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offshore wind
in our sails right now!

September 2015

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Introduction

Climate change and the greenhouse effect are currently the main drivers behind the need to replace 'conventional' energy generation methods. As part of this, carbon emission reduction will be high on the agenda at the climate summit in Paris at the end of this year. The phasing out of nuclear energy has gained new urgency in the wake of the nuclear disaster in Fukushima (Japan) and this too is necessitating adjustments to the European energy policy. Nuclear energy is gradually being replaced with other fossil fuels such as gas as well as renewables. The increased tension between Russia and the European Union over the past year has given Europe an additional energy ambition, i.e. to reduce its dependence on energy imports.

The upshot is that offshore wind farms are springing up all over Europe, with the United Kingdom and Germany as the absolute frontrunners. This is giving an enormous boost to the entire supply chain within the offshore wind industry. In the Netherlands too, the construction of offshore wind farms is set to accelerate in the years ahead. December 2015 will see the start of the first tender for Borssele I and II, two locations off the Zeeland coast at Borssele with a total capacity of 700 MW. The Dutch government plans to put out tenders for 3,500 MW of wind capacity over the coming five years.

In this report, we will provide an update on the status of offshore wind energy in Europe and look at offshore wind initiatives in countries situated around the North Sea, with a special focus on the Netherlands and the upcoming tenders. We will also address the anticipated reduction in the costs of offshore wind turbines as well as the latest trends in wind energy. Finally, we will discuss the status of the offshore industry and the related implications for the Dutch economy.

Offshore wind is an alternative for conventional energy sources. As such, it plays a prominent role in the government's policy to achieve the objectives that Europe has set itself in terms of sustainability and the reduction of carbon emissions. Themes such as the social relevance of offshore wind farms, the potential impacts on the environment, possible visual pollution and the effect on tourism, fall outside the scope of this report.

Overcapacity, so why the subsidy?

Europe has contended with an oversupply of electricity for a number of years now. The newspapers regularly report on Germany exporting electricity free of charge or even paying to offload power simply because the grid cannot cope. With this in mind, investing even more in electricity generation capacity may seem to defy logic.

The oversupply is partly because there are still too many conventional coal and gas-fired power stations in operation. In addition, some European countries continue to rely heavily on nuclear power. Finally, energy generation technologies have become considerably more efficient. Solar and wind energy are moving up the merit order (price-based ranking of available sources of electricity/energy generation), as are other green energy sources such as biomass. Alongside the existing overcapacity, the slump in oil, coal and gas prices would also seem to have diminished the immediate economic incentive to invest in renewables such as offshore wind.

Nevertheless, if the European objectives are to be achieved, it is imperative to continue investing in renewable energy in order to move steadily towards the envisaged radical reduction in the share of fossil fuels in the energy mix. The European and Dutch objective is to achieve 100% renewable energy by 2050. Intermediate targets have been defined for 2020 and 2030 prior to attaining that ultimate goal in 2050. The targets that the EU Member States have set themselves for 2020 are:

1. 20% reduction in carbon emissions
2. 20% reduction in energy consumption
3. 20% of energy consumption from renewables

In October 2014, the European Commission (EC) also agreed on the following climate and energy objectives for 2030:

1. 40% reduction in carbon emissions compared to 1990 levels
2. 27% of energy in EU as a whole from renewable sources
3. ambition to cut energy consumption in EU by at least 27% in 2030 (indicative, not binding)

All in all, these objectives require a major energy transition. In times of transition, limited overcapacity is desirable to guarantee security of energy supply. In addition, substantial subsidies are made available. This makes sense because, without these subsidies, the low prices of conventional fuels would make investments in clean, but more costly, energy sources commercially unviable. And these investments are crucial to cut production costs through innovation and increases in scale.

Trends in offshore wind

Despite the vigorous expansion of the past years, offshore wind energy is still in the early stages of development. Total installed capacity in Europe is expected to be roughly 45 gigawatt (GW) by 2021, i.e. 35 GW of extra capacity, with building permits already issued for 22 GW of this amount. Compared to the existing capacity of over 10 GW – divided over 82 wind farms in 11 different countries – this means growth at an average annual rate of about 22%.

According to the European Wind Energy Association (EWEA), the number of offshore wind turbines installed in the first half of 2015 already exceeded the normal number for a whole year. Germany was particularly prolific, adding eight new offshore wind farms (1,706 MW) which have meanwhile been partly or entirely hooked up to the grid. The United Kingdom inaugurated three offshore wind farms (jointly 522.6 MW), bringing the total extra European offshore wind capacity in the first half of 2015 to just over 2,300 MW.

One crucial trend within the wind sector, and particularly offshore wind, is the larger capacity per wind turbine. Since last year, the average capacity per wind turbine has increased from 3.5 MW to 4.2 MW. In the period from the first half of 2010 until early 2015, nearly all offshore wind turbines had a capacity of up to 4 MW. Many new contracts signed over the past few months are for 6-8 MW turbines, notably in the UK and Germany. These larger 6-8 MW wind turbines are also taller, which makes them more visible from the coast. Given the public concerns about visual pollution in the Netherlands, this may rule them out from the upcoming Dutch tenders.

