Dutch Offshore Wind Innovation Guide

Your guide to Dutch offshore wind policy, technologies and innovations

Issue 2024

wind & water works

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Your guide to Dutch offshore wind policy, technologies and innovations

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Contents

The Netherlands Enterprise Agency developed this offshore wind policy and industry manual, commissioned by the Ministry of Foreign Affairs and International Trade, as a deliverable of the International Clean Energy Partnership (ICEP) on export promotion in the renewables energy sector.

Dutch design & know-how in offshore wind

Thanks to rapid technological advances which have greatly reduced costs, offshore wind has become a mainstream source of renewable energy around the world. In a growing number of countries, offshore wind has become a key element of national plans to reduce the carbon intensity of their energy supplies at a competitive price.

Experience in the Netherlands has shown that governments need to be proactive in order to successfully achieve affordable, large-scale offshore wind capacity, and reap the socioeconomic benefits this industry offers. Thanks to clear policy and continuous innovation, the cost of offshore wind power in the Netherlands has fallen to the point where zero-subsidy bids are now submitted in competitive tenders.

Experiences with the Dutch policy framework and accumulated sector expertise is worth sharing internationally, especially in order to multiply the effects of international know-how in developing new offshore wind markets. It is therefore my pleasure to present you with the 2024 edition of the Dutch Offshore Wind Innovation Guide.

In this annual flagship publication, the public-private partners in the wind & water works campaign provide you with comprehensive overviews of the Dutch regulatory framework and Dutch supply industries for offshore wind. The guide also highlights Dutch breakthrough innovations in offshore wind technologies and offshore wind-to-hydrogen development. The guide also includes press articles showcasing recent export successes of Dutch companies.

Last but not least, I am proud to recommend the wind & water works partners. All have their own unique expertise and experience, and are keen to help solve the challenges of the offshore energy transition. You will find their contact details in the business directory of this guide.

I hope the guide will prove valuable for other governments building their offshore wind sectors, as well as for international developers and businesses looking to identify new cost-reducing technologies and services in offshore wind.

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wind & water works

More info on:
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1. Harnessing the wind

The Paris Climate Change Agreement, to which all countries in the world are signatories, seeks to maintain global warming at well below 2°C, and much closer to 1.5°C, above pre-industrial levels. To achieve this ambition, a vast expansion of renewable energy deployment is required on a global scale.

Offshore wind will become the main renewable energy source (RES) that is commercially deployable with vast untapped potential in the world's seas. Offshore wind has a higher capacity and more consistent output than any other variable RES, with the International Energy Agency describing it as a unique 'variable baseload' technology that could help to integrate the decarbonised energy systems of the future.

Governments around the world recognise the role offshore wind technology can play in kick-starting post-COVID economic recovery through large-scale investment, creating jobs and bringing economic development to coastal communities.

1.1 Global overview: offshore wind development

As countries in coastal regions continue to utilise their offshore wind potential, the Global Wind Energy Council (GWEC) saw the offshore wind market enjoying its second best ever year in 2022. According to its Global Offshore Wind Report 2023, a total of 8.8 GW of new installations were added to global offshore wind capacity, bringing cumulative capacity to 64.3 GW.

Asia-Pacific (APAC)

China continues to lead global offshore wind development, although its new installations dropped to 5 GW in 2022 from 21 GW in 2021 – a record year driven by the end of the feed-in tariff. Still, China's top position in annual new offshore wind installations will likely continue in 2023 too, as China is also leading in projects currently under construction.

Two other markets reported new offshore wind installations in APAC last year: Taiwan (approx. 1 GW) and Japan (84 MW), reaching a total installed offshore wind capacity of 34 GW in the APAC region by the end of 2022.

Europe

Europe connected the remaining 2.5 GW of capacity in 2022, with France and Italy each commissioning their first commercial offshore wind projects. Despite the rate of installations last year being the lowest since 2016, Europe's total offshore wind capacity reached 30 GW by end 2022, 16 GW of which is from EU countries and 14 GW is from the UK, according to GWEC.

United States

In the United States, no offshore projects were built in 2021. However, the Inflation Reduction Act (IRA) is set to turbocharge the US wind sector. It is not only the single largest investment in renewable power in the history of the United States, but simply the largest investment in climate action the world has ever seen, according to GWEC.

1.2 Europe's policy on offshore wind

EU Fit-for-55 (2021)

To keep pace with the ambitions of the Paris Climate Change Agreement, the EU's Fit-for-55 package aims to reduce greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. Under this strategy, offshore wind will become the number one source of electricity in the EU, taking optimal advantage of the potential in Europe's seas – from the North Sea and Baltic to the Black Sea, and from the Atlantic to the Mediterranean.

EU Offshore Renewable Strategy

The EU's Offshore Renewable Energy Strategy, issued in November 2020, sets out the goals of reaching at least 60 GW of offshore wind capacity by 2030 and 300 GW by 2050. According to WindEurope these goals imply a massive scale of change for the sector at an unprecedented speed, as the EU's offshore wind capacity was only 16 GW by end 2022. To meet such ambitious targets, the EU and member states will have to facilitate cross-border marine spatial planning, grid infrastructure development and, last but not least, both good permitting and Power Purchase Agreement (PPA) practices.

REPowerEU (2022)

In an effort to strengthen Europe's energy security and cut its reliance on Russian fossil fuels well before 2030, the EU launched the REPowerEU action plan in May 2022. For offshore wind, the EU called for an additional 30 GW of offshore wind energy by 2030. This target comes on top of the previous targets for offshore wind (60 GW by 2030) already established in the Offshore Renewable Energy Strategy. The current target in the EU's Offshore Wind Energy Strategy is ow 90 GW by 2030 and 300 GW by 2050. Together with the UK and Norway, the EU could have up to 450 GW of offshore wind in operation by 2050.

Esbjerg Declaration (2022)

In response to the REPowerEU call, Belgium, Denmark, Germany and the Netherlands committed in May 2022, in the Esbjerg Declaration, to a joint offshore wind target of reaching at least 65 GW of generation capacity installed by 2030 and 150 GW by 2050. With this 150 GW pledge for 2050, the four EU member states have a joint target of half of the 300 GW total EU capacity aimed for by that time under the EU Offshore Renewable Energy Strategy, issued in November 2020. The four countries have also signed a declaration on realising and advancing plans for energy islands in the North Sea, with one of the first steps being expanding the world's first energy island to its maximum potential capacity of 10 GW by 2040 at the latest.

Dublin Declaration (2022)

In September 2022, the members of the North Seas Energy Cooperation (NSEC) – Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway, Sweden – and the European Commission agreed in Dublin to reach at least 260 GW of offshore wind capacity by 2050. The NSEC members have also agreed expansion targets for the North Sea region of 76 GW of offshore wind by 2030 and 193 GW by 2040. Although non-binding, this agreement stresses the willingness to operate as a collective to achieve more than 85 per cent of the EU-wide ambition of reaching 300 GW by 2050. To realise this ambition, the NSEC members will closely cooperate on a better coordination of area and network planning, a closely linked (hybrid) offshore network and – last but not least – accelerated approval procedures at national and EU level.

As already mentioned, these European ambitions imply a massive change of scale for the sector at an unprecedented speed. By the end of 2022, total offshore wind installed capacity in the EU was just 16 GW and only 1 GW of offshore wind capacity was added to the total last year. To compare, the EU needs to build on average 31 GW a year to 2030 to meet the REPowerEU renewable energy goals.

Ostend Declaration (2023)

In April 2023, the 'Esbjerg' coalition was joined by five other countries, namely France, Ireland, Luxembourg, Norway and the United Kingdom. Building on the Esbjerg declaration, the now expanded coalition of nine countries co-signed the new Ostend Declaration, raising the combined target to 120 GW offshore wind by 2030 in the North Sea and at least 300 GW by 2050.

LionLink

Also in April 2023, Dutch transmission system operator TenneT and UK's National Grid kicked-off the international development of an integrated North Sea electricity grid. They announced a first-of-its-kind cross-border electricity link connected to an offshore wind farm. The so-called LionLink, a multi-purpose interconnector, will connect a Dutch 2 GW offshore wind farm to both countries via subsea interconnectors, also boosting energy security and energy independence in Europe. So in case there is a surplus of wind generated electricity, it can be shared instantly to locations with a shortage of power, and vice versa.

1.3 Offshore wind policy development in the Netherlands

Today, the Netherlands is a front-runner in cost-efficient offshore wind development and installation. To come to this position, however, the Dutch had to overcome significant challenges. As with other countries, the potential offshore wind offers had long been recognised in the Netherlands. Even so, up to 2019, only a few offshore wind farms were actually in operation in the Dutch Economic Zone of the North Sea. Project developers were responsible for site selection and investigation, as well as having to go through the permitting process for projects with no guarantee projects would be approved. As a result, project developers faced high costs and risks before they could even apply for a subsidy. Indeed, out of 80 initial applications, just four offshore wind farms with a combined capacity of less than 1 GW were actually built in the Dutch Economic Zone of the North Sea by that time.

Shift to a more proactive and supportive approach

However, in 2013, conditions for offshore wind development changed significantly when a broad coalition of the Government, employers' associations, trade unions, environmental protection organisations and energy companies, accelerated climate ambitions and agreed to kick-off the Dutch energy transition. The resulting Energy Agreement for Sustainable Growth (hereinafter: Energy Agreement) included ambitious provisions on energy conservation and targets to raise renewable shares in the energy mix to 14% by 2020 and 16% by 2023.

As part of the Energy Agreement, the Government introduced a more proactive and supportive regulatory framework for offshore wind development. The new, more centralised framework tackles disadvantages of the previous approach, in which wind farm developers were left responsible for site selection and investigation, permitting process and grid connection. It is more proactive by nature, providing favorable market conditions for offshore wind project developers, such as legal planning of zones for long-term offshore wind development, multi-annual tender schedules of pre-selected sites (Roadmaps) and timely state-owned grid connections.

The new framework is also more supportive. It provides pre-investigated site survey data and environmental impact information, ensures clear consenting and timely permitting in one process and includes level playing field tenders. The Netherlands Enterprise Agency (RVO.nl) is the coordinating administrator (one-stop shop) under the Ministry of Economic Affairs and Climate Policy. Rijkswaterstaat, an agency of the Ministry of Infrastructure and Water Management, is responsible for the Environmental Impact Assessment and the consenting process (permit).

Acceleration to 4.5 GW (Roadmap 2023)

As planned under the National Energy Agreement (2013), in 2015, the Dutch Government published its first Offshore Wind Energy Roadmap, aimed at adding 3.5 GW of new of offshore wind power capacity by 2023. The Roadmap outlined plans for five offshore wind farms across three designated Wind Farm Zones in the Dutch North Sea, all to be tendered between 2016 and 2019 – Borssele, Hollandse Kust (zuid) and Hollandse Kust (noord) – potentially taking total Dutch offshore wind capacity up to 4.5 GW in 2023.

