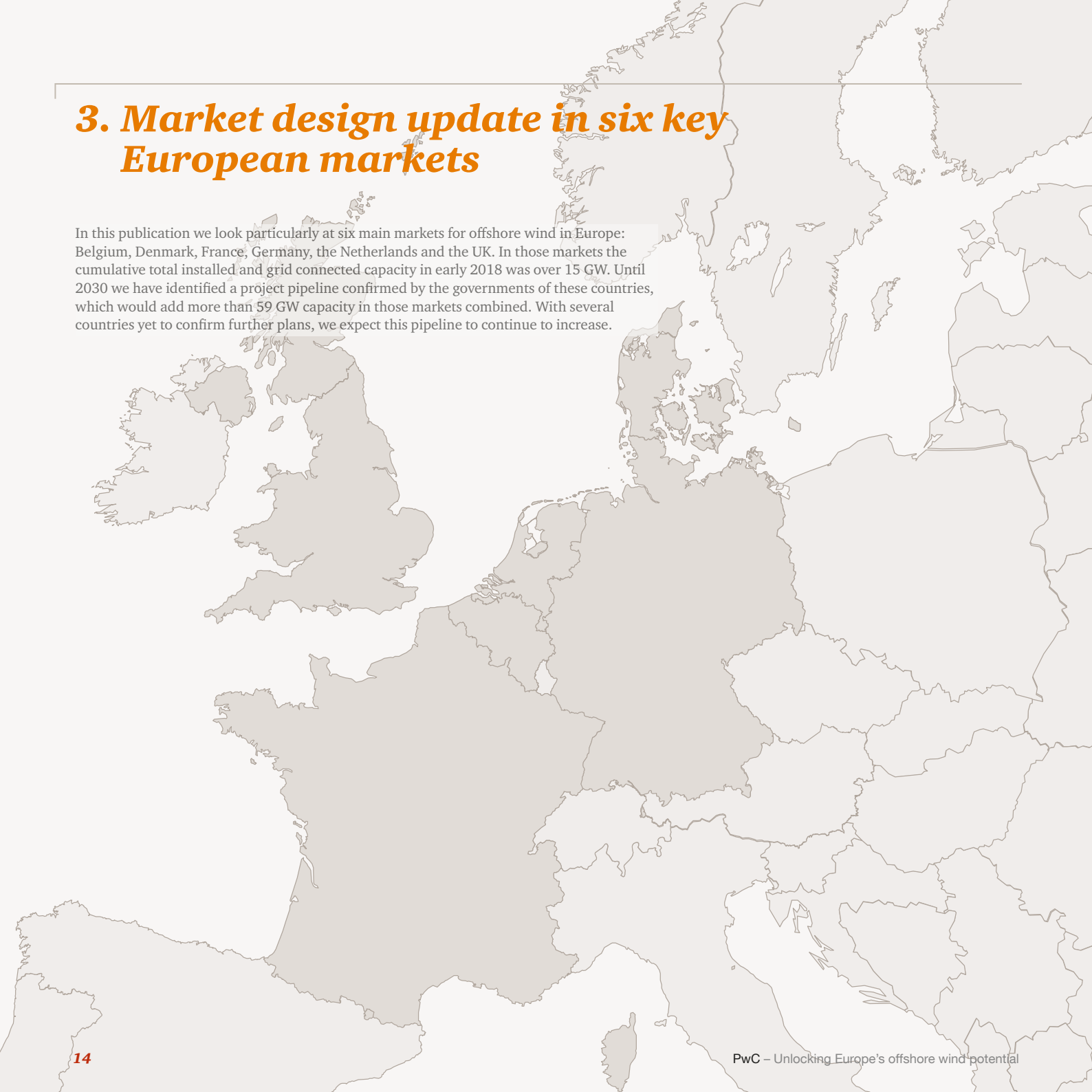
The latest trends in VPPAs

For all but the largest corporations, a common challenge is to procure renewables in smaller amounts, while still accessing the benefits of a VPPA. An emerging approach is for energy providers to sell portions, or "tranches" of a large VPPA to corporate customers - providing a product that is smaller in terms of capacity and may also have a shorter time period than the typical 15 to 20-year tenor of VPPAs. Another emerging approach is for smaller buyers to aggregate their demand, entering into a PPA as a group.

As renewable energy continues to grow, companies considering entering into a VPPA need to be aware of what the former head of the Business Renewables Centre called the 'winner's curse'. Some of the most attractive locations for renewable energy development in the US are now selling so much power to the grid that the prices at the 'node' can become very low or even negative, meaning that the corporate signatory would lose money on the power produced. Companies should carefully assess this 'basis' (locational) risk, and consider hedging it, or mitigating it by having the market price be determined at more liquid regional hubs, rather than at the local node on the grid.

3. Market design update in six key European markets

In this publication we look particularly at six main markets for offshore wind in Europe: Belgium, Denmark, France, Germany, the Netherlands and the UK. In those markets the cumulative total installed and grid connected capacity in early 2018 was over 15 GW. Until 2030 we have identified a project pipeline confirmed by the governments of these countries, which would add more than 59 GW capacity in those markets combined. With several countries yet to confirm further plans, we expect this pipeline to continue to increase.



The Netherlands
Key market developments

The Dutch government has played a vital role in facilitating the rollout of offshore wind over the past years. Zone selection, the use of a competitive tender process and a cost reduction target have all contributed to a more efficient process and large cost reductions. Furthermore, the government has awarded the TSO, TenneT, the role of offshore TSO. With currently 957 MW capacity installed, the Dutch market is anticipated to grow rapidly in the next coming years.

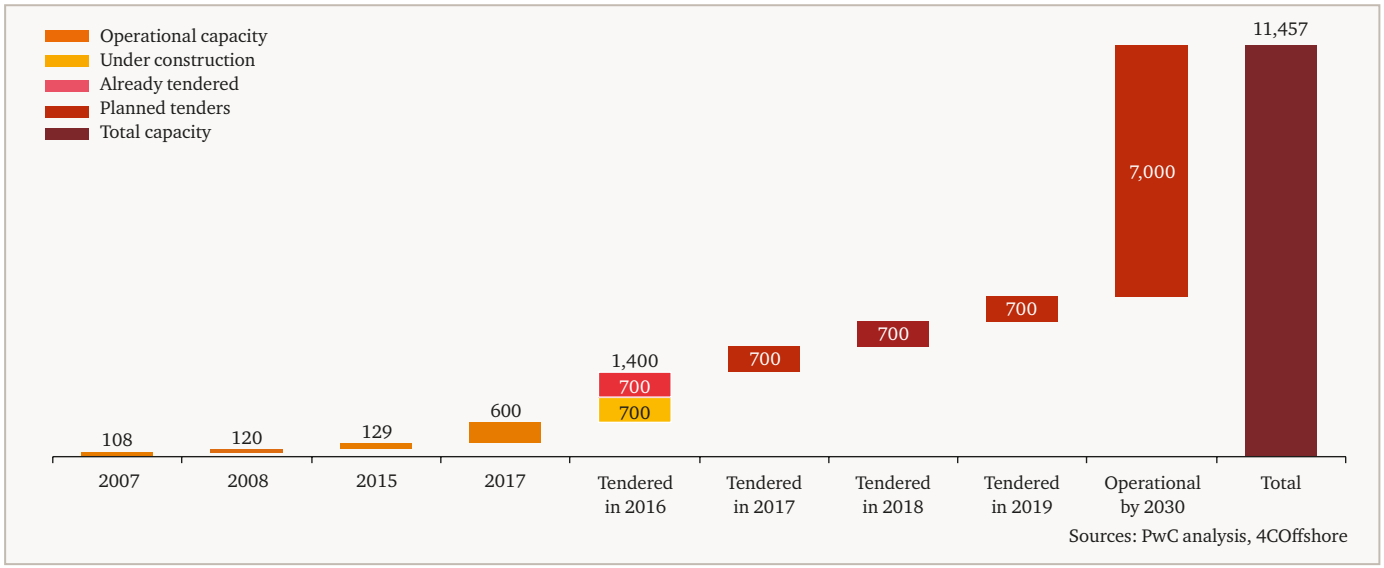
The new Dutch government has announced its ambition to reduce the CO_2 emissions by 4 megatons by 2030 by further increasing the amount of offshore wind farms in the Netherlands. Two Borssele I-V, as well as the Hollandse Kust North and South will together supply 3.5 GW to the Dutch consumer. Furthermore, the Dutch government announced that 1 GW additional capacity will be tendered each year in the years 2026-2030. The Dutch offshore wind sector has been on a strong cost reduction pathway in the past years. A cost-reduction of 55% has currently been realised in the Dutch offshore wind sector, and already exceeds the 40% set by the government for 2024, and which was included in the 2013 Dutch Energy Agreement (an agreement between the Dutch Government, stakeholders, companies and financial institutions).

The progress in cost-efficiency is reflected in the recent tenders in the Netherlands. In 2016, the Borssele 1 and 2 tenders had a winning bid of €72.70/MWh, followed by Borssele 3 and 4 at €54.50/MWh. 2017 continued this downward trend and for the Hollandse Kust sites, bids without subsidies have been submitted.

With the objective of being operational before 2022, Hollandse Kust (zuid) I and II would be the first wind farms in the world to be constructed and operated without subsidies. In addition to this, the Dutch government published a consultative legislative proposal in February 2018 that (among other things) provides the possibility to auction the sites for offshore wind parks, effectively creating a licencing system for the construction and operation of offshore wind farms.

The above shows that the Dutch government is ambitious in the field of offshore wind and therefore created a strong pipeline for offshore wind until 2030. The next step for the market is to prove that they can further lower costs in order to run commercially successful projects, even when subsidies are phased out.