A second trend is that bids for projects are increasingly being submitted by consortia of contractors who each take responsibility for part of the contract. Previously, projects mainly attracted bids from stand-alone energy companies (principal contract) who would then hire specialists from sub-contractors. The consortium contracts, by contrast, are subdivided into four or five sub-contracts. A sub-contract can comprise one or more of the following activities:

- Delivery of the turbine
- Maintenance of the turbine
- Balance of plant (foundations, etc.)
- Internal cabling
- Cable to coast and transformer station

Participation in a consortium reduces the risk for each party. A further advantage is that costs can be spread, which makes it possible to submit more cost-efficient and competitive bids. Within a consortium consisting, for instance, of a wind turbine producer, a value chain party and a financial player, each party can contribute their complementary knowledge, skills and experience to cut costs and gain easier access to funding. Development costs can be shared, thereby reducing the financial risk of losing the tender.

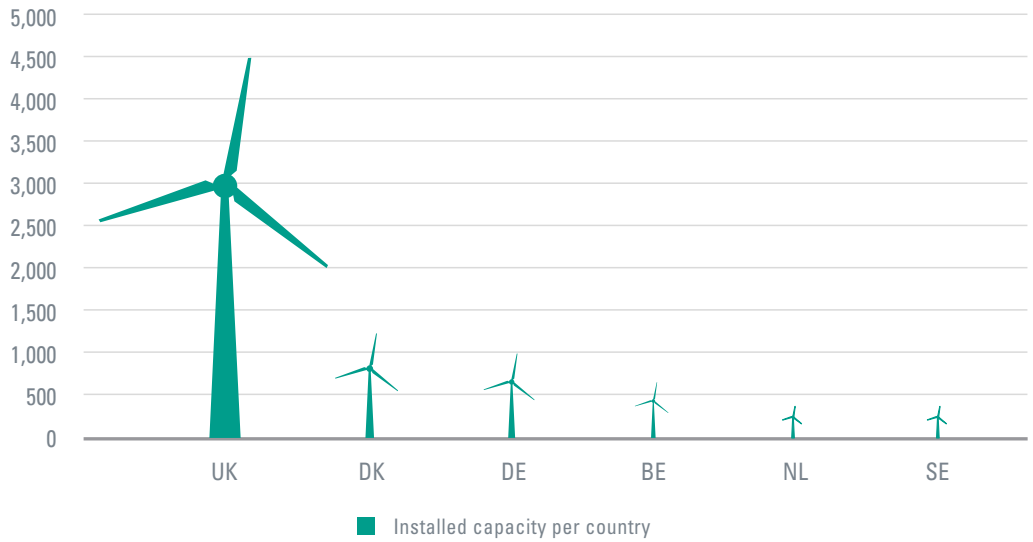
North Sea offshore industry gets with the times

Offshore wind projects typically entail a long-term commitment. Years of planning precede the actual construction works. Clearly, therefore, many of the current plans are still on the drawing board and are subject to change. Things are looking good until 2020, the deadline for the first intermediate European objectives. However, construction activity looks set to slacken considerably thereafter (barring the ongoing work to complete existing projects in 2023 - 2025).

The objectives for 2030 were set by the European Commission. If these are adopted by individual countries, further substantial investments in offshore wind will be required. The 2030 targets are only attainable if all individual countries rapidly commit to the objectives and work out concrete project plans for achieving them. Failing this, orders for new wind turbines are certain to tail off. Maintenance and replacement will of course continue to generate a certain amount of demand. Outside the European Union, offshore wind is still in its infancy, but the ambitions are at least as great. European offshore wind suppliers can take advantage of their experience to tap these new markets.

The proposed European Energy Union, if successful, can lead to a further liberalisation of the European electricity market and improve the interconnection capacity[1] between countries. This, in turn, will make it more attractive to maximise offshore wind capacity in order to supply green power to other European consumers and countries. The desire to radically reduce carbon emissions and the heightened tensions between Europe and Russia have strengthened the political will to translate policy intentions into clear regulation and subsidy schemes. The European Union is considering measures to promote further energy collaboration among its Member States. In 2030, an estimated 8% of European power will be generated by offshore wind farms. A large number of businesses operating in the offshore wind sector have written a joint letter urging the European Union to prioritise the integration of renewables in order to create a competitive regional market. Their hopes are pinned on an EU proposal in 2016 (under the Dutch Presidency) for an agreement defining a shared North Sea electricity strategy.

Total installed offshore wind capacity per country (in MW)