Acceleration to 11.5 GW (Roadmap 2030)

Encouraged by the successful rollout of tenders in the first Roadmap, the Government released another one (Roadmap 2030) in 2018, outlining plans for an additional 7 GW of offshore wind development before the end of 2030. Three extra Wind Farm Zones were added for offshore wind development and the previous offshore wind target of 4.5 GW in 2023 was increased to 11.5 GW by end 2030. Under Roadmap 2030, the additional Wind Farm Zones are Hollandse Kust (west) (1.4 GW), Ten Noorden van de Waddeneilanden (North of Wadden Sea Islands, 0.7 GW) and IJmuiden Ver Alpha and Beta (4 GW).

Acceleration to around 21 GW (Additional Roadmap 2030)

After taking office in January 2022, the current Dutch Government committed to even more ambitious targets for offshore wind development by 2030. To meet the EU's Fit-for-55 goal of reducing CO_2 emissions by 55 per cent by 2030 compared to 1990 levels, the Government decided to almost double the country's offshore wind target from 11.5 GW to approximately 21 GW of operating offshore wind capacity around 2030, equivalent to around 75 per cent of the country's current electricity consumption.

Following up on this decision, the Government presented an extended version of Roadmap 2030 in June 2022. The Additional Offshore Wind Energy Roadmap 2030 (hereinafter: Additional Roadmap 2030) outlines tender timelines for a third batch of offshore wind farms with a combined total of at least 10.7 GW. These will be put out to tender before the end of 2027 and be up and running by 2031.

Mostly located to the west and northwest of the Netherlands, the new offshore Wind Farm Sites (WFS) included in the Additional Roadmap 2030 are IJmuiden Ver Gamma with a capacity of 2 GW, Nederwiek (zuid) I (2 GW), Nederwiek (noord) II (2 GW), Nederwiek (noord) III (2 GW), Hollandse Kust (west) VIII (700 MW), Doordewind I (2 GW) and Doordewind II (2 GW).

Acceleration to 70 GW by 2050

In September 2022, the Dutch Government presented its long-term target for offshore wind capacity by 2050. The Government set a target for 70 GW of offshore wind energy by 2050, based on the assumption that 50 GW could be

installed by 2040. The long term roll-out targets for 2040 and 2050 are in line with the North Seas Energy Cooperation Agreement, in which the Netherlands and the other eight members agreed to install at least 260 GW of offshore wind capacity by 2050, which represents more than 85 per cent of the EU-wide ambition of reaching 300 GW by 2050.

Target Grid

To meet these new national targets, in April 2023, state grid operator TenneT presented its vision for the future Dutch electricity grid in the Dutch North Sea in 2045. Named as Target Grid, Tennet proposes a network of direct current (DC) superhighways in combination with an improved existing alternating current (AC) grid and offshore energy hubs to facilitate exchanging electricity with neighbouring countries (interconnectors) and enable offshore hydrogen production. This combination of energy hubs – connected by superhighways – will ensure that renewable electricity can be transported long distances from the North Sea to consumers and industry, and that the electricity grid remains reliable.

Offshore electricity and hydrogen production

As future offshore wind farms will be located farther offshore in the Netherlands Economic Zone of the North Sea, the Dutch Government plans some of these wind farms to be used for large-scale green hydrogen production. This means that not all future wind farms will need to be connected separately to the onshore electricity grid. By linking remote offshore wind farms together via nearby energy hubs, the energy they produce can then be transported to land – partly as electricity and partly as hydrogen – to allow Dutch industry to switch from gas to green hydrogen. Large scale offshore energy hubs and offshore hydrogen production will therefore become important new aspects of the future offshore energy system.

1.4 Roadmap 2023 results

Under Roadmap 2023, there were successful tenders between 2016 and 2019 (with the results for the last announced in 2020) for five large scale offshore wind farms and one small innovation wind farm. The project sites were divided across three designated Wind Farm Zones. The tender outcomes are more extensively presented in the Dutch Offshore Wind Market Report 2023.[1]

1 https://windopzee.nl/publish/pages/222983/20230419-offshore-wind-market-report_printed-version_final_1.pdf

Borssele WFS I & II (752 MW)

In 2016, the first tenders under Roadmap 2023 concerned Borssele WFS I and II (BWFS I & II) in the Borssele Wind Farm Zone (BWFZ), located some 55 kilometres from the Port of Vlissingen. The tender system was legally based on an electricity cost price auction under the Stimulation of Sustainable Energy Production (SDE++) support scheme, which uses competitive auctions to award operational subsidies to renewable energy projects. In this system the permit, to build and operate an offshore wind farm was to be awarded to the competing project developer that offered the lowest electricity price per MWh (strike price) for operational subsidy support (sliding feed-in premium) at times of low energy prices for fossil energy, over a maximum period of 15 years. There was fierce competition between companies in the public tender to secure the permit and associated subsidy to build and operate BWFS I and II (38 bids). This resulted in achieving a far lower than anticipated price (max. 12.4 Euro cents per kilowatt hour), making the project the cheapest worldwide at the time.

The permit and accompanying subsidy for the BWFS I & II were won by Dong Energy (known today as Ørsted), based on a winning bid of 7.27 Euro cents per kilowatt hour. The offshore wind farm supplied power for the first time through TenneT's offshore grid in November 2020 and was officially opened in September 2021. Currently, Norges Bank Investment Management (NBIM) is 50% co-owner of the wind farms at BWFS I & II.

Borssele WFS III & IV (731.5 MW)

Towards the end of 2016, the Blauwwind consortium – comprising Partners Group (45%), Shell (20%), Diamond Generation Europe (full subsidiary of Mitsubishi Corporation, 15%), Eneco Group (10%) and Van Oord (10%, also being the BP contractor) – won the permit and subsidy to build and operate BWFS III & IV, featuring 77 Vestas 9.5 MW turbines, with a winning bid of 5.45 Euro cents per kilowatt hour. With BWFS III & IV, the subsidy savings were even higher than for the BWFS I & II projects which, at the time, was set to be the world's cheapest offshore wind farm. The offshore wind farm at BWFS III & IV was constructed and operated with a subsidy of just €0.3 billion, meaning it can potentially be operated without subsidy after 7.5 years. The originally anticipated subsidy was €5 billion. The final wind turbine at BWFS III & IV was installed in November 2020.

Borssele III & IV are expected to produce around 3 TWh of electricity per year, enough to power the equivalent of 825,000 Dutch households, or to meet up to 2.3 per cent of total Dutch electricity demand. Today, Borssele's III and IV shareholder group includes Shell, Eneco, INPEX, Luxcara, Swiss Life Asset Managers, Glennmont Partners from Nuveen, and Octopus Energy Generation.

Borssele WFS V (19 MW)

In 2018, Borssele WFS V (BWFS V), designated as a small-scale demonstration site for offshore wind innovations, was won by the Two Towers consortium, comprising Van Oord, Investri Offshore and Green Giraffe. Situated within BWFS III, BWFS V features two Vestas 9.5 MW turbines and several innovations. One innovation" is a submerged Slip Joint, a new method for securing turbine foundations, which have a flanged or grouted connection traditionally. The Slip Joint will significantly reduce both installation costs and time. The design and manufacturing of the Slip Joint were certified by DNV GL in 2019. Other innovations include Thermally Sprayed Aluminum, Impressed Current Cathodic Protection optimisation and oval cable entry holes. Finally, the seabed surrounding the two BWFS V wind turbines is fitted with eco-friendly scour protection.[2] This technology is used to explore how nature and renewable energy generation can be mutually enhancing. Oysters will be placed on the protective layer of rock on the seabed to improve erosion protection as well as biodiversity and the natural habitat for aquatic wildlife. In June 2022, Van Oord sold its shares in the BWFS V project to Octopus Energy Generation, one of Europe's largest renewables investors.

New auction type: comparative assessment

Due to the strong interest and competition for the BWFZ tenders, strike prices dropped rapidly. So much so that tenders for the remaining zones under Roadmap 2023 – Hollandse Kust (zuid) and Hollandse Kust (noord) – were expected to become subsidy free and could be based on a differentiated comparative feasibility assessment instead. A new legal tender model was introduced to allow subsidy-free licensing. Instead, applications will be subject to an independent expert asessment of additional non-price criteria, such as assurance of the actual wind farm construction/operation and the contribution of the wind farm to the national energy mix. In this new tender model, the permit will be granted to the offer with the highest score in the ranking assessment.

Hollandse Kust (zuid) WFS I -IV

In 2018 and 2019, Sweden's Vattenfall won both tenders for building and operating the wind farms at Hollandse Kust (zuid) sites I-IV (HKZWFS I-IV), some 18 - 35 kilometres off the Dutch coast, in the area between The Hague and Zandvoort. The combined 1.5 GW Hollandse Kust (zuid) (comprising HKZWFS I-IV) project marks a series of firsts for the offshore wind industry.
Firstly, these will be the first wind turbines ever to be installed on a subsidy-free offshore wind farm, as Vattenfall is constructing the HKZWFS projects without financial assistance from the Dutch Government.

[2] Scour protection: rocks placed on the seabed around the foundations to avoid seabed erosion.

Secondly, the 140 Siemens Gamesa 11 MW turbines are currently the largest and the most powerful commercial wind turbines to be installed on any wind farm in the world. The turbines have a rotor diameter of 200 metres and a total height from sea level to the top of the blade of 225 metres.

Thirdly, as a combined project, this will be the largest offshore wind farm in operation in the world in 2023, able to produce enough green energy to power 1.5 million Dutch households a year.
Last but not least, with a combined weight of 115,000 tonnes, the 140 monopile foundations are designed so they do not require transition pieces. This design allows faster installation and cost reductions. Currently, BASF and Allianz are co-owners of the HKZ wind farms.

Hollandse Kust (noord) WFS V

In 2020, the CrossWind consortium – a collaboration between Shell (80%) and Eneco (20%) – won the tender to build and operate the fifth and last offshore wind farm under Roadmap 2023. This wind farm is located 18.5 kilometres from the coast of Egmond aan Zee in the Netherlands. With an installed capacity of 760 MW, the consortium plans to have the Hollandse Kust (noord) WFS V project operational by the end of 2023. Comprising 69 Siemens Gamesa 11 MW turbines, it will generate at least 3.3 TWh per year, or enough to meet 2.8 per cent of total electricity demand in the Netherlands.

Similar to the HKZWFZ wind farms, the monopiles in the HKNWFZ V project are a 'TP-less' type, which means they are designed to not require transition pieces, enabling faster installation and cost reductions. As well as building and operating the wind farm, the CrossWind consortium is also deploying a series of innovations (technology demonstrations). Noteworthy in particular is the installation and operation of an offshore solar park inside the HKNWFS V. With offshore solar panels situated in between the offshore wind turbines, it will be possible to also produce energy on sunny but less windy days, thereby increasing the utilisation of the offshore power grid infrastructure. This is set to be the first offshore solar farm in the world to be installed, connected and operated within a wind farm in high wave conditions. The offshore solar park will be provided by Dutch supplier Oceans of Energy in 2025, while the HKNWFS V wind farm will be operational by the end of 2023.