Offshore wind capacity (in MW)



Sources: PwC analysis, 4COffshore

Current and planned capacity

Overview of tender, subsidy and tax regime

Tender		*Subsidies*		*Tax**	
Tender in place	Yes, competitive tender for each site	Subsidy mechanism	Subsidieregeling Duurzame Energie+ (SDE+) Guaranteed price lowered by the electricity market price (market premium). The recent tender without subsidy shows that (more) projects without subsidies are a realistic forecast going forward.	Nominal corporate income tax rate w	Currently 25% (20% for the first €200,000 of taxable income). The standard tax rate will be reduced in steps from 25% to 21% (2019: 24%, 2020: 22.5% and 2021: 21%). The lower basic rate (taxable profit up to €200,000) will decrease by the same steps from 20% to 16% (2019: 19%, 2020: 17.5% and 2021: 16%).
Guarantees in place upfront or after award	Afterwards, bank guarantee is required within four weeks after the bid award (€10m). A second guarantee is required one year after winning the tender (€35m)	The cost of the subsidy scheme per kWh	Difference between guaranteed price and the electricity market price which is corrected by an imbalance and profile factor (correction price) and capped (by a minimum electricity price)	Depreciation terms	Depreciation for Dutch corporate income tax purposes generally follows the applicable accounting rules, unless the tax legislation provides specific rules (e.g. minimum depreciation term of 5 years applicable to tangible assets). The applicable depreciation term is based on the useful life of an asset and in the offshore wind practice the depreciation term is generally in line with the subsidy period.
Local content requirement	No	Guaranteed price for investors	Project-specific (determined in a tender)	Recognition of the decom-missioning provision	Decommissioning provision also recognised for CIT purposes, timing differences may have to be considered
Legal structure before bid submission	Yes, legal structure required prior to tender	Method to assess income from electricity market	Yearly average price (based on day-ahead market price)	Generic tax incentives	No
Max tender amount (€/MWh)	Yes, decreases each tender round (€107.50/MWh in 2017, decreasing to €100.00/MWh in 2019). In the future, the system may move towards a system where bidders can decide to pay for the licence (auction based).	Compensation for imbalance as part of the guaranteed price setting	Yes, imbalance and profiling factor used (defined each year)	Specific tax incentives	No
		Subsidy period	Maximum 15 years +1 year banking	Thin capitali-sation rules	Yes, as of 1 January 2019, implementing the EU Anti Tax Avoidance Directive. Earnings stripping rule: excessive interest costs will only be deductible until the amount equal to 30% of the Dutch EBITDA. The earnings stripping rule will contain a threshold of €1m per taxpayer.

Germany
Key market developments

Germany's offshore wind industry is characterised by strong support from politics as well as major regulatory changes in past years, including the recent change to a tender based system. The amount of power generated by offshore wind turbines was around 17.4 TWh in 2017.[6] This consolidates offshore wind power's position in the German power mix, supplying around 4 million households with electricity.

As of 2017 energy production from offshore wind is supported in the new Windenergie-auf-See Gesetz (Wind Energy at Sea Act) and in the updated Erneuerbare Energien Gesetz (Renewable Energy Act). This new legal framework stipulates a steady increase in offshore wind production capacity, the harmonisation of grid expansion and reduction of subsidy costs in order to reach a target of 15 GW installed capacity by 2030. This would be achieved through a system rolled out in three intervals:

1. Until the end of 2020, 7.7 GW capacity will be installed under the "old" regime on the basis of already awarded unconditional grid connection capacities. At the end of 2017, 5.4 GW was already installed.

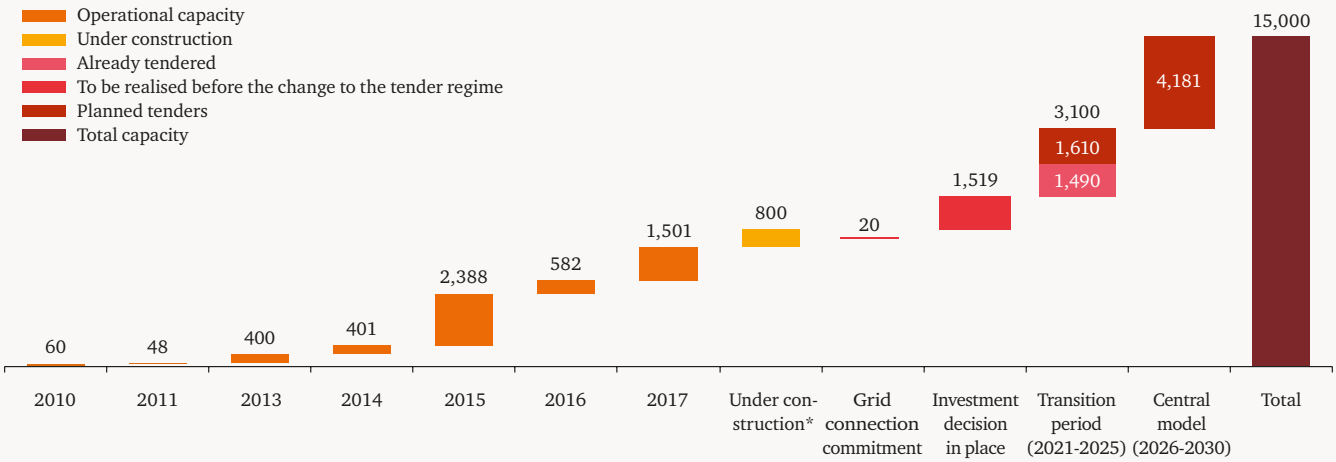
   These projects will receive a statutory fixed market premium for electricity feed-in over 20 years, plus the year of commissioning.

2. In an interim period 2021 -2025 (dates refer to the commissioning date), grid connection and market premium remuneration were and will be awarded to project owners in two tenders in 2017 and 2018. In these tenders, projects which have reached a certain level of development maturity will compete for a grid connection capacity of 3.1 GW. In 2017 1.49 GW were already tendered and 1.38 GW of the successful bids were on a subsidy-free basis. 1.61 GW will be tendered in April 2018.

3. As of 2026 (date refers to the commissioning date), there will be the so called central regime in place. Pre-developed sites will be allocated by the federal government in bi-annual auctions of 700-900 MW per annum. Sites will be awarded to bidders who claim the lowest market premium. The owner of the sites who participated unsuccessfully in the interim regime will receive a step-in right if the sites formerly owned by them are tendered, i.e. they are entitled to a buy-in at the strike price of the award.

Offshore wind capacity (in MW)

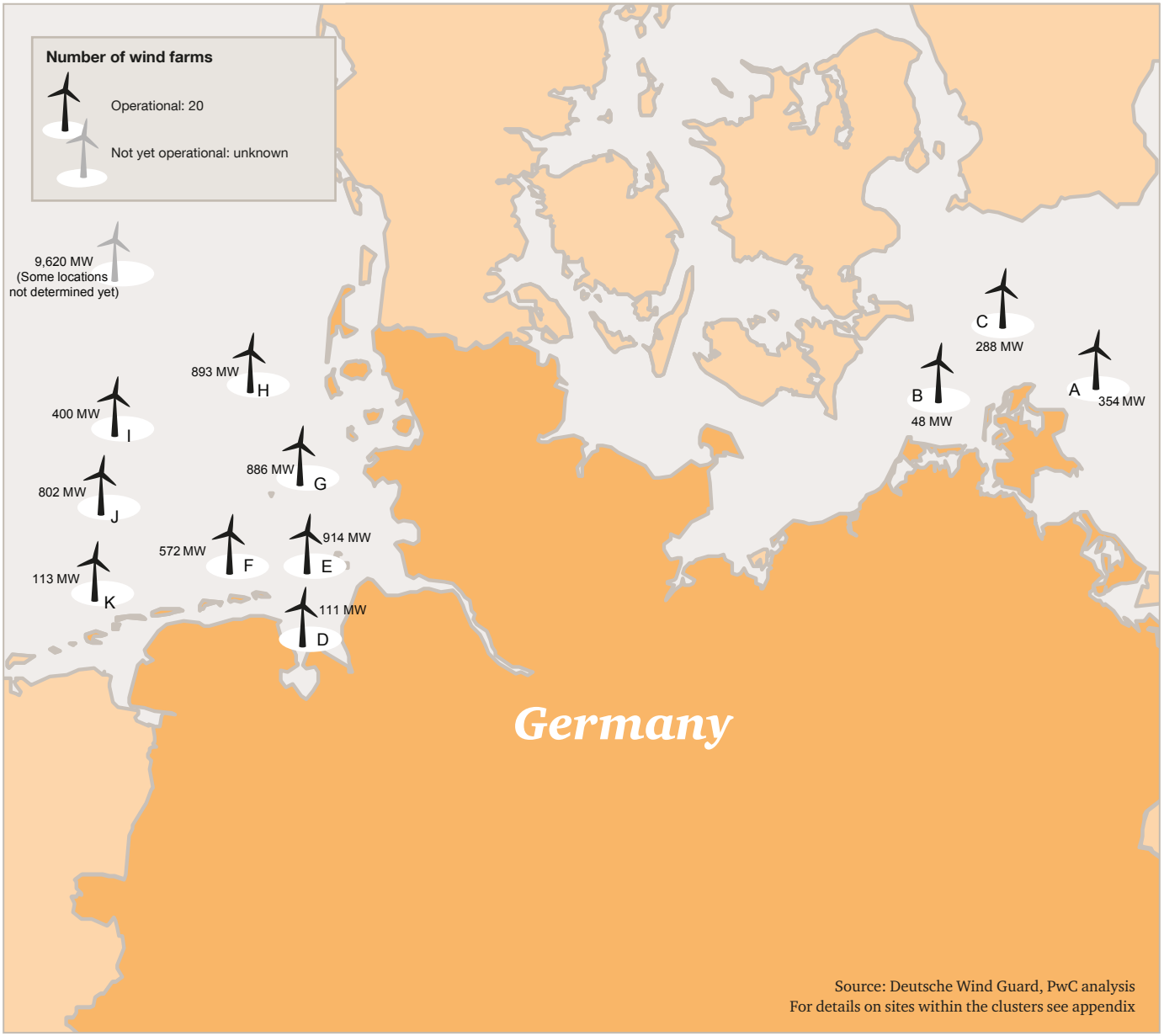
[6] Frauenhofer-Institut für Solare Energiesysteme ISE (2017), Stromerzeugung in Deutschland im Jahr 2017.