Source: EWEA, year-end 2014 data

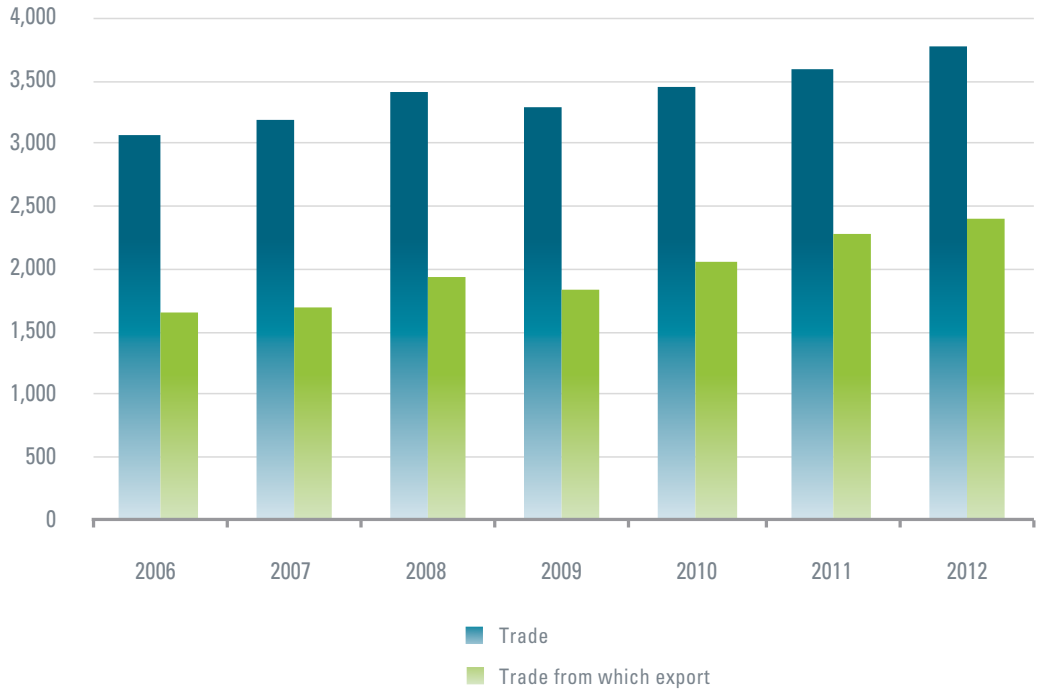
[1] A cross-border transport capacity of electricity

Belgium has rapidly worked its way to the top of the offshore wind energy sector. Apart from creating jobs, various maritime construction companies are also investing in equipment (e.g. high-tech vessels) and installation technologies. Their innovative solutions are already winning worldwide acclaim. Many suppliers are also benefiting from the ongoing development of the offshore wind industry, which is fuelling demand for the delivery of wind turbine components, construction of foundations and production of offshore high-voltage substations, etc. Besides large contractors, there is also a burgeoning network of smaller suppliers. Engineering and surveying firms, for instance, are specialising more in offshore wind.

Similarly, industrial players in the United Kingdom and Germany are keen to capture a slice of the action in the offshore wind market. Apart from the large German wind turbine builders (such as Siemens), there is a tremendous proliferation of offshore wind suppliers and other service providers.

The Dutch offshore industry, too, seems to be effortlessly adjusting to the shift away from the one-sided focus on oil and gas towards a more renewables-based energy supply. Knowledge gained over decades in such areas as deep sea drilling and offshore rig construction is now increasingly being harnessed for the construction of offshore wind farms. The acquired expertise in rig construction also gives these suppliers a head start when it comes to developing services to facilitate offshore turbine placement and maintenance. The Dutch offshore sector is internationally recognised as an expert in this field – one of the reasons why the value chain in the Netherlands remains strong, despite the small number of projects in this country. All in all, offshore exports are running at full throttle. Other sectors, such as dyke building, as well as innovative Dutch SMEs are also receiving an impulse from the sustainability drive. As shown in the diagram, the economic significance of the offshore sector is growing rapidly in the Netherlands.

Direct economic significance of offshore sector in the Netherlands 2006-2012 (x € 1 million)



Source: Dutch Maritime Cluster Monitor 2013, ABN AMRO Group Economics

The question regularly arises as to whether the Netherlands was too slow in embracing offshore wind. But the advantage of starting late is that Dutch industry can learn from the experiences of neighbouring countries. The aforementioned trend towards consortium-based bids is a case in point. By taking on board lessons learned in Denmark, Germany and the United Kingdom, the Dutch can now take a leap forward in terms of efficiencies and costs in a more mature offshore wind market.

The offshore wind sector in the Netherlands is just as advanced as its counterparts in neighbouring countries. But thanks to the Netherlands' long-standing history in the mature offshore oil and gas sector, Dutch companies have the added advantage of already being held in high international regard for their offshore knowledge and experience. The strengths of the Dutch sector have not gone unnoticed abroad, as is evident from the frequent use of its services in neighbouring countries. As a result, an enormous capacity expansion can be seen among offshore suppliers and service providers, both in the Netherlands and the countries surrounding it. It is difficult to say whether this has already led to overcapacity (including the current projects). A distinction needs to be drawn here between existing players that are expanding their capacity and new market entrants starting from scratch. The latter group may well have missed the boat.

In the next few chapters, we will zoom in on the offshore wind objectives and developments in several countries with a North Sea coast. We will then look at the Dutch situation in greater detail.