Another innovation is the introduction of the Baseload Power Hub, an integrated fuel cell system to convert excess wind energy to green hydrogen through an electrolyser and store it as green hydrogen that can be converted to electricity (via a fuel cell)when needed. It will also include battery storage for shorter-term power storage. The system will include a containerised fuel cell power solution with a peak power capacity of 1 MW to regenerate stable and dispatchable power. The Baseload Power Hub aims to reduce the problem of the variable character of renewable

energy production (as the wind does not blow at all times). It will store energy and release it when demand exceeds the wind farm's output. Once installed, this will be the global first offshore combination of battery storage and round-trip hydrogen integrated in an offshore wind farm.

Furthermore, CrossWind partner Shell has also started working on a large-scale hydrogen project in the port of Rotterdam. This involves a 200 MW electrolysis plant to convert excess electricity produced at HHKNWFS V to green hydrogen. The plant for the project, named Hydrogen Holland I, is said to become Europe's largest renewable hydrogen plant once operational in 2025. The electrolysis plant will be constructed on the Tweede Maasvlakte in the Port of Rotterdam and will produce up to 60,000 kilogrammes of renewable hydrogen per day. The hydrogen is planned to be transported through the HyTransPort pipeline, which will form part of the Netherlands hydrogen infrastructure. With a length of about 40 kilometres, it will run from the plant to Shell's Energy and Chemicals Park Rotterdam, where it will replace some of the grey hydrogen usage in the refinery.

1.5 Roadmap 2023: a kickstarter for energy transition

Looking back at the results of Roadmap 2023, it is safe to conclude that the Energy Agreement proved to be a 'game changer' for the development of offshore wind in the Netherlands. Under older policy up to 2013, there was little activity in offshore wind, with just under 1 GW installed in total. With today's more proactive and supportive policy approach, a legal framework has been introduced and a total of 3.5 GW was successfully tendered between 2016 and 2019. This will result in a cumulative installed Dutch offshore wind capacity of more than 4.5 GW (4.7 GW) by end 2023. The cost of wind energy has also gone down substantially faster than targeted. In the 2013 Energy Agreement, cost reduction was initially targeted at 40% by 2020, compared to price levels in 2010. The target price for 2020 was set to €100/MWh. However, in 2016 the price level for BWFS I & II was already substantially lower than the 2020 target.

The latest tenders for sites in the HKZWFZ and HKNWFZ resulted in prices without the need for subsidy, taking into account that grid connection is publicly funded. In an evaluation of the more recent Energy Agreement 2023, the independent Netherlands Court of Audit found that the costs for offshore have even dropped 80%, compared to the reference price calculated in 2013 (15 cents/kWh) by Energy Research Center of the Netherlands. It illustrates the importance of a strong public-private process guided by the Government, whilst setting parameters for the pace at which proposed new capacity is developed, the maximum capacity of the wind farms, planning and zoning, site investigations and, last but not least, grid connection. By regulating all conditions for the construction of the wind farms, the Dutch Government reduces project risk, financing and societal costs.

Blueprint for other countries

International project developers generally acknowledge the introduction of non-price requirements in the tender system as a model for other countries' tenders. Involving system integration and integrating ecological innovation into the bid concept is a driving force for developers as well, in terms of looking at how to develop future offshore wind farms in the rest of the world.

1.6 Current Roadmap 2030

On 14 April 2022, the Dutch Government kicked-off the current Roadmap 2030 by launching the tender for WFS VI and VII in the Hollandse Kust (west) Wind Farm Zone (HKWWFZ). The HKWWFZ tenders awarded permits to develop two individual 700 MW sites, located 53 kilometres from the coast. The maximum number of turbines to be installed at each site is 60, with an individual rated capacity of at least 14 MW. Transmission system operator TenneT is constructing two offshore platforms and two grid connections within the zone. If the winning bidders go for a full build-out, HKWWFS VI and VII will have a total combined capacity of at least 1,680 MW operational by 2025 - 2026.

New auction type: comparative assessment with financial bid

As with the previous tenders, the winning bidder for HKWWFS VI and VII were to be selected on the basis of a subsidy-free comparative assessment. Under site specific rules for the tenders, to win the rights to HKWWFS VI, the bidders had to also include ecological measures in their concept, whereas for HKWWFS VII investments and innovations which are beneficial for the Dutch energy system integration were required. A new element in these tenders was a one-off financial bid by a potential developer. The financial bid was capped at €50 million. This means the maximum score for the financial bid is achieved if a developer bids €50 million for the permit. A relative number of points is awarded in case of a lower bid, in steps of €2.5 million per point.

Another new financial tender element was that the costs for the site studies and environmental impact assessments are to be passed on to the winner of the tender. To prevent prohibited state aid in the form of avoided costs for studies made in preparing the permit (Wind Farm Site Decision), these costs are charged to the permit holder. These costs are therefore separate from the structural integration costs and the financial bid.

Hollandse Kust (west) WFS VI

Ecowende, a joint venture of Shell and Eneco, won the permit for the construction and operation of the 756 MW HKWWFS VI project. Ecowende will construct and operate the project without subsidy, but instead pay its maximum financial offer of €50 million. Together with the costs for the environmental impact assessments and location studies that are being paid by Ecowende, the financial return for the Government is about €63.5 million. As already mentioned, for the HKWWFS VI, limiting ecological impact was the main non-price criterion in the assessment of the applications for the permit. The winning design of Ecowende's offshore wind farm will be 'nature-inclusive', including a section where wind turbines are widely spaced so birds can fly between them safely. Furthermore, various piling techniques will be used to measure and minimise the impact on marine habitats and marine biodiversity will be fostered by placing reef structures on the seabed.
The HKWWFS VI project is expected to be commissioned in 2026 and will be built more than 50 kilometres off the Dutch coast in the North Sea near IJmuiden. The offshore wind farm will produce enough electricity to meet approximately 3 per cent of the Dutch electricity demand annually, which is enough to meet the needs of one million households.

Hollandse Kust (west) WFS VII

Oranje Wind Power II, a project company of Germany-based developer RWE, won the permit for the construction and operation of the 760 MW HKWWFS VII project. Apart from the financial offer of €50 million, Oranje Wind Power II performed best in the non-price comparative assessment on system integration, partly through its promise to convert surplus electricity into green hydrogen through a 600 MW onshore electrolyser. RWE also joined forces with Dutch floating solar energy supplier Solar Duck to incorporate floating solar panels with integrated storage to allow more efficient use of North Sea space as part of the company's bid for the HKWWFS VII.
RWE will also introduce flexible demand solutions in the project, such as battery storage for surplus electricity. The battery system, which will have an installed power capacity of 35 MW and a storage capacity of 41 MWh, will consist of a total of 110 lithium-ion battery racks that will be installed at RWE's biomass plant in Eemshaven and will be virtually coupled with RWE's power plants in the Netherlands. The battery project is an important step to optimally integrate the weather-related fluctuating offshore wind power generation of the 'OranjeWind' offshore wind farm into the Dutch energy system.

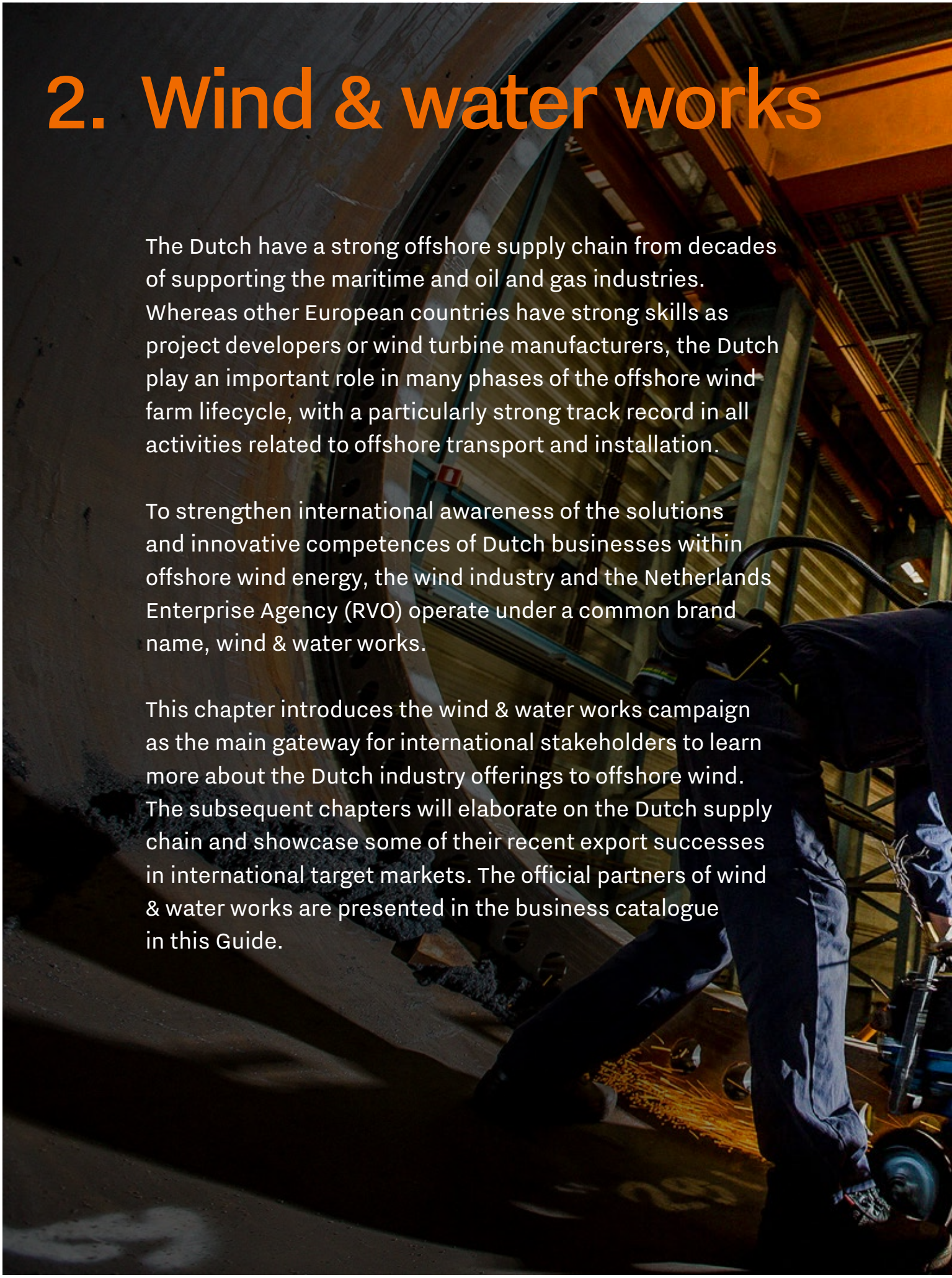
1.7 Upcoming tender: IJmuiden Ver offshore wind farm sites (4 GW)

Following the successful completion of the HKWWFS VI and VII tenders, the individual sites in the IJmuiden Ver Wind Farm Zone (IJVWFZ), located 62 kilometres off the west coast of the Netherlands in the Dutch North Sea, have been designated as next in line to be issued for tender. However, to speed up the rollout – to meet the ambitious climate targets and enable economies of scale for the offshore wind business community – the Government has decided to bundle four initial 1 GW project sites into two large sites, named Alpha (2 GW) and Beta (2 GW). Both 2 GW sites will be auctioned in combined tender round in 2023, making it the largest tender ever organised in the Netherlands. The winners of the IJVWFS Alpha and Beta tender round will be revealed in the beginning of 2024. Both sites are scheduled to go into operation in 2029.