* Includes capacity without grid connection

Source: Deutsche Wind Guard, PwC analysis

Current and planned capacity



Source: Deutsche Wind Guard, PwC analysis
For details on sites within the clusters see appendix

Overview of tender, subsidy and tax regime

Tender		*Subsidies*		*Tax**	
Tender in place	Current regime (until end of 2020): no tender Interim regime (2021-2025): change to tender system - 1st tender: 04/2017: 1,490 MW tendered; 2nd tender 04/2018: 1,610 MW to be tendered Centralized regime (as of 2026): annual tenders of 700-900 MW	Subsidy mechanism	For projects commissioned until 2021: market premium under fixed feed-in tariff system For projects commissioned from 2021: market premium under a base price awarded in tender	Nominal corporate income tax rate	15% Corporate Income Tax (CIT) plus Solidarity Surcharge of 5.5% thereon (together 15.825%) and Trade Tax (TT) at a rate depending on where the business in located, usually around 14%
Guarantees in place upfront or after award	Current regime: no Interim regime: yes, upfront guarantee of 100,000 Euro / MW Centralized regime: yes, upfront guarantee of 200,000 Euro / MW	The cost of the subsidy scheme per kWh	For projects commissioned from 2021, i.e. awarded under the new tender system: Difference between the awarded base price and the electricity market price	Depreciation terms	Useful lifetime of the depreciable assets (generator, cabling, substation) 16 years. Straight line depreciation with accelerated depreciation regime available (up to 20% in the year of acquisition and the four following years)
Local content requirement	No	Guaranteed price for investors	For projects commissioned from 2021, i.e. awarded under the new tender system: awarded base price	Recognition of the decom-missioning provision	Decommissioning provision also recognised for CIT and TT purposes, timing differences may have to be considered
Legal structure before bid submission	Usually a SPV owned by a corporate or a consortium Interim regime: bidder participates in tender witt own (qualified) project Centralized regime: bidder participates in tender without own project	Method to assess income from electricity market	Monthly average market price for energy source “wind energy offshore” of EPEX Spot SE / Paris	Generic tax incentives available for offshore wind	No
Max tender amount (€/MWh)	Interim regime: €120/MWh Centralized regime: minimum amount of 2018 auction within interim regime. Individual amount can be fixed by Federal Grid Agency	Compensation for imbalance as part of the guaranteed price setting	95 % compensation of losses (if < 1% of annual earnings) 100% compensation of losses (for losses above 1% of annual earnings)	Specific tax incentives for offshore wind	No
		Subsidy period	For projects commissioned until 2021: 20 years + year of commissioning For projects commissioned from 2021, i.e. awarded under the new tender system: 20 years	Thin capitalisation rules	No thin capitalisation rules as such; their substitute is the 'interest limitation' to, basically, 30% of EBITDA

* Under the EU Anti Tax Avoidance Directive each Member State should by 1 January 2019 have introduced a rule restricting net borrowing costs to 30% of the taxpayer’s EBITDA, optionally with a EUR 3m threshold. Standalone entities may be excluded from the scope. Within consolidated groups, Member States may allow full or partial deduction of exceeding borrowing costs under ‘group ratio’ conditions. Member States may exclude loans concluded before 17 June 2016, loans used to fund long-term EU public infrastructure projects, and financial undertakings.

Source: PwC analysis

Belgium
Key market developments

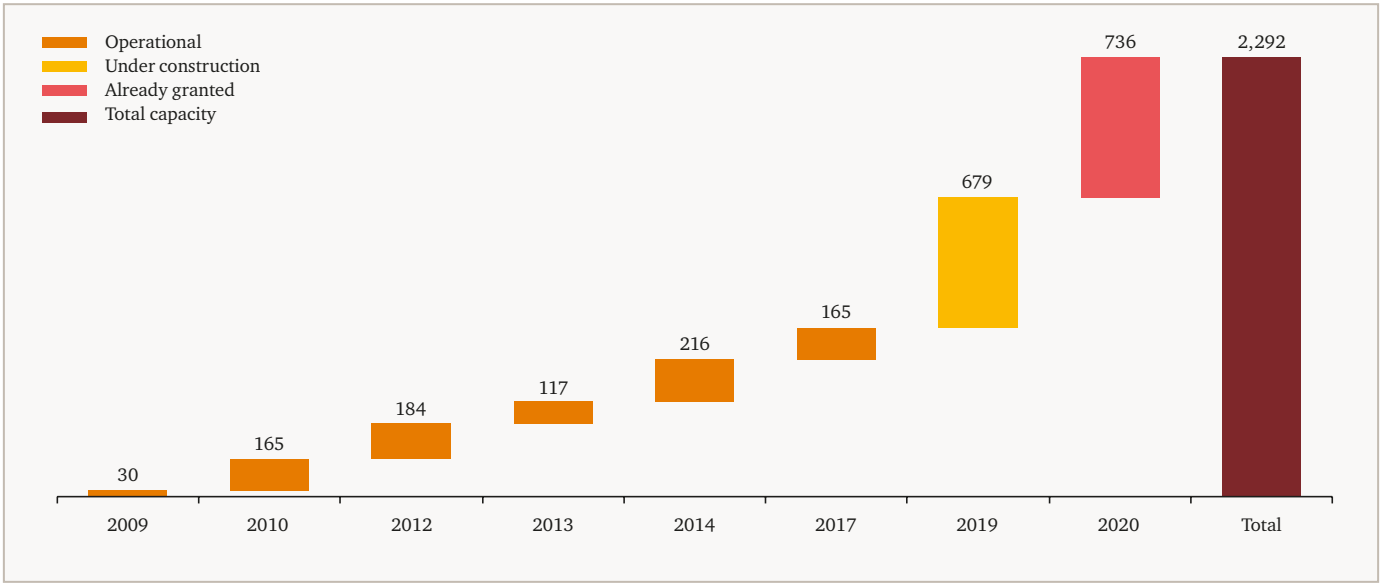
The Belgian government has decided to phase out nuclear energy by 2025 and therefore needs to focus increasingly on renewable energies. In line with EU objectives, the government supports the development of renewable energy sources and aims to have a share of 13% of renewables in the gross final energy consumption by 2020. Offshore wind plays a key role in the country's renewable energy plan.[7] Over half of the electricity produced by wind farms is planned to be produced offshore on the Belgian North Sea.

However, the increase in offshore wind capacity has stalled recently and it is uncertain if the 2020 target of 2 GW will be met. Until 2019, the present capacity of 877 MW will not increase, although for two parks, the pre-construction preparations have started and a new support scheme for the three remaining concessions has been installed. The Belgian government will investigate in the near future which other zones in the Belgian North Sea could be eligible for additional development of offshore wind parks.

A discussion between industrial consumers, mainly led by energy intensive companies, and investors on the adequate level of support for offshore wind through green certificates, led to a subsidy system reform in early 2014. A new and less generous framework was approved by the government in June 2016. This has altered some of the subsidy scheme specifications for the next two wind farms soon to be built (Rentel and Norther).

As a result of the recent price trends in Dutch waters close to the Dutch-Belgian maritime border, the Belgian government was under pressure to cut subsidies for the sector. The Belgian government reached an agreement with the developers in October of 2017 of the three remaining offshore wind park concessions (Northwester 2, Seastar and Mermaid) on a price of €79/MWh as part of the government's support scheme. This is considerably lower than the subsidy level committed to two offshore wind projects two years ago (at €129.8 and €124/MWh).

Offshore wind capacity (in MW)



[7] Under the Directive 2009/28/EC each EU member state submitted its National Renewable Energy Action Plan to the European Commission in 2010, outlining how they plan to meet their obligations under the Renewable Energy Directive, including legally binding 2020 targets.