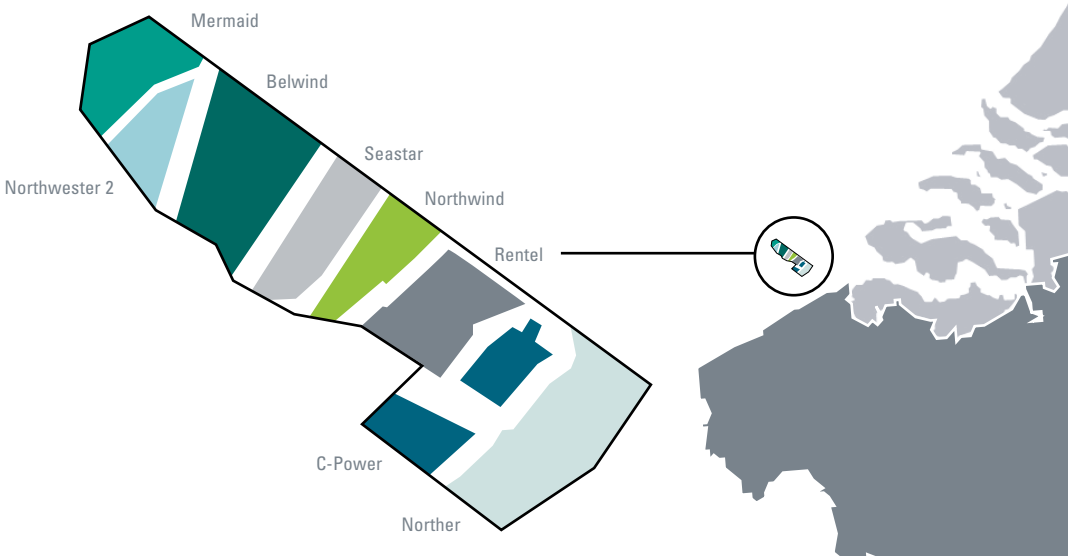
United Kingdom

According to the European objectives, the UK is required to generate 15% of its energy (including 29 GW of electricity) from renewables by 2020. With its existing offshore wind capacity for generating electricity of just over 5 GW, the UK is Europe's largest offshore wind market. The British government is moving swiftly and purposefully to achieve its ambitious offshore wind plans. The third wind farm construction round, encompassing nine different zones around the UK, is currently under way. Construction is due to start in 2015 and could comprise more than 24 GW. Dogger Bank is the largest project (up to 13 GW of capacity); it is one of the biggest energy projects in the world.

Belgium

Based on the objectives, Belgium is required to generate 13% of its energy from renewables by 2020 and 20% in 2030, with electricity production accounting for two-thirds of this. With the construction of five new wind farms (Norther, Seastar, Rentel, Mermaid and Northwester II), Belgium's total installed wind turbine capacity in the North Sea will be expanded to more than 2,200 MW in 2020. This is sufficient to meet more than 10% of Belgium's total electricity requirement or about 50% of the electricity requirement of Belgian households.

Belgian wind projects

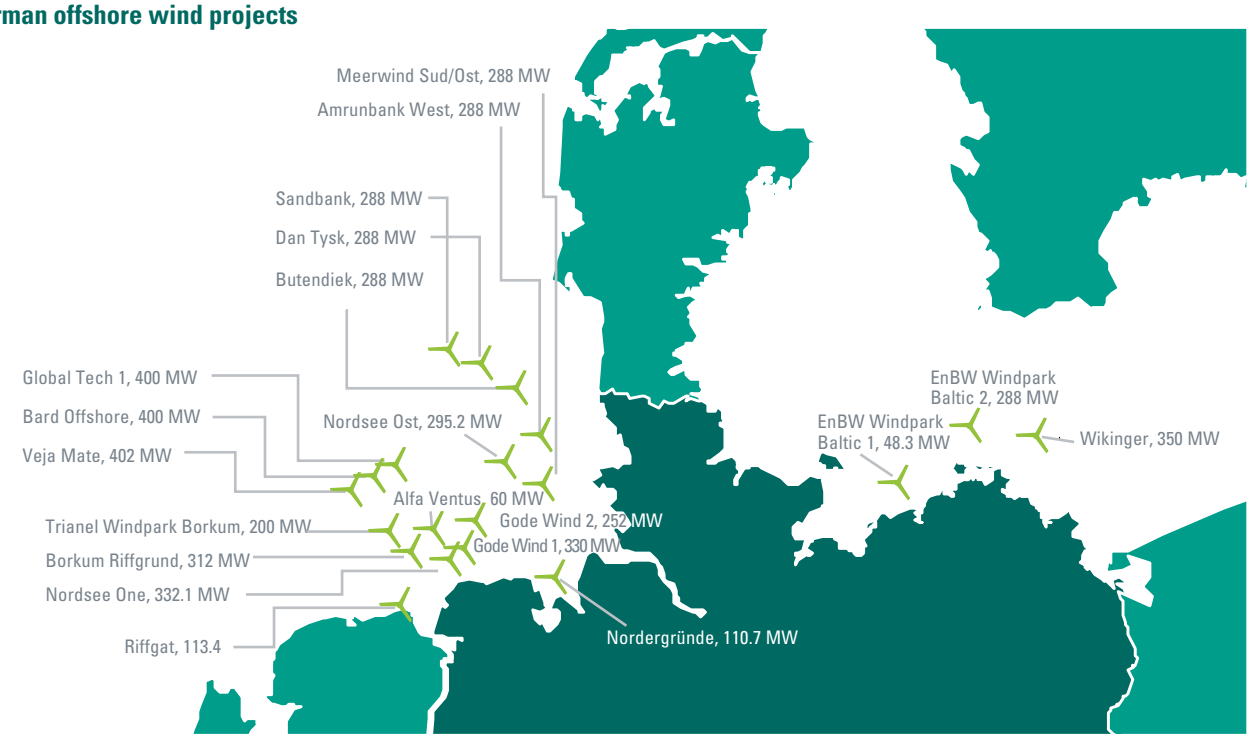


Offshore wind energy may well become one of the strongest-growing sectors of the Belgian economy in the coming years. The construction of the five new offshore wind turbine farms between 2014 and 2020 represents an investment of about € 5 billion.