Auction type:

Similar to the HKW tender rounds, the tenders for IJVWFS Alpha and IJVWFS Beta will be based on a statutory ranking system. There is a maximum number of points to be awarded for the bid value (annual financial fee), which reflects the bidder's willingness to pay, and another maximum number of points for the so-called qualitative criteria. For both sites, the qualitative criteria include certainty the wind farm will be realised, contribution of the wind farm to Dutch renewable energy supply, circularity and International Responsible Business Conduct (IRBC), previously referred to as International Corporate Social Responsibility (ICRS). For IJVWFS Alpha, an additional site-specific condition is the contribution of the wind farm to the ecosystem of the Dutch North Sea. For IJVWFS Beta, the additional site-specific criteria includes the integration of the wind farm into the Dutch energy system and measures to reduce Harbour Porpoise disturbance days during the construction of the wind farm. The revenue from the annual financial fee paid by the winning developer will be used to partially support integration of these offshore energy developments with other activities in the North Sea.

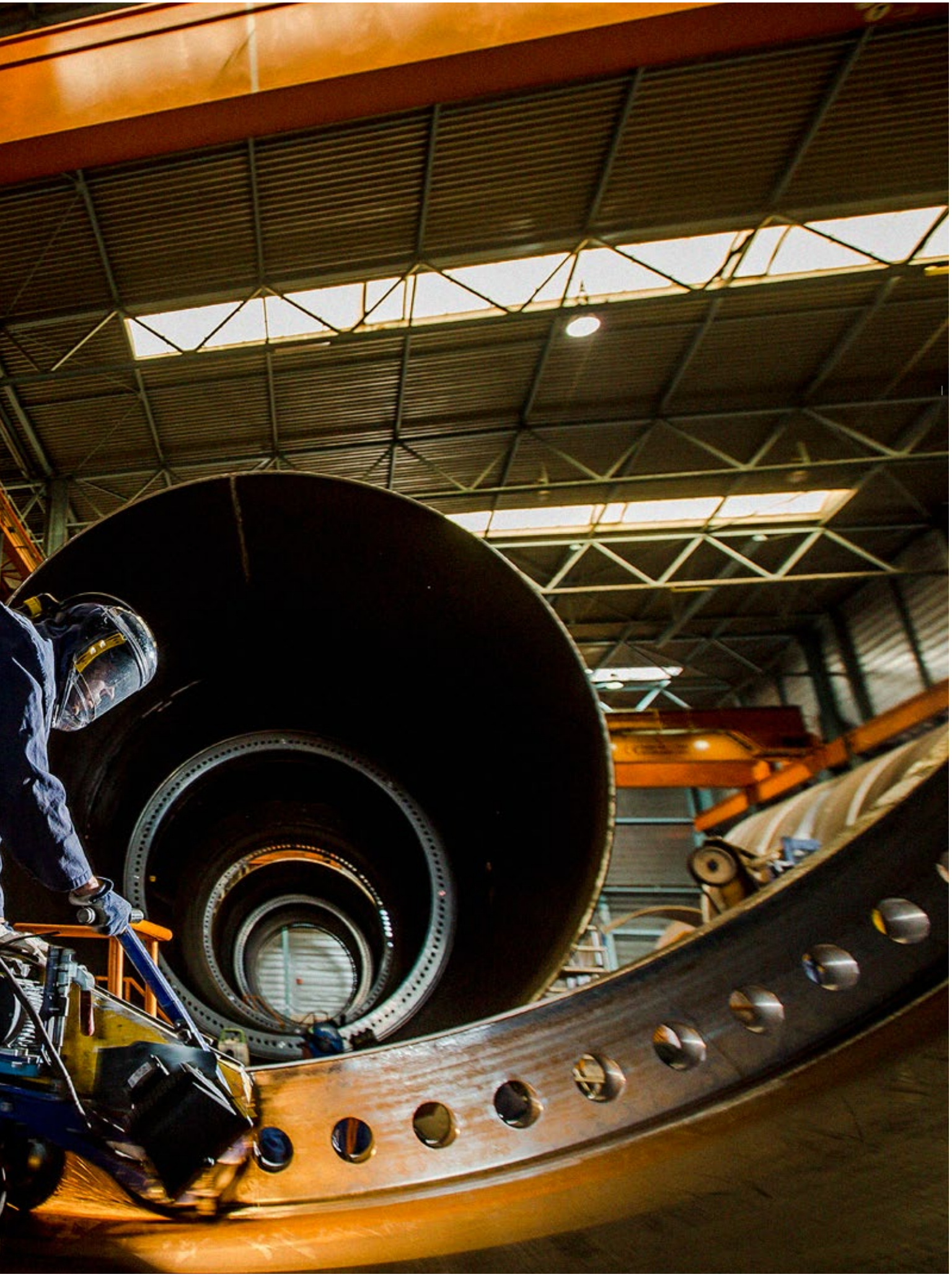
2. Wind & water works



The Dutch have a strong offshore supply chain from decades of supporting the maritime and oil and gas industries. Whereas other European countries have strong skills as project developers or wind turbine manufacturers, the Dutch play an important role in many phases of the offshore wind farm lifecycle, with a particularly strong track record in all activities related to offshore transport and installation.

To strengthen international awareness of the solutions and innovative competences of Dutch businesses within offshore wind energy, the wind industry and the Netherlands Enterprise Agency (RVO) operate under a common brand name, wind & water works.

This chapter introduces the wind & water works campaign as the main gateway for international stakeholders to learn more about the Dutch industry offerings to offshore wind. The subsequent chapters will elaborate on the Dutch supply chain and showcase some of their recent export successes in international target markets. The official partners of wind & water works are presented in the business catalogue in this Guide.



2.1 An experienced Dutch supply chain

For centuries, Dutch companies have worked offshore gaining a deep understanding of the specific conditions above and below sea level that can make or break a project. That experience means the Netherlands is home to some of most successful and innovative offshore wind businesses, maritime companies, and research institutes in the world. Our supply chain is a strong one with global reach and it's here to help you develop your own offshore wind industry with confidence.

In the Netherlands, the Government has taken on the task of developing offshore wind farms in the Dutch North Sea itself. It has introduced a stable policy environment with clear project pipelines. There are flexible rules and regulations in place. High quality site data is provided by the Netherlands Enterprise Agency to prospective developers of designated wind farm sites. Transmission system operator, TenneT, is responsible for all grid connection infrastructure. Meantime, Rijkswaterstaat grants consents for wind farm sites and monitors environmental impact. This approach provides greater certainty for developers, increases investor confidence, and has been proven to foster innovation and drive down overall costs for offshore wind projects. Combined, this array of Dutch private and public sector expertise can provide international neighbours with the right solutions for offshore wind in different site conditions around the world. We have proven experience working in the global wind industry to support its growth in a proactive, sustainable, and successful way and we are willing to share the lessons learned. Through the wind & water works gateway, our aim is to share this expertise and forge strong international partnerships to ensure the successful development of the offshore wind sector around the world. We are ready, willing, and able to work with you, so let's connect to maximise the full global potential of offshore wind.

2.2 One-stop information Portal

At the heart of the wind & water works campaign is the one-stop offshore wind information portal: www.windandwaterworks.nl and associated social media channels via #windandwaterworks. Featuring the latest offshore wind news, project showcases and company profiles, the website shares Dutch expertise and provides practical information to help other countries successfully develop their offshore wind markets.

Through the wind & water works gateway, Dutch businesses share their expertise and forge strong international partnerships to ensure the successful development of the offshore wind sector around the world. Meanwhile, wind & water works also provides news and updates on export opportunities for Dutch companies hoping to increase their international activities. Dutch presence at international events and trade missions as well as public-private partnerships aimed at enhancing international trade are all featured. Company profiles and business links are also included under the Partners section of the website. More than 60 companies from across the Dutch wind industry have joined wind & water works as a partner already.

We will continue to welcome additional partners and add new insights and information across the website as the wind & water works campaign gathers momentum.

2.3 Founding fathers of wind & water works

Wind & water works is a public-private partnership between the Dutch Government and leading business associations in offshore wind: Holland Home of Wind Energy (HHWE), the Association of Dutch Suppliers in the Offshore Energy Industry (IRO), Netherlands Maritime Technology (NMT) and the Netherlands Wind Energy Association (NWEA). The main goal is to inform and establish relations with stakeholders in the international offshore wind community. Through sharing of Dutch knowledge, experience and innovations, the wind & water works stakeholders aim to enhance their international visibility and reinforce their network as part of the international wind community.

2.4 Introduction to the next chapters

The next chapters will elaborate in more detail on the specific expertise the Dutch wind & water works partners can provide in the international offshore wind supply chain. The chapters follow the consecutive stages of a wind farm's lifecycle:

1. Feasibility, design and development
2. Construction and engineering
3. Transport and installation
4. Operations and maintenance

The guide also highlights Dutch breakthrough innovations in offshore wind technologies and offshore wind-to-hydrogen development.

To highlight the international track record of the Dutch expertise, a selection of recent export successes will also be presented in news items. These showcases are derived from international media coverage through industry news outlets, such as Navingo's offshore wind.biz platform.

HHWE: Holland Home of Wind Energy is an independent exporters association representing the interests of Dutch wind power companies abroad. HHWE's mission is to initiate and support marketing and promotional activities that will positively influence the image of the Dutch wind energy sector on emerging wind energy markets.
www.hhwe.eu

IRO: the Association of Dutch Suppliers in the Offshore Energy Industry is an independent non-profit organization that supports and promotes the interests of Dutch suppliers within the offshore energy industry.

www.iro.nl

NMT: The Netherlands Maritime Technology trade association represents Dutch shipyards, maritime suppliers and maritime service providers in the fields of (inter)national trade, Innovation and Human Capital.