Current and planned capacity

Sources: 4C Offshore, PwC analysis
For details on sites within the clusters see appendix

Overview of tender, subsidy and tax regime

Tender		*Subsidies*		*Tax**	
Tender in place	No tender currently in place, all concessions have been granted. A new marine spatial plan for the period after 2020 will be prepared in the coming years, possibly leading to new concessions or tenders.	Subsidy mechanism	Offshore wind operators receive green power certificates for every MWh produced at a guaranteed minimum price over a 20 year period	Nominal corporate income tax rate	As of FY18 Belgian companies are subject to a standard corporate income tax rate of 29.58% and as from FY20 to a rate of 25%.
Guarantees in place upfront or after award	Not applicable. Concessions have been granted	The cost of the subsidy scheme per kWh and guaranteed price for investors	Three different subsidy levels exist - ranging from €107/MWh + power price, for the 877MW installed/under construction, to guaranteed total income (subsidy + electricity price) of 124/129 €/MWh for the next two wind farms and 79 €/MWh for the three remaining concessions being granted.	Depreciation terms	Tax depreciation follows accounting tax purposes (unless tax law specifically deviates). Depreciation term is the useful life of an asset.
Local content requirement	No	Method to assess income from electricity market	Yearly average of the daily rates in €/MWh on the electricity exchange Endex Cal Y+1	Recognition of decommissioning provision	Yes, if certain requirements are met.
Legal structure before tender bid submission	Adequate legal structure required for construction and operational phase, usually in the form of a consortium.	Compensation for imbalance as part of the guaranteed price setting	Yes, guaranteed price of the certificate drops to €0 for a maximum of 72 hours per year, if there is overproduction in the market and when electricity price is less than -€20 /MWh	Generic tax incentives available for offshore wind	New incremental notional interest deduction ("NID") regime available for all Belgian companies which is calculated based on the incremental equity over a five year period.
Max tender amount (€/MWh)	Not applicable	Subsidy period	Ranging from 19 to 22 years for the operational parks and parks under construction, for which a 10 year extension without subsidy is possible. For the three remaining concessions to reach financial close, the subsidy period has been capped at 16 years, which could be extended with 1 year in case of lesser wind conditions.	Specific tax incentives for offshore wind	Wind farms may be eligible for a one-off investment deduction on certain items of the acquisition value.
				Thin capitalisation rules	Currently, interest payments or attributions on intercompany debt in excess of a 5:1 debt-equity ratio are not tax deductible. Following the EU Anti-Tax-Avoidance-Directive, a 30% EBITDA interest limitation rule will be implemented.

* Under the EU Anti Tax Avoidance Directive each Member State should by 1 January 2019 have introduced a rule restricting net borrowing costs to 30% of the taxpayer's EBITDA, optionally with a EUR 3m threshold. Standalone entities may be excluded from the scope. Within consolidated groups, Member States may allow full or partial deduction of exceeding borrowing costs under 'group ratio' conditions. Member States may exclude loans concluded before 17 June 2016, loans used to fund long-term EU public infrastructure projects, and financial undertakings.

France
Key market developments

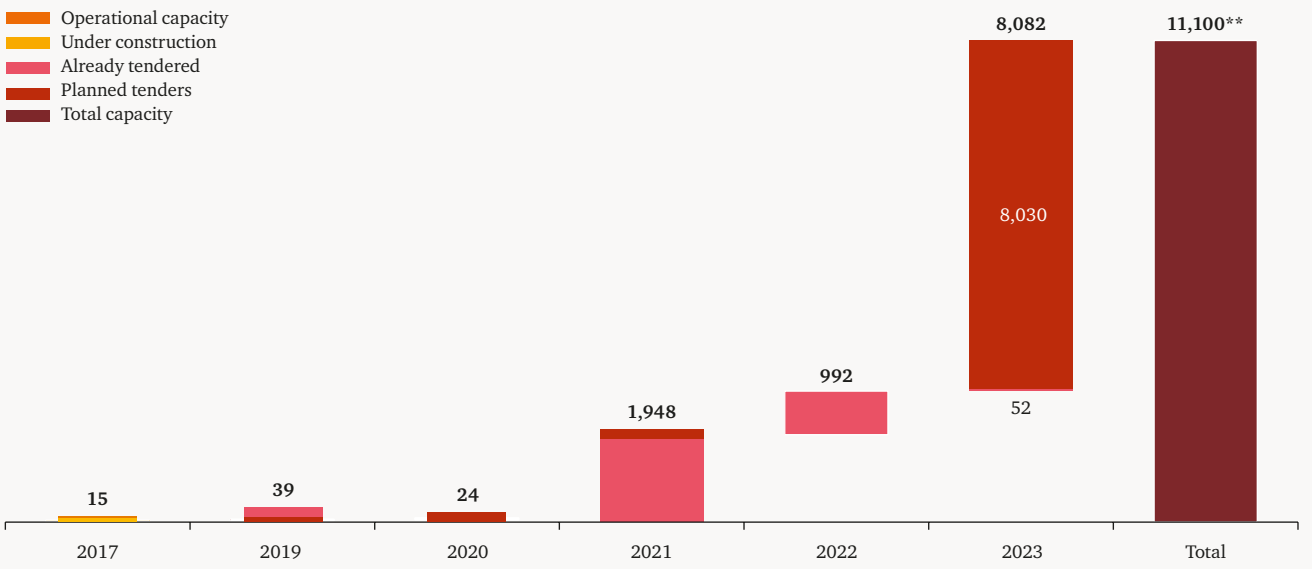
In many respects though, France is an ideal country for wind energy with marine territories on the English Channel, Atlantic Ocean and Mediterranean Sea. As an indication of this potential, France's long-term offshore wind potential is estimated to be 90 TWh per annum.

Frances's Energy Transition Law (2015) lays out measure to ease the consenting process, and sets a 40% target for renewables in the country's electricity supply by 2030 - effectively doubling the share of renewables in the French energy mix. For offshore wind the targets are 3-9 GW for fixed-base structures, to be tendered or installed by 2023, and 10-2000 MW floating offshore wind power and other marine renewables. Those targets could however be reviewed in the government's 2018 Energy Plan. France's current offshore wind capacity stands at 2 MW, as one floating offshore wind pilot farm came online in 2017.

The French government has set up three rounds of tenders for offshore wind to date and is currently preparing a fourth one. During two first rounds of tender in 2012 and 2014, six offshore wind farms totalling 3 GW were tendered. The construction of those projects are due to start shortly with grid connection dates set between 2020 and 2023.

For a third tender in Dunkirk, around ten bidders were shortlisted in April 2017 through a new procedure called 'competitive dialogue'. The dialogue aims to select potential developers and define the best suited area (capacity estimated around 400-500 MW). The final offer is expected by summer 2018. The fourth tender near Oléron Island will be based on the same principle. Alongside this, the first tender for floating offshore wind has given the go-ahead for four pilot projects of 24 MW each. Those are currently going through public enquiry and design phases.

Offshore wind capacity (in MW)



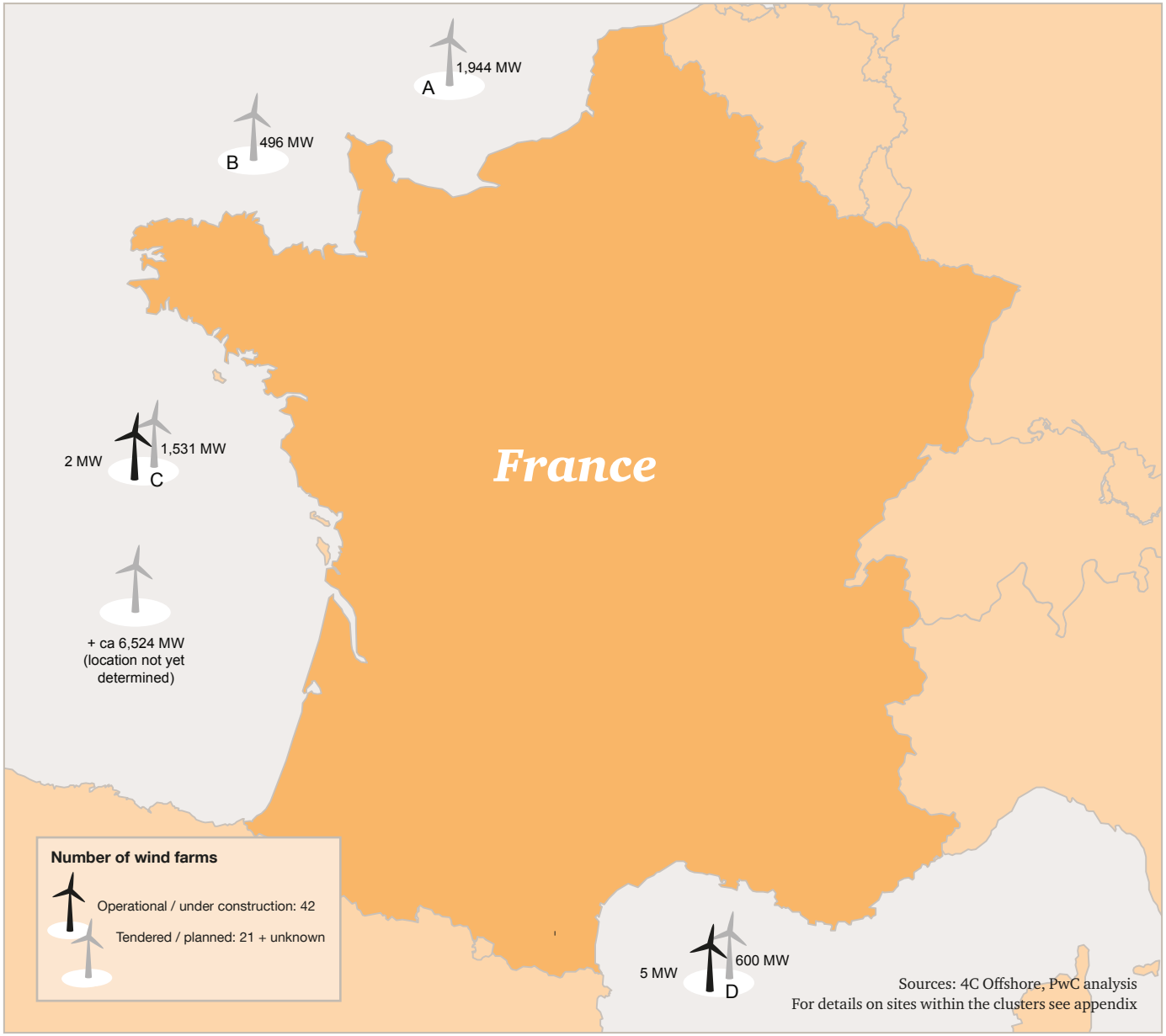
* This includes other marine energies like floating wind power (the best case 2023 target of 2000 MW also contains some hydrokinetic capacity)
** Maximum expected range as per the current French Energy plan (an update is expected by the end of 2018)

Sources: C4 Offshore, PwC analysis

Despite regulatory improvements, and an attempt to mitigate some industrial risks (thanks to better known wind and soil characteristics before the bid), offshore wind sector in France is still facing several challenges: a substantial gap between initial feed-in tariffs awarded in 2012/2014 and the current market LCOE, a need for cost reduction for future wind farms, a need to define areas for offshore wind development among conflicting maritime interests, as well as increased competition in the market.