Germany

Germany has set ambitious targets for its energy transition (*Energiewende*) and withdrawal from nuclear energy (*Atomausstieg*): 80% reduction in greenhouse gases compared to 1990 levels in 2050, and 50% renewable energy by 2020. German offshore wind capacity was just over 1 GW at the end of 2014. The objective for 2020 is 7 GW. The initial target was 10 GW, but this had to be revised down due to changes in Germany's renewable energy legislation. The plan is to build 17 wind farms in the North Sea, and four in the Baltic Sea.

German offshore wind projects



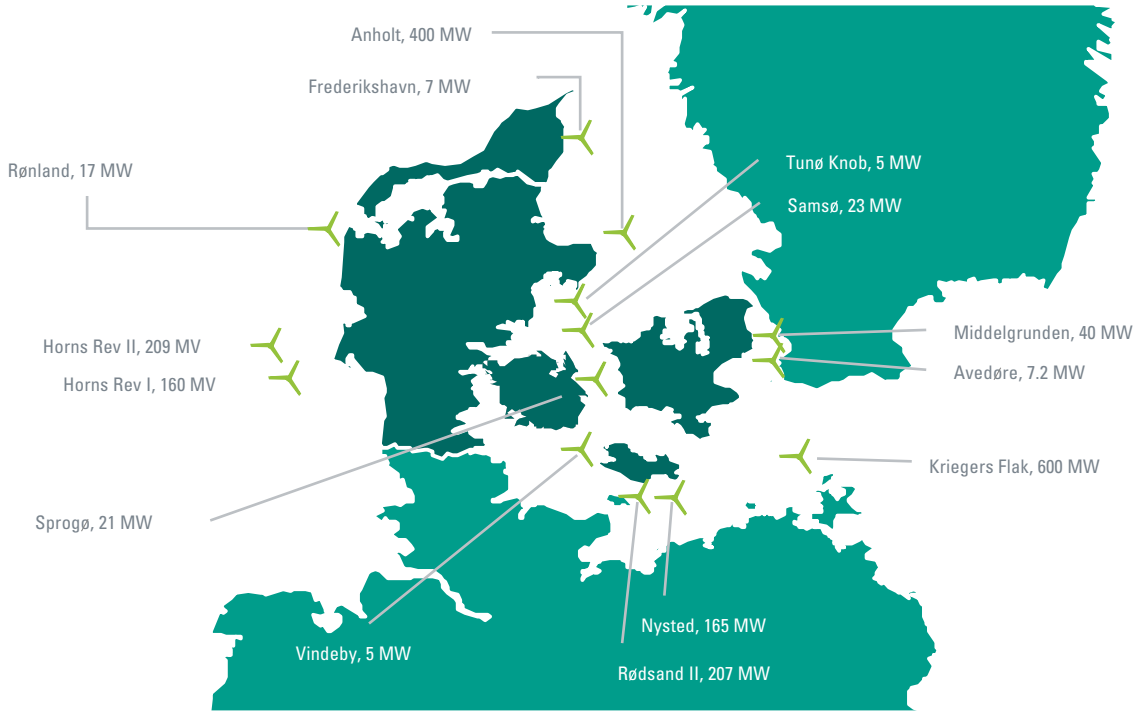
Source: Stiftung Offshore Windenergie, ABN AMRO Bank N.V.

Denmark

Denmark built the world's first-ever offshore wind farm in 1991: the Vindeby wind farm. This farm consisted of 11 wind turbines with a total capacity of 4.95 MW and was located only two kilometres off the coast. The Danish Energy Authority (DEA) published its first 'Offshore Wind Turbine Action Plan' in 1997, which was updated in 2007. In this plan, specific areas are earmarked for the generation of up to 4,600 MW of electricity. This would be more than sufficient to meet Denmark's entire electricity requirement. In being the first country to put offshore wind on the national agenda, Denmark is widely seen as the trendsetter in the drive to make the energy mix more sustainable.

Denmark currently has an installed offshore wind capacity of 1,271 MW, with a further 1,000 MW coming on line when the two planned wind farms (Horns Rev 3 and Kriger's Flak) are completed in 2020. In February of this year, the Danish government announced that the future 'Horns Rev 3' offshore wind farm will set a new record by generating power at a price of only € 0.1031 per KWh, a cost saving of over 30% compared to the last offshore wind farm Denmark built. Horns Rev 3 is expected to be completed in 2020 and will generate sufficient electricity to power 450,000 households.

Current offshore wind projects in Denmark

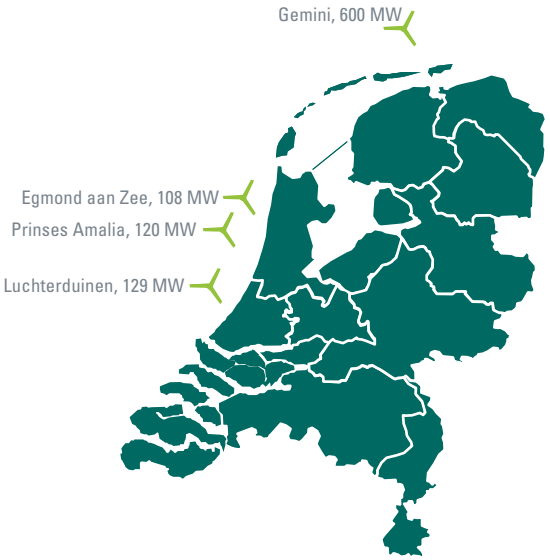


Source: South Baltic Offshore, ABN AMRO Bank N.V.