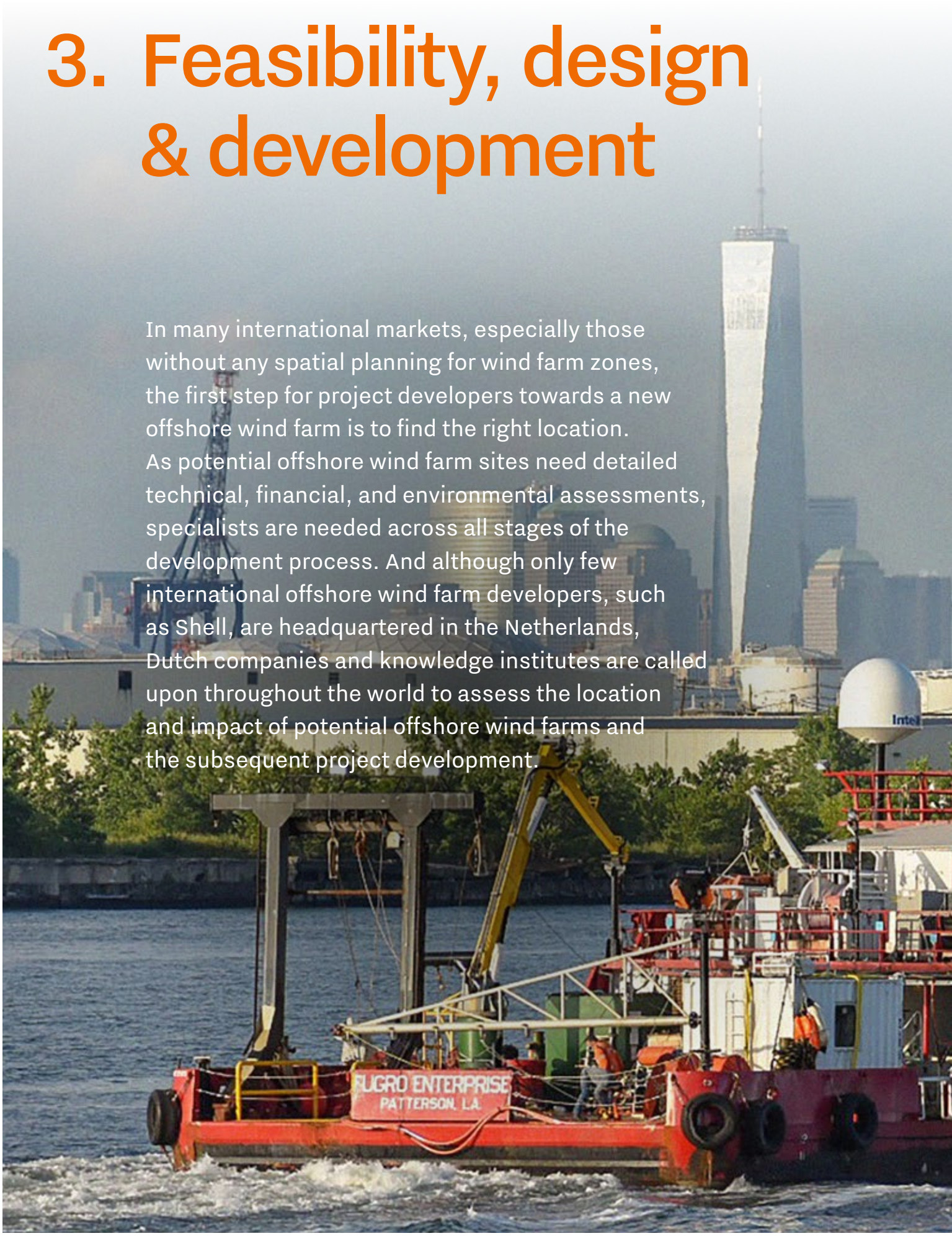
www.maritimetechnology.nl

NWEA: The Netherlands Wind Energy Association (NWEA) is the Dutch sector association working to increase sustainable wind energy on land and at sea. NWEA unites the wind sector in the Netherlands and accelerates the transition towards a renewable energy supply by spurring businesses and governments to invest in wind energy.

www.nwea.nl

3. Feasibility, design & development

In many international markets, especially those without any spatial planning for wind farm zones, the first step for project developers towards a new offshore wind farm is to find the right location. As potential offshore wind farm sites need detailed technical, financial, and environmental assessments, specialists are needed across all stages of the development process. And although only few international offshore wind farm developers, such as Shell, are headquartered in the Netherlands, Dutch companies and knowledge institutes are called upon throughout the world to assess the location and impact of potential offshore wind farms and the subsequent project development.




FUGRO

3.1 Development and project management

Although most wind farm utilities develop the initial offshore wind farm concept in-house during the pre-Front End Engineering Design stage (or pre-FEED), many consultancy and project management services are often subcontracted to third parties. Support includes legal advice, financial advice, planning, consenting, engineering consultancy, risk management and logistics.

Dutch consultants are internationally renowned at this early stage of project development in terms of consenting and development services and project management. A wide range of services are already provided by Dutch consultants to the development and project management area, such as legal and financial services.

In the news 2022

IX Wind and Foxwell Energy enter into long term cooperation for offshore wind in Taiwan

Source: windpower.nl

IX Wind, with its headquarters in the Netherlands, and Foxwell Energy, a subsidiary of Taiwanese renewables company Shinfox Energy, have officially entered into a cooperation. Entering this new, formal agreement ensures a long term commitment and stability in the realization of the Taiwan Power Company (TPC/Taipower) Offshore Wind Power Generation Phase II Project in Changhua County Waihai, Taiwan.

The project for Foxwell involves the full scope of engineering, procurement, construction, installation and operation and maintenance for the following years. Foxwell Energy is the first company in Taiwan to execute a full EPCI contract. The specific demands that are implied with a state owned company project can form a challenge, as well as complying with the Taiwanese local content demands.

Role IX Wind
In the past, IX Wind has already been executing the role of advisor for Foxwell and is leading the procurement of the Wind Turbine Generators. One of the new roles of IX Wind is expanding the Taipower Phase II OWF project team with experts, package leads and senior management. The experts that will be reinforcing the project team originate from both IX Wind, as well as from IX Wind's international network. Since December 2020 the project team has gone through significant developments. The team is expanded to continuously improve.

In the news 2022

BLIX To prepare Estonian Offshore wind farm

Source: Baltic Wind

Enefit, a developer, has signed a contract to prepare a conceptual engineering design for a wind farm in the Gulf of Riga. The project is co-financed by the European Union.

Margus Vals, a Member of Enefit's Management Board, said there is a strong demand for renewable electricity throughout Europe. "An increase in renewable energy production is crucial for the environment, consumers and national security. The offshore wind farm in the Gulf of Riga will play a key role in Estonia's energy supply and is in line with the government's green transition goals. Upon successful completion of the planning phase, the wind farm could begin production as early as 2028 and cover half of the electricity consumed in Estonia", said Vals.

The project will be prepared by the international engineering and consulting firm BLIX Consultancy. BLIX will analyze alternative wind turbine options, as well as foundations, substation and onshore solutions for the wind farm. The project will also provide technical solutions as input to the ongoing environmental impact assessment.

Albert van der Hem, Founder and Managing Director of BLIX Consultancy, said: "We will share more than 20 years of our experience in offshore wind development with Enefit and optimize the offshore wind farm project in the Gulf of Riga. We will incorporate not only relevant experience from recent offshore wind farm projects in northwestern Europe and Asia, but also from our recent assignments for clients in Estonia, Latvia, Lithuania, Finland and Poland".

3.2 Environmental impact assessments

Offshore wind farm developers have to cross critical path items, such as environmental and social impacts that need to be assessed in terms of public scrutiny and comment, subject to legal challenges. Examples of environmental impact relate to birds, bats, fish, and marine mammals (noise mitigation) during the development process. Other topics relate to aesthetic considerations, decommissioning requirements, and the impact on tourism, fishing, navigation, and transportation that arise in the planning, construction, and operation of an offshore wind project.

In the news 2022

Iberdrola and DP Energy Power Ahead with Large-Scale Irish Floater

Source: offshorewind.biz

Iberdrola and DP Energy have appointed Royal HaskoningDHV together with Mott MacDonald to lead the production of an Environmental Impact Assessment Report (EIAR) for the Inis Ealga Marine Energy Park project offshore Ireland.

The 1GW Inis Ealga Marine Energy Park is located off the South Coast of Ireland.

Royal HaskoningDHV has been awarded the work as lead consultant, alongside Mott MacDonald as a partner consultant, which will be supporting the project from its Dublin and Cork offices.

“This announcement is a significant step in the proposed development of the Inis Ealga Marine Energy Park and a significant contributor to Ireland reaching its climate action goals,” Adam Cronin, DP Energy’s Head of Offshore, said.

DP Energy entered into a joint venture with Iberdrola in February 2021 for a 3 GW pipeline of offshore wind projects.

The Inis Ealga project is currently in its early development stage, with ecology surveys underway and site investigation surveys being planned.

Once operational, the floating offshore wind farm will generate enough green energy to power the equivalent of nearly 860,000 Irish homes. The project is programmed to be operational by 2030, the developers said.

“Royal HaskoningDHV are industry leaders in delivering Environmental Impact Assessment Reports and this, coupled with Mott MacDonald’s expertise and local knowledge, will enable us to complete this important project for the south west coast of Ireland. We look forward to working together in the years ahead.”

Royal HaskoningDHV and Mott MacDonald will deliver a full Environmental Impact Assessment Report to examine the potential impacts of the proposed development on the surrounding environment including sea, land, and wildlife throughout the project lifecycle from site investigations to construction and right through to operation and eventual decommissioning of the wind farm.

3.3 Ecological surveys

Environmental surveys establish the distribution, density, diversity, and number of different species such as benthic, birds and marine mammals (acoustic impact during offshore piling). These studies take place early in the development process to provide information for the environmental impact assessment (EIA).

In the news 2022

Wind Turbines Offshore Netherlands Open to Sea Life

Source: offshore WIND.biz

Offshore wind developer Vattenfall and De Rijke Noordzee (The Rich North Sea) are jointly investigating the effect of water replenishment holes in wind turbine foundations on the surrounding sea life.

The research is being carried out on Vattenfall's 1.5 GW Hollandse Kust Zuid wind farm, the world's first subsidy-free offshore wind farm. Hollandse Kust Zuid will also become the world's largest operational offshore wind farm once commissioned in 2023.

All 140 of the wind farm's turbine monopile foundations are manufactured with elliptical openings located above the seabed and just below the water surface, which are approximately 30 centimetres by 1 metre in size.
The openings are envisaged as water replenishment holes in the hollow foundations of the wind turbines. These holes ensure that the water in the foundation flows well and is refreshed.

The openings are also expected to allow fish and other sea life such as anemones, crabs, and shrimps to enter the wind turbine foundations and potentially use them as shelter or to find food.

The investigations are focused on assessing whether the living conditions, such as oxygen content and temperature, are suitable for the development of marine life in the foundations.

The investigations will also cover the differences between the conditions inside and outside the foundations, as well as how marine life will develop in this environment over time.

"If our expectations come true, it will boost biodiversity under water. Building with nature is the future. I am proud that we are working with Vattenfall on these kinds of innovative solutions, with which we provide our country with sustainable energy and strengthening nature at the same time," said Erwin Coolen, Program Director at De Rijke Noordzee.