In order to mitigate the first of those concerns, a 2018 proposal by the French government suggested reducing subsidies for the projects tendered in 2012 and 2014, but failed to win political support in the French Senate. Even if the extreme amendment has been rejected, the previously agreed tariff of ca. €200/MWh is still subject to discussion with the French State in order for the authorities to reduce the burden on the National Budget.

Current and planned capacity



Overview of tender, subsidy and tax regime

Tender		*Subsidies*		*Tax**	
Tender in place	Yes (New process with simplified authorization process and detailed information about soil & wind provided to the bidders during a competitive phase)	Subsidy mechanism	Feed-in tariff	Nominal corporate income tax rate	For FY 2018 : 28% up to €500k of tax result, 33.1/3% for the above result, excluding 3.3% social contribution and exceptional contribution on profits For following FYs, progressive reduction (until 2022) to a 25% rate
Guarantees in place upfront or after award	After Bid Award: (i) For Design and preliminary works, 15 days after the bid award (ii) For Construction & Operation, before submitting the allowance file for assessment	The cost of the subsidy scheme per kWh	Guaranteed price (feed-in tariff, depending on tender round, location and bid)	Depreciation terms	Tax depreciation follows accounting depreciation plan (unless tax law specifically deviates)Depreciation term is the useful life of the asset. Some equipment may be eligible for accelerated tax depreciations
Local content requirement	Yes (installation of equipment factory and/or increased capacity in the national territory)	Guaranteed price for investors	Project-specific, now between €0.14/kWh and €0.22/kWh	Recognition of the decommissioning provision	Yes, this provision should be adjusted yearly. Specific accounting and tax regulations apply
Legal structure before bid submission	Yes, usually as a consortium	Method to assess income from electricity market	Not applicable	Generic tax incentives available for offshore wind	No
Max tender amount (€/MWh)	Yes, capped and incentive bid assessment with decreasing feed-in tariff	Compensation for imbalance as part of the guaranteed price setting	No	Specific tax incentives for offshore wind	No
		Subsidy period	20 years	Additional contributions on offshore wind energy	Public maritime domain occupancy fee (€1000 per turbine + €1 per meter of power connection cable + €6000 per MW installed). Special tax on offshore wind turbines (2017 amount: €15,842 per MW installed).
				Thin capitalisation rules	Yes, however the thin capitalisation rules do not apply to interest payable to banks and credit institutions

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The United Kingdom
Key market developments

The UK is the world leader in offshore wind with 6.1GW installed at the end of 2017 and capacity expected to reach around 15 GW by 2025. The sector meets around 6% of the UK's annual energy demand,[8] and is expected to grow to 10% by 2020. There is a strong pipeline of projects in development, as the UK plans to increase its offshore wind capacity to help bridge a looming electricity supply gap as old nuclear plants and coal-fired power stations close.[9] More than £9.5 billion has been invested in offshore wind in the United Kingdom since 2010, with another £18 billion due by 2021.[10]

In the UK the Crown Estate is the legal owner and manager of the UK seabed, including sites for offshore wind farms. It is responsible for identifying and leasing sites to offshore wind developers. Leases provide successful bidders with the responsibility to develop, operate and manage an asset for the period of the lease, in return for lease payments which become payable once the wind farm is operational. In addition, the project developer will require a revenue support contract, which stabilise the revenues from the wind farm for a period of 15-20 years. The latest licensing round in 2017 saw in excess of 3GW of contracts awarded to three projects. Notably, two of the projects due to be delivered in 2022/23 were awarded contracts with a strike price of £57.50/MWh (2012 prices).

For all tenders, the Crown Estate is responsible for programme delivery, which includes geological modelling and zone contract management. Developers can register for one or more of the selected sites. The company or consortium with the best and cheapest plan obtains both a permit and a grant to develop the wind farm, although as stated above, this does not guarantee that the developer will develop the project.

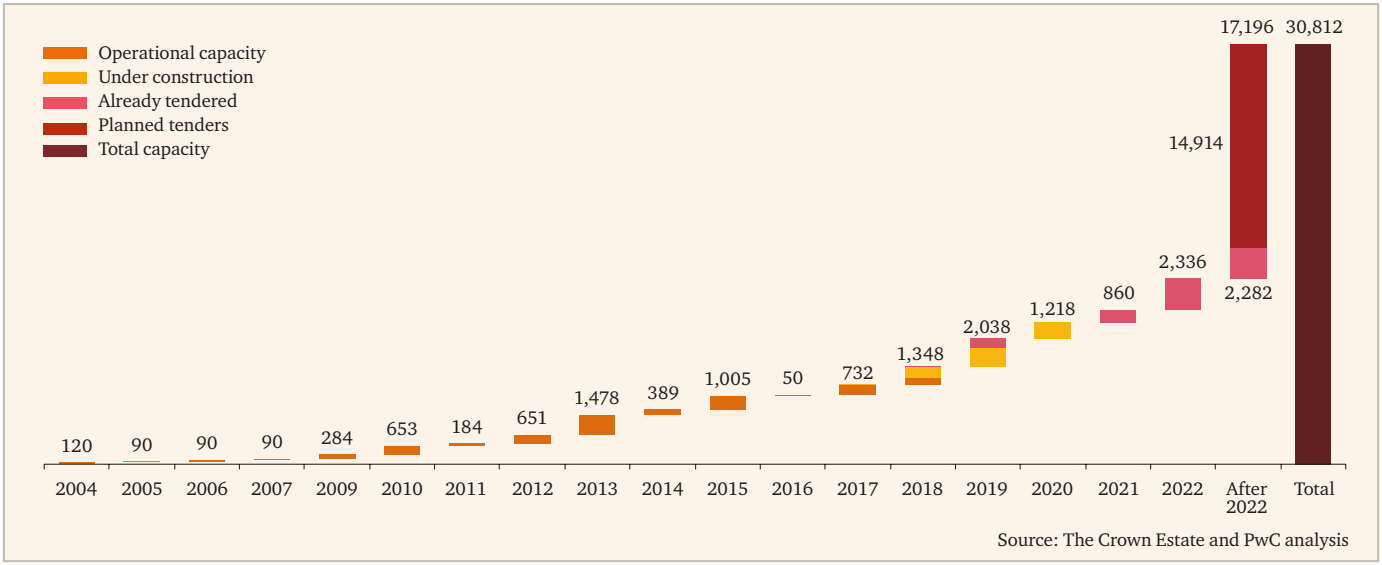
Access to the revenue support mechanism is a critical factor for progressing projects. Offshore Transmission Owners (OFTOs) are responsible for connection to the onshore high voltage transmission grid. Generally, OFTOs are initially owned by the original developers until construction has been completed, after which the offshore grid is auctioned and transferred to the OFTO.

[8] Based on 2016 values.

[9] The UK has a legally binding target to cut emissions of harmful greenhouse gases by 80% from 1990 levels by 2050.

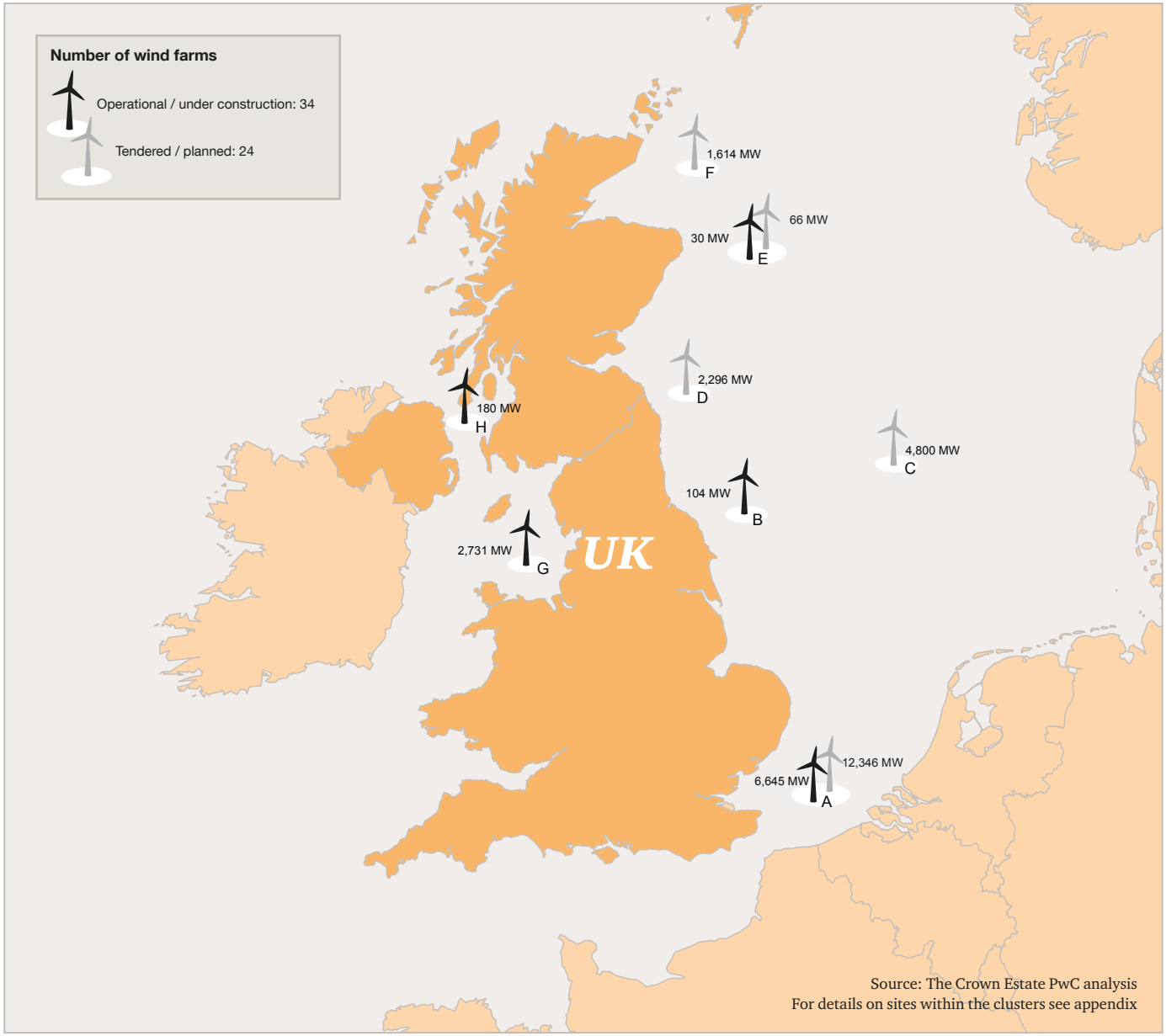
[10] The Offshore Wind Programme Board (2017), Cost Reduction Monitoring Framework 2016.