The Netherlands

The Netherlands comes fourth in the European offshore wind rankings after the United Kingdom, Denmark and Germany. The Dutch offshore wind energy component currently consists of two wind farms: Offshore Windpark Egmond aan Zee (OWEZ) of 108 MW and Windturbinepark Prinses Amalia (IJmuiden) of 120 MW. Three more energy farms are under development: Windpark Luchterduinen (Noordwijk – 129 MW), Windpark Buitengaats and Windmolenpark Zee-energie. The latter two are jointly also referred to as the Gemini-Windpark and are located some 80 km off the coast of the island of Schiermonnikoog (jointly 600 MW). Upon completion of these wind farms, the total Dutch offshore wind capacity will be about 1,000 MW.

Current offshore wind projects in the Netherlands



The Dutch government's offshore wind objective was revised down in the national energy agreement to an installed capacity of 4,450 MW by 2023. Substantial investments are vital in the coming years to achieve the estimated 1,000 extra offshore wind turbines needed to hit this target. Projects take a long time to complete, so there is no time to lose.

The nine permits granted in 2009 for the construction of offshore wind farms were withdrawn by Minister Kamp in September 2014. In its Government Structural Vision for Offshore Wind ('Rijksstructuurvisie Windenergie op Zee'), the Dutch Cabinet designated areas for the construction of wind farms. These are 'Hollandse Kust' (western mainland coast) and the area 'To the North of the Wadden Islands'. Borssele off the Zeeland coast and 'IJmuiden Ver' had already been designated as wind energy areas.

Finding other locations for offshore wind energy will be difficult as much of the available space on the North Sea is already allocated to fisheries, shipping, sand, oil and gas extraction, and military exercises. New shipping lanes to speed up the development of future wind farms have also been brought into use. The Dutch Cabinet expects the clustering of wind farms to lead to savings of € 3 billion. For more details, see the section on upcoming tenders.

Tenders for new-build wind farms in the Netherlands

On 30 June 2015, the Dutch offshore wind energy sector took the next step towards the achievement of the European objectives. On that date, the Ministry of Economic Affairs published the regulations for the first round of offshore wind energy tenders (Borssele I and Borssele II). These regulations set out the rules for the upcoming tenders.

Under the 'Offshore Wind Energy Implementing Regulations' companies can apply for a renewable energy grant (SDE+) for 700 MW of offshore wind energy at the two Borssele locations. The available budget is € 5 billion (€ 2.5 billion per plot, source: ECN). The maximum grant to which an applicant is entitled is calculated on the basis of a formula. The grant is equal to the difference between the tender amount (maximum of € 0.124 per KWh) and the basic electricity price (€ 0.029 per KWh), multiplied by the maximum number of KWh specified in the grant award decision for the entire period for which the grant is awarded. The maximum number of KWh is based on the installed capacity of the facility and the number of full load hours. The tender period for Borssele I and Borssele II will run from 1 December 2015 to 31 March 2016.

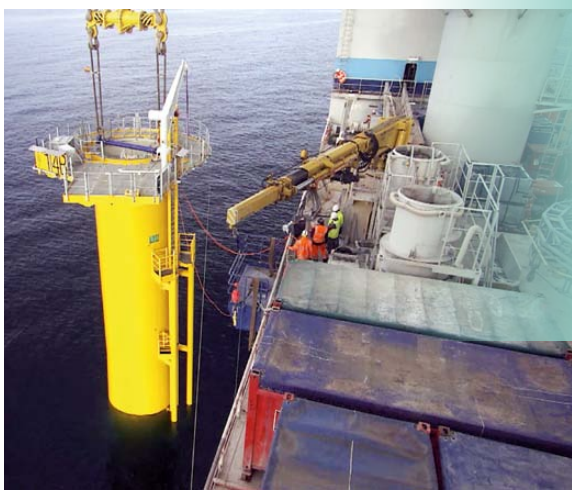


Table 1: Offshore Wind Tender Process in the Netherlands

Year	New Tender (in MW)	New Operational (in MW)	Cumulative Operational (in MW)
2015	700	0	0
2016	700	0	0
2017	700	0	0
2018	700	0	0
2019	700	700	700
2020	0	700	1400
2021	0	700	2100
2022	0	700	2800
2023	**0**	**700**	**3500**
Existing wind farms and those under construction in 2015			1000
Total MWs operational in 2023			**4500**

Source: Rijksdienst voor Ondernemend Nederland (RVO)

The tender for Borssele I and II will start in 2015, with Borssele III and IV following in 2016 (also a total of 700 MW). The first tender for the western mainland coast will be held for the province of Zuid-Holland ('Hollandse Kust: Zuid Holland') in 2017 and 2018, followed by the province of Noord-Holland ('Hollandse Kust: Noord Holland') in 2019.