According to Vattenfall, this is the first time research is being carried out to determine how water replenishment holes can improve marine life at offshore wind farms.

3.4 Site investigations

During the site selection, developers also call upon specialists to carry out site investigations, including geotechnical and geophysical studies to identify suitable locations for the wind farm and cable routes. These investigations identify seabed topography and locate unexploded ordnance. Further geophysical surveys are often completed post-consent and pre-construction to determine turbine locations, foundation design and cable routes. Environmental studies such as wildlife impact assessments are sometimes combined with the geophysical surveys.

Site investigations are required at both the wind farm location and at the proposed onshore and offshore cable route and the onshore substation site. Depending on the survey type, the contract may involve both data collection and analysis, such as geotechnical surveys, or data collection only, where analysis is performed by the developer in-house, for example, meteorological and oceanographic (metocean) data. Geophysical surveys include bathymetric, cable route and unexploded ordnance surveys. These surveys plot the surface topography in support of the wind farm design and installation engineering.

In the news 2023

Fugro to Start Star of the South Geotechnical Site Investigation

Source: offshorewind.biz

Dutch geo-data specialist company Fugro has been awarded a contract to perform a geotechnical site investigation, which is set to kick in this weekend, for Australia's first offshore wind farm, Star of the South.

The geotechnical site investigation is partly funded by the Victorian Government through the Energy Innovation Fund with a USD 19.5 million investment.

A specialist vessel and crew will spend five weeks at sea collecting soil and rock samples from up to 70 metres beneath the seafloor, with the findings to help design the proposed offshore wind farm to suit local seabed conditions.

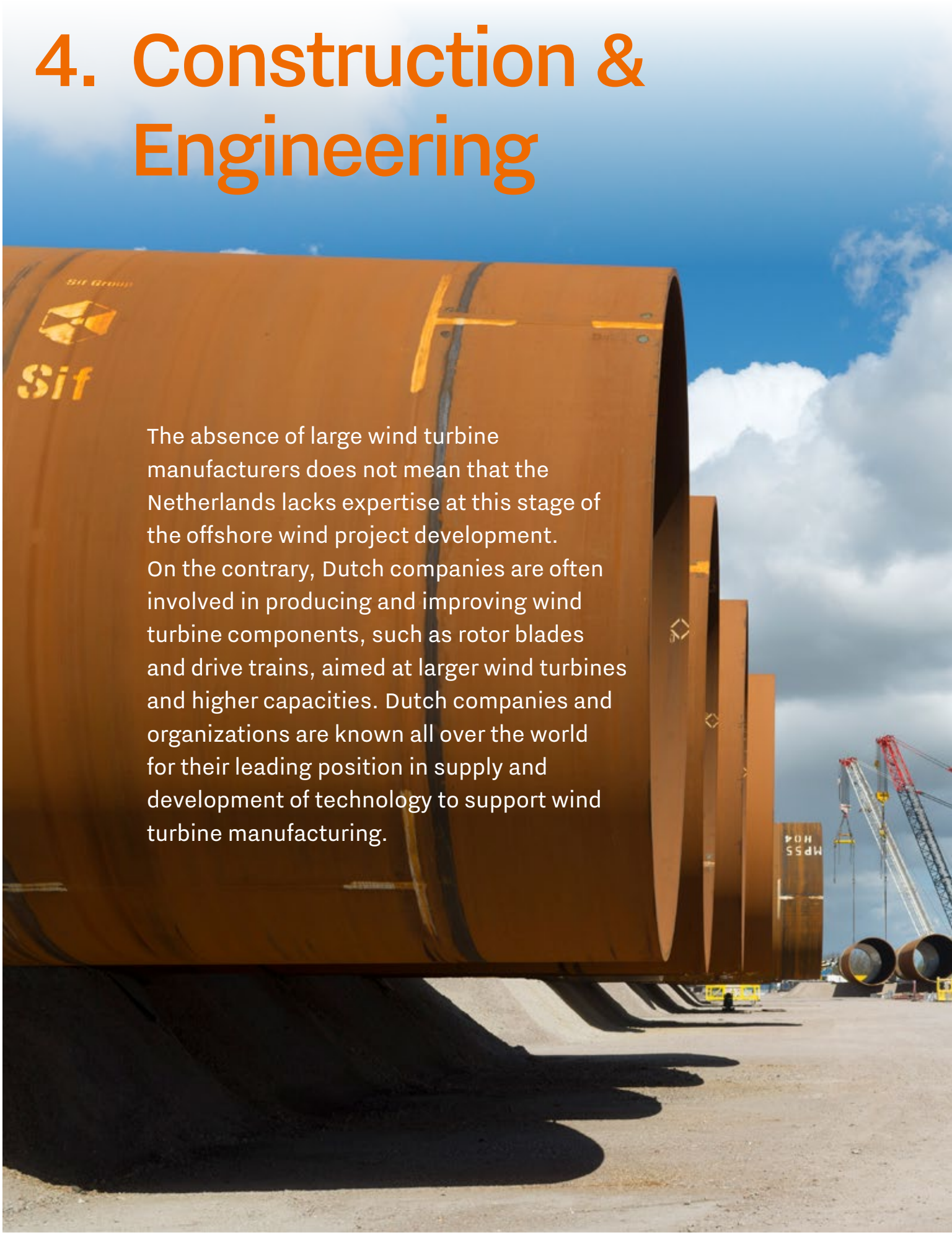
Star of the South is currently in the feasibility phase and has the potential to generate up to 2.2 GW of new capacity to supply around 20 per cent of Victoria's energy needs and power around 1.2 million homes across the state.

In March of last year, the Victorian Government announced a plan to build at least 2 GW of offshore wind capacity by 2032, 4 GW by 2035, and 9 GW by 2040.

Star of the South, the first and most progressed offshore wind project in Victoria, is being developed to deliver clean energy to the grid by 2028.

Pending approvals, the project is planning to start construction around the middle of the decade and is expected to comprise up to 200 wind turbines.

4. Construction & Engineering



The absence of large wind turbine manufacturers does not mean that the Netherlands lacks expertise at this stage of the offshore wind project development. On the contrary, Dutch companies are often involved in producing and improving wind turbine components, such as rotor blades and drive trains, aimed at larger wind turbines and higher capacities. Dutch companies and organizations are known all over the world for their leading position in supply and development of technology to support wind turbine manufacturing.


OLEG STRASHNOV

4.1 Turbine component supply, engineering

Wind turbine manufacturers can best be seen as system integrators: designing the overall system and components such as nacelle, rotor and the tower, then assembling the components (mostly at the offshore site), which it may manufacture in-house or source from suppliers externally.

4.2 Turbine foundation supply

Turbine foundations are one of the main elements of any offshore wind farm, accounting for over one fourth of the total equipment cost. Developers select a foundation type depending on the water depth, seabed conditions, wave and tidal loading, and turbine loading, mass and rotor speed. The foundation types are listed and briefly summarised below:

- Monopiles;
- Jacket and tripod steel foundations;
- Suction piles/ buckets;
- Gravity base foundations;
- Floating foundations.

Monopiles

To date, most offshore wind farms have steel monopile foundations, being selected in more than 60% of the worldwide offshore wind installations. The main characteristics in favor of monopiles are simplicity (easily standardised design for series manufacturing without the need for high-end 3D cutting and welding technology) and adaptability (more easily adaptable to different installation site characteristics, avoiding the need for a large amount of field data).

The most common design has been a cylindrical monopile that is first driven into the seabed, with cylindrical transition piece mounted over it and grouted into position. The purpose of the transition piece is to provide access arrangements (these welded appurtenances would not survive the piling activity) and levelling of the tower base interface. Increasingly large designs, with XL units up to 2.000t or more, are currently being deployed for deeper waters up to 60 – 70 metres.

In the news 2023

Polenergia, Equinor Book Sif for Polish Offshore Wind Job

Source: offshorewind.biz

Sif and the joint venture between Equinor and Polenergia have entered a capacity reservation agreement to supply 90 monopile foundations for the MFW Bałtyk II and MFW Bałtyk III offshore wind farms in the Polish Baltic Sea.

Once finalised, this will be the first contract under the terms of the strategy collaboration agreement between Equinor and Sif.

The monopiles will be manufactured in 2025-2026 and have an estimated production volume of about 105 Kton.

"It is great to witness this next chapter of the successful cooperation Sif and Equinor have developed over the years and that has materialized in the recently signed framework agreement. We are also happy to welcome Polenergia as a new potential customer", said Fred van Beers, CEO of Sif Holding.

Polenergia and Equinor are jointly developing the MFW Bałtyk II and MFW Bałtyk III offshore wind farms with a combined capacity of 1,440 MW.

The two 720 MW wind farms, featuring Siemens Gamesa 14 MW wind turbines, were awarded Contracts for Differenc (CfD) in May 2021 by Poland's Energy Regulatory Office (ERO).

Recently, the geophysical and geotechnical surveys were completed for the offshore wind projects, located in the Polish Baltic Sea.

The seabed surveys were carried out by a fleet of ten vessels owned by different contractors along a 1,000-kilometre section for the two wind farms with a total area of approximately 240 square kilometres and cable routes of 400 kilometres.

Monopiles not always an option

Monopiles are used for almost all European developments because of their low cost (simplicity of fabrication and construction) and their ability to be hammered or vibrated deeply into seabeds consisting of either sand, silt, medium to hard clays – or a mixture. But many of the most promising areas around the world do not have such competent seabed stratum. They are instead characterised by soft marine clays, hard volcanic and sedimentary rocks, deep faulting, seismic activity and loose deposits with liquefaction potential. This means that certain situations may require alternative foundation systems – including piled jackets, suction buckets, or gravity-based structures.

Jacket and tripod steel foundations

There are several non-monopile steel foundation concepts for deeper water projects where monopiles are not a feasible option:

- Jacket: structures typically used in O&G sector but optimised for offshore wind farms. It has a transition piece platform on top and the main structure is made of legs, braces, and pin piles to anchor the complete structure to the seabed. It can have four or three legs.
- Tripod: three-leg structure made of cylindrical steel tubes. The central steel shaft of the tripod makes the transition to the wind turbine tower. The base width and pile penetration depth can be adjusted to suit actual environmental and soil conditions.

There are no current Dutch suppliers with international interests known in this field.

Suction piles/buckets

In 2017, SPT Offshore (now part of DEME) launched a new wind turbine suction pile foundation concept, as an alternative to jacket foundations. The foundation involves a star-shaped transition piece that is positioned in between the three (or potentially four) suction piles and the mono tubular. The suction bucket foundation creates a vacuum to secure the foundation to the sea floor. Pumping air back into the bucket reverses the suction process and aids the removal of the structure.

This foundation is potentially cost saving as the mono tubular is inexpensive to fabricate, being some three times less expensive than jackets. Furthermore, the suction piles have several advantages, including fast and noise-free installation. Also, suction piles do not cause any shocks to the foundation, so that single piece installation up to the work platform is possible.