Offshore wind capacity (in MW)



Source: The Crown Estate and PwC analysis

Current and planned capacity



Overview of tender, subsidy and tax regime

Tender		*Subsidies*		*Tax**	
Tender in place	Yes, the last subsidy tender was in 2017. The next one expected in 2019 for delivery post 2023.	Subsidy mechanism	CfDs replaced ROCs as the primary support mechanism from April 2017. Renewable Obligation Certificates (ROCs) – a green certificate mechanism – are available to projects that have received grace periods until March 2018. Contracts for Difference (CfDs) – pays developers a pre-agreed price (strike price) for 15 years	Nominal corporate income tax rate	Nominal corporate income tax rate 19% (reducing to 17% in 2020).
Guarantees in place upfront or after award	Not applicable	The cost of the subsidy scheme per kWh	For CfDs the price payable is determined through a tender process. The level of subsidy is determined by the difference between the strike price and the half-hourly electricity price.	Depreciation terms	Capital allowances may be deducted - 18% calculated on a reducing-balance basis for assets with a useful economic life less than 25 years or, 8% for assets with a useful economic life greater than 25 years
Local content requirement	Yes for schemes over 300MW under CfD	Guaranteed price for investors	Under the CfD, the strike price offered to successful projects will be equal to the lower of the clearing price for the relevant delivery year, and the relevant Administrative Strike Price. The clearing price for each delivery year is set at the strike price bid of the last accepted (marginal) bid in that year	Recognition of the decom-missioning provision	Commercially, additions to a decommissioning provision are recognized on an accrual basis. However, for tax purposes tax relief is only available when the provision is utilised at the end of the asset life
Legal structure before bid submission	Not applicable	Method to assess income from electricity market	A combination of the actual market price in every half hour of generation plus the difference payment	Generic tax incentives available for offshore wind	No
Max tender amount (£/MWh)	The government will control costs by capping offshore wind strike prices. Strike prices for delivery 2021/22 are capped at £105/MWh (2011-12 prices) and the government's ambition was that this would fall to £85/MWh for projects commissioning by 2026 - However this may reduce further as two projects with delivery years of 2022/23 received strike prices of £57.50 in the recent 2017 auction.	Compen-sation for imbalance as part of the guaranteed price setting	Not applicable	Specific tax incentives for offshore wind	No
		Subsidy period	15 years for CfDs and 20 years for ROCs	Thin capitalisation rules	No set thin cap limit, but cannot exceed arm's length and a range of anti-avoidance restrictions.

* Based on the EU Anti Tax Avoidance Directive, from 1 April 2017 the UK introduced a rule restricting net borrowing costs to 30% of the taxpayer's EBITDA, with a £2m threshold. Additional borrowing costs may be deducted under a 'group ratio' test or on loans used to fund certain public infrastructure projects.

Source: The Crown Estate

Denmark

Key market developments

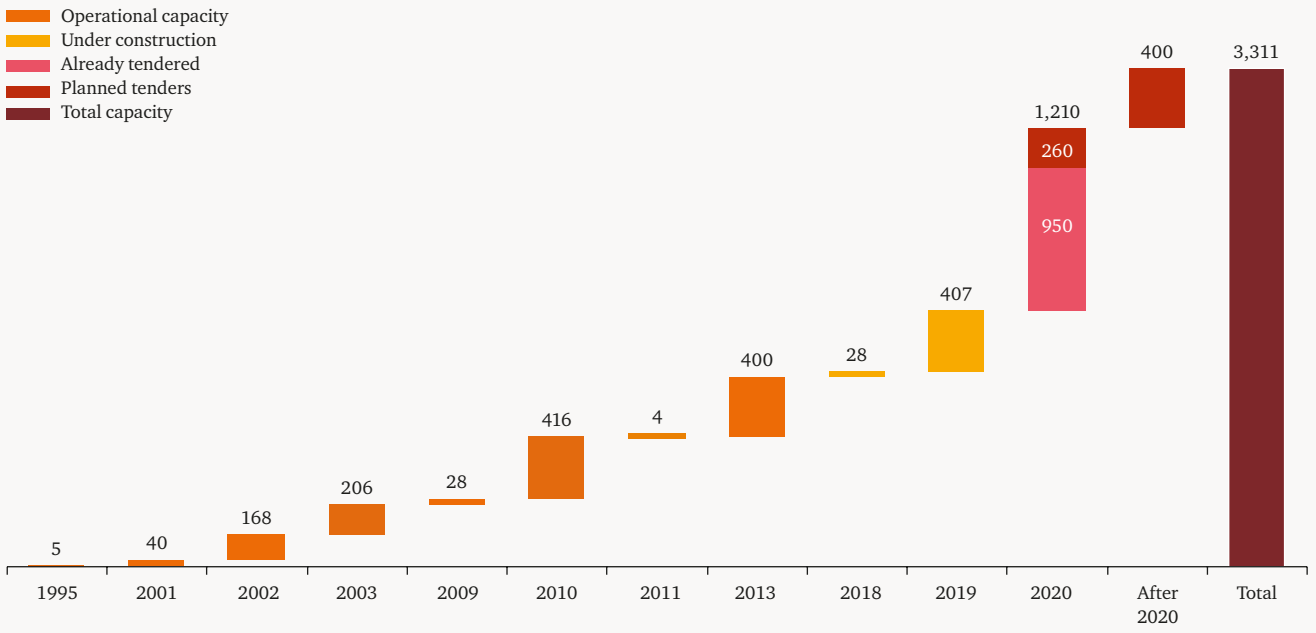
Denmark has the longest history of offshore wind turbines in the world. The first wind farm was established in 1991 at Vindeby and was decommissioned in 2017. Denmark is the country with the largest share of wind energy in its electricity demand (44% in 2017). Denmark has 1.3 GW capacity installed today and when Horns Rev 3, Krieger's Flak is commissioned this will increase with 1 GW. In addition, another 350 MW nearshore and trial turbines are planned for commissioning in 2020. By 2020 the installed capacity is expected to cover 50% of electricity consumption in Denmark.

Offshore wind turbines can be installed following two different procedures: Government tender or open-door procedure. For both procedures, the project developer must obtain three licenses: 1) a license to carry out preliminary investigations, 2) a license to establish the offshore wind turbines and 3) a license to exploit wind power for a given number of years.

In the government tender procedure, the Danish Energy Agency announces a tender for an offshore wind project of a specific size within a specifically defined geographical area. In the open-door procedure, the project developer takes the initiative to establish a wind farm of a chosen size in a specific area. This is done by submitting an unsolicited application for a license to carry out preliminary investigations in the given area.