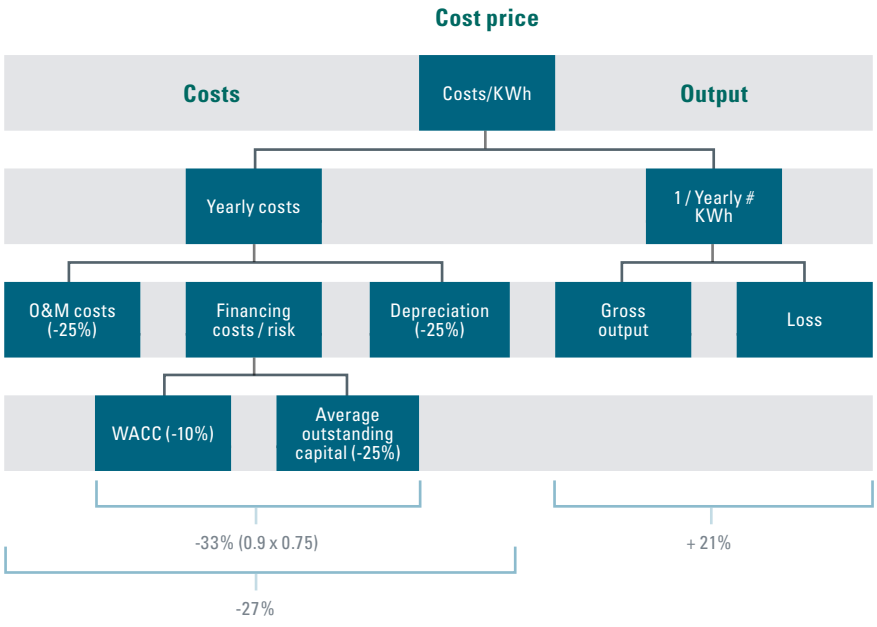
Offshore wind energy costs

The cost of offshore wind energy is significantly higher than for onshore wind. Onshore wind can now compete on price with conventional fossil fuels. The higher cost of offshore wind is due to various aspects.

First, the construction of wind turbine foundations is considerably more complex and the seawater and harsher weather conditions cause more corrosion which, in turn, necessitates more maintenance. Second, the costs for the connection with the onshore power grid are high. Despite these drawbacks, offshore wind can still be made commercially viable as the higher and more constant speeds of offshore wind generate larger energy yields.

Both the offshore industry and Minister Kamp of Economic Affairs expect the costs of offshore wind energy to fall by 40% between now and 2020. This expectation is predicated on increases in scale, guaranteed sales through long-term contracts and cost reductions thanks to competition and advancing technology.

Breakdown of 40% wind energy cost reduction until 2020 (in %)



Source: NWEA

Costs*: -27%
Output: +21%
Cost price: -40%

* Based on the following cost allocation: 25-35% O&M, 40-50% Capex, 20-30% Financing Costs

Further cost reductions can only be achieved by means of a stable policy and a minimum guaranteed sales volume (output), particularly in view of the long completion time for these projects. Over the past years, the cost of offshore wind energy has actually increased, the main reasons being increased raw material costs, capacity problems with the production of parts, insufficient reliability and the fact that these wind farms are increasingly being constructed in deeper water. That said, there is the positive development that wind turbine capacity has also increased significantly: whereas the Prinses Amalia Wind Farm still uses 2 MW turbines, Gemini will have 4 MW turbines. Thanks to this larger capacity, the costs per kilowatt hour have not increased.

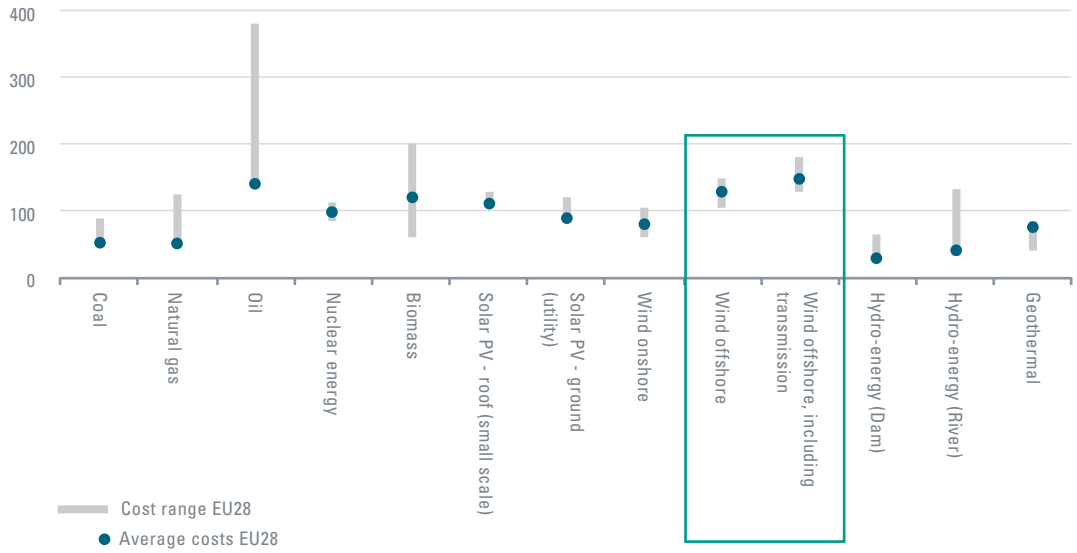
In response to parliamentary questions, Minister Kamp has said that the amount to be allocated in the coming years to wind energy projects under the SDE+ scheme will be capped at € 18 billion. The costs are expected to be lower, however.