There is significant interest in suction piles/buckets as seabed connections as a means of lowering installation costs and the impact of piling on wildlife.

In the news 2022

First Suction Pile Jacket Installed at Changle Waihai OWF

Source: offshorewind.biz

CCCC – First Harbor Engineering Company has installed the first suction pile jacket at the Fujian Changle Waihai offshore wind project in China.

CCCC installed the suction pile jacket on 21 February using SPT Offshore's SAPS007S suction spread.

The Netherlands-based SPT Offshore won a contract in August 2020 for the design and installation of suction pile jacket foundations at the project.

Dongfang Electric Corporation (DEC) will deliver the turbines.

The 300 MW Changle Area A will consist of 40 turbines, 15 of which mounted on suction pile jacket foundations, while the 496 MW Changle Area C will feature 62 turbines all set to be installed on suction pile jackets.

The wind farm is located in the east water area of Changle, Fuzhou City, 31–50 km from shore in water depths of 37 to 45 m, and is currently the farthest and deepest offshore wind farm in China.

Gravity-based foundations
Gravity-based structures (GBSs) are assembled onshore and installed without the need for piling. This avoids some of the noise restrictions faced by some projects to limit the impact on marine mammals and eliminates the need for expensive heavy-lift vessels. Large quayside or dry dock facilities are required with heavy lift capabilities for manufacture. These are made from concrete or are steelconcrete hybrids. Requiring no piles and no specialised installation vessels, gravity-based structures maximise the use of both local labour and materials. They have the potential to be an attractive option for many locations e.g. Asia.

4.3 Sealing, corrosion protection

Foundations for wind turbines and offshore substations require solid steel protection and bolting fixation, as bad sealings and corrosion can cause severe damage that is both expensive and difficult to repair.

4.4 Subsea cables

Subsea cables deliver the power from the turbines to the onshore grid. Array cables connect the turbines to an offshore substation from which the power is transmitted to an onshore substation via high voltage (HV) export cables. The array cable technology is well established and has been extensively used in the power and oil and gas industries. To date, array cables have predominantly been medium voltage (MV) and rated at 33 kV. Dutch offshore wind farms will be connected through 66 kV cables, and this is expected to be a rapidly growing market elsewhere over the coming years. Export cables from substation to shore have a significantly higher capacity than array cables, ranging from 132 kV to 245 kV. Export cable installation takes place early in the construction schedule and there are potentially long lead times. It is therefore one of the first Tier 1 contracts placed.

Export cables can either be HV alternating current (HVAC) or HV direct current (HVDC). Most export cables to date have been alternating current (AC), but as future projects tend to be further from shore, it is likely to lead to greater use of direct current (DC) systems.

4.5 Substations and foundations

Modern commercial-scale offshore wind farms have at least one offshore substation, incorporating electrical components such as reactive compensation systems, switchgear, transformers, back-up generators and converters where required. HVAC electrical systems have been the most common solution to date. For projects that are built further offshore, however, there is cost benefit in using HVDC systems due to a reduction in electricity losses.

Offshore substation electrical systems are mounted on platforms (topsides). Offshore substation platforms are large complex steel structures. A HVAC offshore substation platform weighs up to 2,000 t and may include a helipad and emergency accommodation. HVDC substations are much larger, with masses of up to 15,000 t. Substation manufacturing is analogous to shipbuilding and offshore oil and gas platform fabrication. Both monopile and jacket foundations have been used to support these.

Substation supply can be divided into the supply of electrical systems and the supply of the structures. Electrical systems comprise transformers, reactors switchgear, power electronics, cables within the substation and control and auxiliary systems. Offshore substation structures include the offshore platform and associated structures for access and accommodation, and the substation foundation. Both monopile and jacket foundations have been used to support these.

5. Transport & Installation

The Netherlands has a large and internationally renowned offshore services sector. Traditional Dutch offshore oil and gas contractors and dredging companies are now also world leaders in the installation of offshore turbines and foundations. With their strong market position and expanding track record, they offer either transport and installation or Balance of Plant packages, depending on the preference of the developer. In various partnerships and consortia, these companies also focus on faster development, higher efficiency and environmentally friendly installation methods for turbines and foundations.


AEOLUS
Van Oord

5.1 Turbine and foundation installation

Turbine installation is undertaken by main contractors using jack-up vessels which transport wind farm components from port to site. Recent projects have mostly used vessels which are purpose built for offshore wind. It takes two to three days on average to install a turbine, including transit time, weather downtime and mobilisation/ demobilisation time. The turbine installation is undertaken by the original equipment manufacturer (OEM) but the vessel is often contracted by the developer. Turbine installation may well be part of a full balance of plant contract.

For foundations, vessels may either transport the structures from port to site and undertake the installation or remain onsite with foundations transported to the site using feeder vessels. Some jack-up vessels are used for both turbine and foundation installation. Others are floating heavy lift vessels, which may be used for substations as in other maritime sectors. For jacket foundations, deck space is the limiting factor for vessel choice, whereas for monopile foundations it is increasingly the crane capacity. It takes about three days to install a monopile and five days on average to install a jacket foundation, including transit time, weather downtime and mobilization/demobilization time.

The oil and gas industry is the origin of Dutch expertise in turbine installation. As the offshore wind industry has matured, the vessels used have become increasingly bespoke and many are exclusively used in offshore wind.

In the news 2022

Heerema to Install XL Foundations at He Dreiht Offshore Wind Farm

Source: offshorewind.biz

EnBW has awarded Heerema Marine Contractors with the contract to transport and install the turbine foundations at the 900 MW He Dreiht offshore wind farm in the German North Sea.

The work includes the transport and installation of 64 monopiles and transition pieces.

During operations, Heerema will use the IHC IQIP double-walled noise mitigation system NMS-10,000 amongst other systems to reduce noise pollution, the company said.

The monopile foundations will support Vestas' flagship V236-15.0 MW wind turbines. He Dreiht will be the first project to feature this model, and the first wind farm to feature a turbine model with an individual capacity of 15 MW or more.

Located 90 kilometers northwest of Borkum and about 110 kilometres west of Heligoland, the subsidy-free He Dreiht is scheduled to go into operation in 2025. EnBW He Dreiht Project Director, Jörn Däinghaus said: "Heerema is a contractor with a high level of experience and excellent technological know-how. We look forward to working with Heerema to develop and install our first subsidy-free offshore windpark."

In the news 2023

Van Oord's Next-Gen Newbuild to Install Nordseecluster Foundations

Source: offshorewind.biz

Van Oord has been selected as the preferred supplier for the transport and installation of foundations for RWE and Northland Power's 1.6 GW Nordseecluster offshore wind project in Germany.

For this work, Van Oord will deploy its brand-new offshore installation vessel Boreas which is currently being built by Yantai CIMC Raffles Shipyard (YCRO) in China.

The new 175-metre vessel is purpose-built for the transport and installation of next-generation of foundations and turbines at offshore wind farms. It has an advanced jacking system and can lift more than 3,000 tonnes.

In addition, its four giant legs, each measuring 126 metres, will allow the vessel to be jacked up and work in waters up to 70 metres deep.

The vessel will be able to run on the future fuel methanol, reducing the ship's carbon footprint by more than 78 per cent, said Van Oord.

Van Oord's Boreas will work on Nordseecluster offshore wind project located in the German North Sea, 35 kilometres north of Juist Island and 55 kilometres off the German coast.

The Nordseecluster will be constructed in two phases, Nordseecluster A and Nordseecluster B, each comprising two offshore wind farms.

The two Nordseecluster A wind farms (N-3.8 and N-3.7), which have a combined capacity of 660 MW, are currently in the permit application phase. The first phase will comprise 44 Vestas 15 MW wind turbines and is scheduled for commercial operation in early 2027.

For the 900 MW Nordseecluster B, RWE and Northland Power plan to secure the two sites (N-3.6 and N-3.5) by bidding and exercising the step-in rights in the German offshore wind auctions this year, as they did for the Nordseecluster A sites in 2021.

This second phase is planned to be built by 2029.

In the news 2023

All Foundations Stand at Changfang & Xidao Wind Farms Offshore Taiwan

Source: offshorewind.biz

All 62 three-legged jacket foundations have been installed at the 589 MW Changfang and Xidao wind farms offshore Taiwan, according to Dennis Sanou, CEO of Changfang Xidao Offshore Wind Farms at Copenhagen Offshore Partners.

Century Wind Power was responsible for manufacturing the jacket foundations, with the last one being built a few days ago.

Boskalis was in charge of installing the units at the offshore construction site, located some 15 kilometres off the coast of Changhua County.

The company deployed its Bokalift 1 and Bokalift 2 crane vessels for this mission. The ships were supported by vessels BOKA Atlantic and BOKA Tiamat which provided essential supporting activities.

Bokalift 1 was assisted by Boskalis' heavy transport vessel Mighty Servant 3, which transported a number of jackets from the Port of Taipei to the offshore wind farms.
The Dutch company completed the first phase of foundation installation in July of last year. A year later, Boskalis reached the halfway mark on the project by installing 31 jacket foundations.

The 62 units will hold Vestas V174-9.5 MW wind turbines, the first of which was put in place in July of last year by the installation vessel Bold Tern.
Changfang and Xidao offshore wind farms, owned by Copenhagen Infrastructure Partners (CIP) and two local life insurance companies, Taiwan Life Insurance and TransGlobe Life Insurance, are scheduled to be fully commissioned by early 2024.

In the news 2022

Van Oord Cracks US Market with Offshore Wind Contract

Source: offshorewind.biz

Van Oord has won a contract to transport and install wind turbines at an undisclosed wind farm offshore the East Coast of the USA.

The company will deploy the offshore installation vessel Aeolus on the project.

The turbine installation work is scheduled to start in 2023.

Van Oord said that this is the first contract for the company in the USA.

There are two offshore projects on the East Coast of the USA which are scheduled to enter the turbine installation phase in 2023.

The first project is the 804 MW Vineyard Wind 1 offshore Massachusetts. DEME Offshore US is in charge of transporting and installing the 63 GE Haliade-X 13 MW wind turbines at the wind farm. The installation vessel to be deployed on this project is the Sea Installer.

The second project is the 132 MW South Fork wind farm located 56 kilometres (35 miles) east of Montauk Point, New York, and some 30 kilometres (19 miles) southeast of Block Island.

South Fork is being developed by the joint venture partners Eversource and Ørsted and is slated for full commissioning at the end of 2023.

5.2 Substation installation

Offshore substation electrical systems are mounted on platforms. These structures are often similar to offshore oil and gas platforms, as is the installation process, although substations are typically in shallower water. Most topsides have typically been installed with a single lift from a barge. Both sheerleg (two-legged lifting device) and heavy lift vessels can undertake the lift from the barge. Substation foundations may be either jackets or monopiles, and the installation of these may form part of the turbine foundation installation contract and use the same vessels.

Current Dutch suppliers are basically the same as those for the turbine and foundation installation.