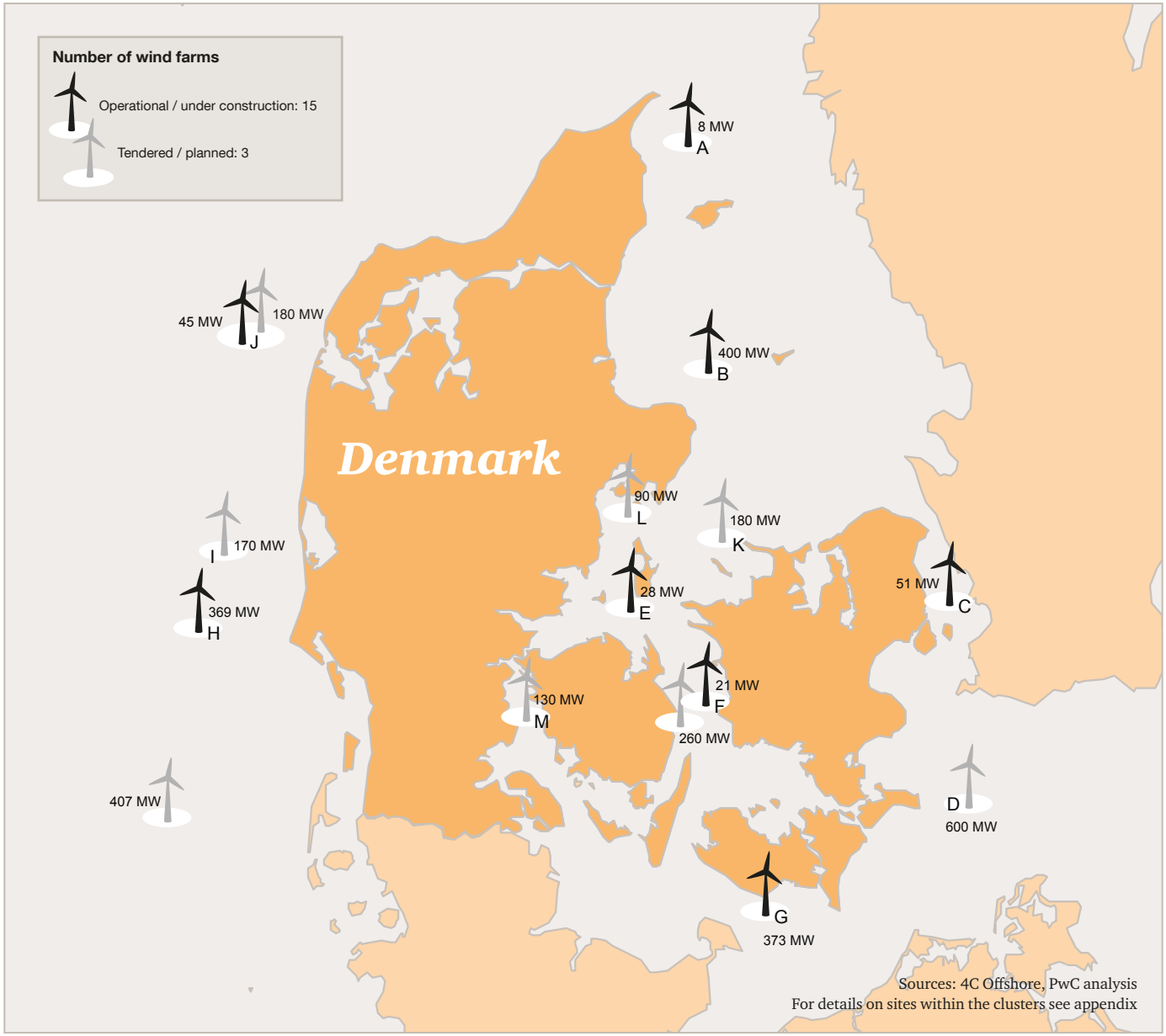
The Danish government is contemplating phasing out subsidies as this is the pre-requisite in the country's energy transition plan.

Offshore wind capacity (in MW)



Sources: C4 Offshore and PwC analysis

Current and planned capacity



Overview of tender, subsidy and tax regime

Tender		*Subsidies*		*Tax**	
Tender in place	Yes + an open door procedure. Open door has less advantageous financial terms. No large scale project has been developed in the open door system	Subsidy mechanism	Tender: feed-in premium (Public Service Obligations (PSO)). Open door: set subsidy per kWh, tapering off above a market price of 33 øre/ kWh	Nominal corporate income tax rate	22% corporate income tax rate
Guarantees in place upfront or after award	State guarantee for bank loans. However, only for groups of local citizens and only in open door procedure	The cost of the subsidy scheme per kWh	Tender system: the difference between the guaranteed price and electricity market price. Open door: 25 øre per kWh, tapering off on a 1:1 basis at a market price above 33 øre/ kWh (=guaranteed price of 58 øre/ kWh)	Depreciation terms	Wind farms are usually depreciated with up to 25 %. However, special rules apply to wind farms acquired after the income year 2013 with a capacity exceeding 1 MW. they, can only be depreciated with up to 15 %
Local content requirement	No	Guaranteed price for investors	Project-specific	Recognition of the decommissioning provision	For tax purposes, there is no recognition of the decommissioning provision or any additions hereto
Legal structure before bid submission	No	Method to assess income from electricity market	Tender: Hourly spot price in the relevant area. Open door: Weighted monthly average	Generic tax incentives available for offshore wind	Not applicable
Max tender amount (DKK/MWh)	Project specific	Compensation for imbalance as part of the guaranteed price setting	Tenders: loss due to a reduction or halt in production ordered by the TSO is compensated at guaranteed rate for lost production (Project dependant) Separate imbalance compensation of 1.8 øre/ kWh in open door and older wind farms	Specific tax incentives for offshore wind	Not applicable
		Subsidy period	Tender: 20 years and also a set amount of power, project specific, normally corresponding to 50,000 hours of production at full capacity (e.g. 20 TWh for a 400 MW park). Open door: formula combining 6,600 hours of full load plus 5.6 MWh per m2 of wing area (swept area)	Thin capitalisation rules	Danish resident companies and Danish branches of foreign companies are subject to three sets of restrictions, each of which may seriously limit or disallow Danish tax deduction for financing costs. The rules are: 1) Thin capitalization, 2) Asset-based rule and 3) the EBIT rule

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4. Our service offerings

Three examples from our different territories will give you an idea of the range of services PwC can offer you.

Cost reduction

PwC collaborated with DNV-GL and Ecorys to identify the cost reduction potential for offshore wind energy in the Netherlands for TKI Wind op Zee

The Dutch government has set a 40% cost reduction target for offshore wind in 2020, compared to 2010. The Knowledge and Innovation Platform for Offshore Wind (TKI Wind op Zee) wanted to know the options for cost reduction for offshore wind in the Netherlands in order to determine if the government's target was feasible. Several cost reduction studies for offshore wind have been conducted in North-West Europe, of which one study in the UK was performed by PwC, but none had previously been done for the Netherlands.

In order to identify options for cost reduction, PwC performed market interviews, conducted workshops and studied the literature. Three main areas for cost reduction were found: technology, finance and market & supply chain. Due to the specific regulatory regime and local circumstances, new cost reduction options applied, compared to previous studies.

When combining the different options for cost reduction, the total cost reduction potential in the Netherlands from 2010 to 2020 was assessed at 46% - i.e. higher than the government's target. This included only the cost reduction options that lead to a greater than 1% decrease of the levelised cost of electricity (LCoE) and excluded changes in external effects (like interest rates and commodity prices). Technological innovations have the largest cost reduction potential at 27%, market and supply chain developments 19% and financing options 14%.

PwC also found some key steps for all market participants to take, in order to reach the 2020 target but also in order to position offshore wind as a competitive energy source compared to fossil fuel based power generation by 2030.

Gode Wind 1

Financial and regulatory advice as well as project management support for the € 556m Project Bond for the offshore wind farm "Gode Wind I"

The offshore windfarm Gode Wind I, which was developed by DONG Energy, consists of 55 WTG Siemens SWT-6.0-154 turbines, with a total 330 MW installed capacity. In the course of Global Infrastructure Partners' acquisition of a 50% stake in the offshore wind farm from DONG Energy, PwC acted as financial advisor to the institutional investors which invested in a senior debt funding solution put in place at the holding company level. The senior debt of in total € 556 million was structured as a certified green bond, rated BBB and was arranged without the involvement of banks. Talanx Asset Management in Cologne acted as anchor investor and arranger of the bond.

In addition to the financial advisory services, PwC also conducted a commercial due diligence assessment on behalf of the institutional investors and advised on the regulatory framework for the German regulated investors (insurers, pension funds, pension schemes), including potential SCR impact and rating effects in relation to Solvency II.

The on-time delivery of the financing solution was facilitated by a project management office set-up and run by the PwC Infrastructure Advisory team.

Les Eoliennes en mer

Cross-expertise support (tax, accounting, project management) for the SPV in charge of the € 4,000m offshore farm projects in France

A joint venture created by ENGIE, EDP Renewables & Neoen Marine (recently replaced by Caisse des Depots) was awarded by the French Ministry for the Environment in June 2014, to develop, finance and build two off shore wind farms in the Tréport and Îles d'Yeu/Noirmoutier, each of them consisting of 62 Gamesa-8MW WTG turbines with a capacity of around 500 MW.

At the tender stage, PwC carried out the financial model review and assisted the joint venture in the definition of the projects' accounting and tax assumptions.

In 2015, PwC was assigned to document the special purpose vehicle's (SPV) and services company's transfer pricing policy for the French tax authorities during the de-risking phase of the project. Moreover, PwC's Consulting team supported the definition of the SPV process framework: governance (roles and responsibilities and delegations of power) and manual management of the process (flowcharts, procedures, supporting tools) covering the Core/Functional/Governance macro-processes.

In 2016, a German/French PwC Advisory team also supported the design of a new Organisation model, in order to confirm Final Investment Decision, for the next project phases and performed a Quantitative Risk Assessment on both windfarm projects.

Belgian Offshore Platform

Financial advice for the Belgian Offshore Platform (BOP) in determining the Levelised Cost of Energy (LCOE) for the three remaining offshore wind parks to be built in Belgium

Recent price trends in the Netherlands and other European countries have urged the Belgian Minister of Energy, to re-evaluate the subsidy scheme for the Belgian offshore wind parks to be built in the near future. An updated LCOE in the Belgian context, was calculated by the CREG, the Belgian energy regulator, and led to a revised LCOE between €78 and €80/MWh.

Concession holders for offshore wind parks, united in the Belgian Offshore Platform, believed this LCOE to be not realistic and asked PwC to objectively determine the LCOE for wind parks to be built, taking into account all financial and fiscal aspects, technical elements and a forecast of revenues based on publicly available data.