In the summer of 2014, TenneT was asked to construct the required grid connections for offshore wind farms in its capacity as offshore grid operator. TenneT has already gained experience in this field in Germany. By entrusting this task to a single party, the Minister hopes to achieve further cost reductions. An initial indication that this assumption is correct came from TenneT's cost estimate. The company estimates the cost of hooking up the offshore electricity network to the national transmission grid at about € 4 billion. That is 40% less than the amount the wind farm developers would charge for the hook-up, representing a 10% reduction in total offshore costs. This calculation was recently confirmed by ECN (Energy Research Centre Netherlands).

According to ECN, about 5% of the envisaged cost savings should be achieved from new technologies, and 15% needs to come from larger and more powerful wind turbines. ECN has therefore made a strong appeal for more scope for testing and demonstrating innovations in order to achieve the required cost savings within the set time line. The initial intention was to have this take place at the Leeghwater wind farm comprising 50-70 wind turbines. However, the construction of this wind farm was recently cancelled due to the high costs and because companies now see less need for large-scale pilot projects. Despite this, the testing of small innovations will continue by distributing these among wind farms on the basis of private tenders. More substantial breakthrough technologies will be tested at two large wind turbines (10 MW each) that are currently being constructed directly adjacent to the Borssele wind farm, but this will take place later than initially scheduled.

The offshore industry realises that, in order to be competitive, the cost price needs to drop below € 100/MWh. According to a recent cost price calculation by Ecofys, this is roughly the cost price for generating electricity from conventional sources. We do need to remember, however, that this calculation was made before the recent sharp fall in oil and gas prices. The aforementioned measures should make this price reduction possible over the coming years.

Average energy costs for electricity in EU28 (EUR/MWh 2012)



Source: Ecofys – Subsidies and costs of EU Energy, November 2014

Financial sector essential for funding offshore wind farms

The Dutch plans for building 3,450 MW of offshore wind generation capacity (wind farms and grid) have still to be finalised, so the costs are difficult to estimate at this point. Projections vary from € 12 billion to € 17 billion. Many years ago, the Netherlands gained international renown with another large water-related project: the Delta Plan. Even starting from the conservative estimate of € 12 billion, the offshore wind plans would still cost substantially more than the budget for the Delta Plan (adjusted for inflation). Such enormous amounts can obviously only be financed with loans from the financial sector (possibly supplemented with equity).

When the offshore wind industry was still in its infancy, energy companies mainly used on-balance sheet financing to raise capital for projects. These days, most energy companies are strapped for cash and have little leeway for investments in new production capacity such as offshore wind farms. For this reason, more use will be made of project financing.

Most developers can only raise such large loans through project financing, with the underlying assets serving as collateral for the loan (i.e. separated from the developer's other financial obligations outside the project). The loan is repaid according to a strict schedule over an extended period of time from the wind farm revenues. The wind farm owners are only allowed to distribute dividends after all payment obligations and specific covenants have been met. Before agreeing to provide project financing, banks will perform a thorough review of all technical, legal and commercial aspects of the project. Although time-consuming, this also yields an extremely accurate analysis of the project risks and imposes tight financial discipline during the construction and maintenance of the wind farm.

If the balance sheet is strong enough, the developer (often a utility company) will fund the wind farm on the corporate balance sheet. This gives the developer greater flexibility (as it is not required to meet the bank's strict conditions at project level).

Summary

All over Europe, awareness is dawning of the urgent need to accelerate the shift towards a greener energy mix and a reduction in carbon emissions. Government policy is being adjusted to quicken the pace of the sustainability measures. Over the coming years, capacity will be considerably stepped up in many countries around the North Sea. This will give a further boost to the entire chain within the offshore wind industry.

The Netherlands is still lagging behind its neighbours, but now that the wind energy market has become more mature, it can start catching up on the back of the lessons learned by these countries. The first tender for Borssele I and II will start in December. This is the first step in a series of tenders. The Dutch government plans to put out tenders for 3,500 MW of wind capacity over the coming five years. Together with the roughly 770 MW already under construction, this will see the Netherlands expanding its offshore wind capacity from the current 228 MW to 4,500 MW, representing an almost 20-fold increase.

The industry is confident that this expansion, combined with the use of larger wind turbines, the appointment of a single offshore grid operator (TenneT) and the clustering of wind farms, will lead to cost reductions. In addition, a clear trend can be seen towards a new tendering strategy. In the past, a single contractor would submit a bid for a project and then enlist the assistance of numerous subcontractors. Today, consortia comprising four or five parties submit joint bids in order to share the costs and risks. This helps to make offshore wind energy cheaper and more efficient. All in all, the sector and the government are looking for a cost reduction of 40%.

We believe that the offshore wind sector has a promising outlook for the coming five years. Existing companies in the sector are definitely well-placed to capitalise on the forthcoming expansion. This will also have a positive effect on job creation in the sector and, by extension, on the entire European economy. The ambition to steadily phase out the use of fossil fuels for energy generation, and for electricity in particular, is entering a new era.

The next big event is the climate summit in Paris. The sense of disappointment after the previous summit in Denmark has made way for the hope that, this time around, concrete agreements can be reached with the international community to achieve a significant cut in the use of fossil fuels and thereby to reduce carbon emissions. The reduction in surplus carbon emission rights to set the Emissions Trading Scheme in motion is one solution that can give an extra impulse to Europe's efforts to meet the set objectives for 2020 and 2030 and, ultimately, to make the energy supply 100% renewable in 2050.

The message for the European energy mix is clear: Let's put the offshore wind in our sails right now!

colophon

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