The calculation, which was a shared effort by Regulatory and Valuation professionals within PwC Belgium led to an estimated LCOE of €105, considerably higher than the result retrieved by the CREG, mainly because synergy effects on the (quite small) Belgian market were overestimated. The study also identified and calculated the impact of a series of possible synergies to be developed (developer side) and regulatory changes (government side) that could drive down the LCOE. This eventually led to a fruitful negotiation that created the synergies and regulatory changes that rendered an LCOE of €79/MWh.

Dutch offshore Borssele 3 & 4

Project tax and accounting counsel to Blauwwind consortium in the Netherlands

The Dutch offshore wind farm Borssele 3&4 was won by the Blauwwind consortium consisting of Shell, Eneco, Diamond Generating Europe Ltd (Mitsubishi) and Van Oord. The tender package (i.e. licenses and SDE+ subsidy) was won for a price of €54.5/MWh. This successful bid was substantially lower than the SDE+ subsidy price cap of €119.75/MWh.

As a result the potential funding requirement for Dutch government has decreased by approximately EUR 4.7 billion compared to the original budget. A dedicated PwC team is acting as project counsel to the Blauwwind consortium for tax and accounting related matters. This team is also assisting with the sale process of part of the project to Partners Group.

Our service offerings

Tax & accounting
Identify the optimal tax structure and advising on the tax and accounting issues from bidding strategy to COD and beyond

Strategy & Valuation
Help our clients to determine their investment strategy and make well-informed decisions

Project & corporate finance
Support our clients to identify the best financing structure, raise financing and optimise terms & conditions

Legal Services
Support our clients on all legal topics in project development, finance and transaction

Transaction and M&A services
Help our clients to identify opportunities and risk of target projects

Capital projects
Help our clients to keep projects within budget, on time and meet desired quality expectations

What we offer		*How we can help you*
Strategy & valuation	**Market entry study & Deal modelling**	• Identify offshore wind markets that may be interesting for you, taking into account your corporate strategy. Assess attractiveness based on analysis of current and future development of target markets (market entry study) • Build a financial model to forecast the future cash flow, taking into account CAPEX for new offshore wind farms • Specify assumptions for key parameters like wholesale power prices. We have an in-house market model to simulate the electricity price • Assess uncertainties in cash flows • Advise an optimal bidding strategy to maximise the win chance, while minimising the winner's curse
Legal Services	**Support on legal topics**	• Support our clients on all legal topics in project development, finance and transaction • Corporate PPA Advisory
Tax & accounting	**Tax and accounting impact**	• Assisting in the tax and accounting aspects of a bid strategy • Assess potential tax liabilities and exposures of existing projects • Provide insight into the tax and accounting impact of the acquisition on the financial statements • Structure the transaction to optimise net cash flows • Obtaining certainty in advance from local tax authorities • Providing tax assistance in relation to documentation of the project • Ensure that tax/accounting compliance requirements are met throughout the deal
Capital projects & infrastructure	**Project Management**	• Assess maturity and gain fast overview on potential weaknesses and provide improvement measures • Enhance main business performance indicators by building key success factors which can greatly improve the way project owners and contractors manage their projects
Transaction and M&A services	**Buyer assistance and Buy-side due diligence**	• Request, collect and analyse relevant information from the owner of the project • Review the business plan and challenge underlying assumptions (incl. financial, legal and tax issues) • Prepare management report of our key findings and provide our view on potential risks and opportunities of the target offshore wind project • Identify individual (existing and new) offshore wind projects that may be interest to you • Determine attractiveness of these projects and make a short list • Assess the latest status and future planning of the projects • Reach out to the owners to assess the willingness to divest
Project & corporate finance	**Debt advisory**	• Explore different options for financing layers for your investment (i.e. from mezzanine and junior debt to private placements, ECA debt and senior bank debt) • Develop optimal financing structure, by translating the equity case into a bankable business case • Reach out to potential lenders (banks, pension funds, insurance companies, ECA's, government institutions) to create a competitive playing field • Coordinate legal transaction documentation phase
Tax & Accounting	**Tax and accounting impact**	• Assisting in the tax and accounting aspects of a bid strategy • Assess potential tax liabilities and exposures of existing projects • Provide insight into the tax and accounting impact of the acquisition on the financial statements • Structure the transaction to optimise net cash flows • Obtaining certainty in advance from local tax authorities • Providing tax assistance in relation to documentation of the project • Ensure that tax/accounting compliance requirements are met throughout the deal

Appendix - Explanation of wind farm sites within the clusters mentioned on the country maps

The Netherlands		
Cluster group	***Wind farms Operational / under construction***	***Wind farms Tendered / planned***
A		Gemini
B	OWEZ	Hollandse Kust NH I
	Prinses Amaliapark	Hollandse Kust NH II
	Luchterduinen	Hollandse Kust ZH I
		Hollandse Kust ZH II
		Hollandse Kust ZH III
		Hollandse Kust ZH IV
C		Borselle I
		Borselle II
		Borselle III
		Borselle IV
Location not yet determined		Future wind park to be tendered (2020)
		Future wind park to be tendered (2021)
		Future wind park to be tendered (2022)
		Future wind park to be tendered (2023)
		Future wind park to be tendered (2024)
		Future wind park to be tendered (2025)
		Future wind park to be tendered (2026)

Belgium		
Cluster group	***Wind farms Operational / under construction***	***Wind farms Tendered / planned***
A	C-Power 1	Mermaid
	Belwind 1	Norther
	C-Power 2	Rentel
	C-Power 3	Seastar
	Belwind pilot with Alstom	NorthWester II
	Northwind	
	Nobelwind	

Germany - North Sea	
Cluster group	***Wind farms Operational / under construction***
A	Wikinger
B	Baltic 1
C	Baltic 2
D	Nordergründe
E	Gode wind 1
	Gode wind 2
	Nordsee 1
F	Alpha Ventus
	Borkum Riffgrund I
	Trainel Windpark Borkum phase I
G	Amrumbank West
	Meerwind Süd/Ost
	Nordsee Ost
H	Butendiek
	Dan Tysk
	Sandbank
I	Global Tech 1
J	Bard Offshore 1
	Veja Mate
K	Borkum Riffgat

France		
Cluster group	***Wind farms Operational / under construction***	***Wind farms Tendered / planned***
A		Eoliennes Offshore du Calvados - Courseulles
		Eoliennes Offshore des Hautes Falaises - Fecamp
		Parc éolien en mer de Dieppe - Tréport
		Parc éolien Dunkerque
B		Projet éolien en mer de la Baie de Saint-Brieuc
C	Floatgen Project	Parc du Banc de Guérande – Saint Nazaire
		Parc des Iles d'Yeu et de Noirmoutier
		Pilot Floating wind farm – GROIX (1/2)
		Pilot Floating wind farm – GROIX (2/2)
		SEA REED - GROIX
		Parc éolien en mer - Oleron
		SEM-REV
D	VertiMED/THE TWINFLOAT – phase 1	Spinfloat Demonstrator
		VertiMED/THE TWINFLOAT - phase 2
		Pilot Floating wind farm - GRUISSAN
		EolMed – Ideol & Quadran Floating Project
		Pilot Floating wind farm - LEUCATE
		Pilot Floating wind farm – FARAMAN
		InFLOW
		MISTRAL

The United Kingdom		
Cluster group	***Wind farms Operational / under construction***	***Wind farms Tendered / planned***
A	Scroby Sands	Triton Knoll
	Kentish Flats	East Anglia THREE
	Lynn	Hornsea Project Two
	Gunfleet Sands I and II	East Anglia ONE North
	Thanet	East Anglia Two
	Sherringham Shoal	Hornsea Project Four
	Greater Gabbard	Hornsea Project Three
	Gunfleet Sands 3 - (demo)	Norfolk Boreas
	Lincs	Norfolk Vanguard
	London Array	
	Humber Gateway	
	Westermost Rough	
	Kentish Flats Extension	
	Dudgeon	
	Rampion	
	Galloper Wind Farm	
	Race Bank	
	East Anglia ONE	
	Hornsea Project ONE	
B	Teeside	Blyth Offshore Wind demo
C		Dogger Bank - Creyke Beck A
		Dogger Bank - Creyke Beck B
		Dogger Bank - Lackenby A
		Dogger Bank - Lackenby B
D	Levenmouth demonstration turbine	Alpha (Firth of Forth)
		Bravo
		Inch Cape
		Neart na Gaoithe
		2-B Energy Test Site
E	Hywind 2 demonstration	Abderdeen demonstration
F		Moray Firth (MacColl)
		Moray Firth (Stevenson)
		Moray Firth (Telford)

The United Kingdom		
Cluster group	***Wind farms Operational / under construction***	***Wind farms Tendered / planned***
G	North Hoyle	
	Barrow	
	Burbo Bank	
	Rhyl Flats	
	Walney 1	
	Ormonde	
	Walney 2	
	West of Duddon Sands	
	Gwynt Y Mor	
	Burbo Bank Extension	
	Walney Extension	
H	Robin Rigg	

Denmark			
Cluster group	***Wind farms Operational / under construction***	***Cluster group***	***Wind farms – not yet developed***
A	Frederikshavn		
B	Anholt		
C	Middelgrunden		
	Avedore Holme		
	Avedore Holme		
		D	Kriegers Flak
E	Tuno Knob		
	Samso		
F	Sprogo	F	Omo Syd
G	Nysted (Rodsand I)		
	Rodsand II		
H	Horns Rev 1		
	Horns Rev 2		
	Horns Rev III		
		I	Vesterhav Syd
J	Ronland	J	Vesterhav Nord
	Nissum Bredning		
		K	Jammerland Bugt
		L	Mejl Flak
		M	Lillebælt Syd

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