In the news 2022

Heerema to Install Dogger Bank C Offshore Substation

Source: offshorewind.biz

Heerema Marine Contractors will transport and install the Dogger Bank C offshore substation under a contract awarded to the company by the Dogger Bank Wind Farm joint venture partners SSE Renewables, Equinor, and Eni.

For the third phase of the 3.6 GW Dogger Bank Wind Farm, Heerema will transport and install the project's 3,500-tonne jacket foundation, four main piles, and the 9,500-tonne offshore substation topside.

The company will perform offshore lifting to position the jacket foundation on the scour bed, using main piles to provide jacket on-bottom stability. The offshore substation will be lifted from a barge prior to the set-down on the jacket foundation.

"Installation of the offshore substation on the third phase of Dogger Bank Wind Farm will be a significant moment for our world-leading project. We welcome Hereema to our strong team of tier-one suppliers, and we look forward to working with them to install this innovative platform on the DBC site", said Steve Wilson, Project Director for Dogger Bank Wind Farm.

Heerema's Wind Director, Jeroen van Oosten, said: "Installing sizeable offshore substations is core business for Heerema Marine Contractors and we are looking forward to working together on the preparation and installation of Dogger Bank C".

5.3 Cable laying

Cable installation can be undertaken either in a single lay and burial process using a plough, or through a separate surface lay and subsequent burial approach using a jetting tool on a remotely operated vehicle (ROV). Installation of array cables is more challenging due to the large number of operations involved, with a pull-in at each foundation. For nearshore installations, shallow-draft barges are often used, whilst large-scale projects further from shore typically use dynamically positioned cable ships. Export cables are typically installed as a single length of cable and thus larger vessels are used with the necessary storage. Unlike turbine and foundation installation, success in the cable installation market is driven as much by technical capability and track record as it is by vessel capability.

In the news 2023

Dutch Company Nets Greater Changhua 2b & 4 Cable Deal

Source: offshorewind.biz

The Netherlands-based Twentsche KabelFabriek (TKF) has been awarded a cable supply contract from Ørsted for the 920 MW Greater Changhua 2b and 4 offshore wind farms in Taiwan.

The contract scope includes the supply and termination of close to 200 kilometres of inter-array cables and other cables including accessories and connectors, all operating 66 kV for the Greater Changhua 2b and 4 offshore wind farms.

"We are honoured that Ørsted has selected TKF for its prestigious Greater Changhua project, and we are looking forward supplying green energy to the Taiwanese households through our state-of-the-art inter-array and other cables", said **Walter Heerts**, Business Line Director Subsea from TKF.

The contract announcement follows Ørsted's final investment decision, taken in March 2023. The wind farms are now under construction and are set to be some of the largest offshore wind projects in Asia Pacific. The Greater Changhua 2b and 4 offshore wind farms will comprise around 65 wind turbines with an individual capacity of 14 MW, installed some 35-60 kilometres off the Changhua coast.

LS Cable & System is responsible for the supply of high-voltage subsea for both projects.
In 2018, Ørsted secured 920 MW of grid capacity for the offshore wind farms in Taiwan's first competitive price-based auction with no mandatory local content requirements. Two years later, the developer signed a corporate power purchase agreement (CPPA) with Taiwan Semiconductor Manufacturing Company Limited (TSMC) for the offtake of the full production from Changhua 2b and 4.

In the news 2023

Boskalis Wins 'Large' Baltica 2 Cabling Contracts

Source: offshorewind.biz

Boskalis has been awarded contracts by PGE Polska Grupa Energetyczna and Ørsted for the transportation and installation of the export and array cables for the Baltica 2 offshore wind farm in Poland, classifying the contract value as "large", which for Boskalis means it is worth more than EUR 300 million.

The project scope comprises the transportation and installation of 107 array cables with a total length of more than 150 kilometres in addition to four 275 kV export cables with a total combined length of nearly 300 kilometres.

In addition to the laying of the export and array cables, Boskalis will carry out seabed preparation activities including the levelling of the seabed, pre-trenching, and the removal of boulders.

Upon completion of the cable installation activities, the Netherlands-headquartered company will protect and stabilise the cable protection systems (CPS) with the placement of rock.

Boskalis will deploy two cable-laying vessels, a construction support vessel, a subsea rock installation vessel, and a trailing suction hopper dredger. The cables will be installed in a pre-cut trench using the multi-mode Megalodon plough deployed from Boskalis' construction support vessel *Falcon*.

Preparatory works will commence in 2025 and the transport and installation activities are planned to start in 2027.

5.4 Installation tools

This section covers the lower tier activities which are undertaken in support of the primary (Tier 1) installation contracts. Equipment used during installation includes:

- Cranes for loading components on the quayside;
- Sea fastenings and racks for securing components in transit;
- Foundation piling equipment such as templates, hammers, and handling equipment;
- Cable installation equipment such as carousels, tensioners, grapnels, trenching and burial tools, and cable retrieval tools;
- Turbine installation equipment, such as cranes and yokes.

Equipment such as cranes and cable-handling equipment may be bought by the installation contractor and permanently installed on the vessel or rented from a supplier. There are some elements of installation equipment that are designed and manufactured based on the needs of the specific projects. Examples include sea fastening equipment, blade racks and pile-handling tools.

In the news 2023

Crane for First US Wind Turbine Installation Vessel on Its Way to Texas

Source: offshorewind.biz

Stars have aligned today, 24 February, for the first wind turbine installation vessel (WTIV) being built in the US as Huisman loaded the vessel's crane onboard BigLift Shipping's Happy Star and sent it off to the Lone Star State. In Texas, Huisman's US team will commission the crane at the Keppel AmFELS shipyard, which is building the WTIV for Dominion Energy.

The WTIV, named Charybdis and designed by Gusto MSC, is the first US Jones Act-compliant offshore wind installation vessel and is scheduled to enter into service this year.

Already in 2021, the WTIV secured its first job as Ørsted and Eversource entered into an agreement with Dominion Energy to charter *Charybdis* for the construction of their Revolution Wind and Sunrise Wind offshore wind farms in the US Northeast.

Dominion Energy announced it had selected Huisman to deliver the crane for the WTIV in September 2020, a couple of months before Keppel AmFELS laid the keel for the new vessel at its shipyard in Brownsville, Texas.

Shortly after the keel-laying ceremony, Huisman signed a contract with Keppel AmFELS to deliver the Leg Encircling Crane (LEC) for *Charybdis*.

Back in 2020, Huisman said it would implement the same robust and proven technology used for the LEC for Seajacks' offshore wind installation vessel Scylla, which is fitted with a 1500-tonne LEC crane.

The crane now delivered for Charybdis is able to lift 2,200 tonnes, has a 130-metre-long boom, and allows for the installation of the new generation of offshore wind turbines, according to the company.

The 2,200-tonne LEC features a fully electrically driven system, resulting in high positioning accuracy, reduced maintenance and higher reliability, Huisman's specifics of the LEC read.

Furthermore, the crane's unique Lambda boom has a lightweight and stiff design, with the latter leading to reduced motion at the crane tip.

Huisman also notes that the crane's small tail swing allows for optimised utilisation of free deck space.

In the news 2022

Huisman Receives First Monopile Gripper Order from Japan

Source: offshorewind.biz

Huisman has been awarded a contract by TOA Corporation and Obayashi in Japan for the delivery of a monopile gripper.

The gripper will allow TOA and Obayashi to upend and install monopiles without using a separate upending bucket, which is said to improve the safety and efficiency of operations on board.

The Huisman Monopile Gripper will be the first of its kind to be used in Japan, Huisman said.

The gripper will be installed on TOA and Obayashi's Self Elevating Platform (SEP), which is outfitted with a 1,250mt Huisman Pedestal Mounted Crane.

The gripper will be capable of handling monopiles of up to 8 metres in diameter, fully utilising the capacity of the SEP.

Huisman said the company paid special attention to optimising the upending process, in which the gripper and crane control software communicate with each other to ensure the system – as a whole – operates within its limits.

"We are extremely honoured to be awarded our very first monopile gripper contract in Japan. This order is the result of our partnership with TOA Corporation and Obayashi, which we have developed over multiple years," **Timon Ligterink**, Commercial Director Asia-Pacific at Huisman.

"Together with the Huisman-built crane, the gripper will allow safe upending and installation of monopiles in Japanese waters, accelerating the energy transition in the country. We thank TOA Corporation and Obayashi for their continued trust in Huisman and look forward to successfully developing this gripper together."

In the news 2022

Jacket Piles In at Ishikari Offshore Wind Farm

Source: offshorewind.biz

CAPE Holland has announced that 56 jacket foundation pin piles were installed at the Ishikari offshore wind farm in Japan.

From May to August 2022, the CAPE VLT-320 was used for the installation of 56 pin piles with lengths of 60 metres and a diameter of 2.5 metres for the Japanese offshore wind project.

The piles were driven through a seabed template until trunnions were just above the pile gripper. Pile verticality was critical with constant monitoring while driving via the CAPE Holland in-built inclinometer system, the company said.

The project's developers, Pattern Energy Group and its affiliate in Japan, Green Power Investment Corporation (GPI), completed financing and began full construction of the offshore wind farm in October, located approximately three kilometres from the shore of the Ishikari Bay in Hokkaido.

Ishikari Offshore Wind will utilise 14 Siemens Gamesa 8.0 MW wind turbines, which are built specifically for offshore use. The SG 8.0-167 DD offshore turbine is designed to meet local codes and standards regarding typhoons, seismic activities, 50 Hertz operation, as well as operation in high and low ambient temperatures.

Ishikari Wind will also feature a battery storage component with 100 MW x 180 MWh of capacity.

The Ishikari Offshore Wind project, and accompanying battery storage component, is expected to reach commercial operation in December of 2023.

The project has a 20-year power purchase agreement with Hokkaido Electric Power Network for 100 per cent of the power output.

5.5 Vessel design, ship building, deck equipment

Installation vessels

As already indicated, there are basically two main vessel options for steel foundation installation: a jack-up vessel, mostly used for turbine installation; or a floating vessel, often with components fed using a separate floating vessel. Turbine installation on all existing commercial-scale projects to date has been undertaken by a jack-up vessel, to provide sufficient stability for the nacelle and rotor lifts.

Subsea cable installation can be undertaken using either a single lay and burial process with a plough or using a separate surface lay with subsequent burial, using a jetting tool operated from a ROV. Array cable laying is considered a more technically challenging process than export cable-laying due to the large number of operations that are involved and the cable pull-in interface at each foundation. Export cable-laying vessels tend to be larger with cable carousels with a higher capacity to enable a single length of cable to be laid from substation to shore, where possible.

Support vessels

The sort of support services required during installation includes cable route surveys and clearance, support vessels such as crew transfer and guard vessels, diving, ROV operations, grouting and several marine operations, including vessel modifications, logistics, certification, weather forecasting and planning. Many of these services are delivered by small and medium sized companies.

In the news 2023

Shimizu Corporation Takes Delivery of Mega Jack-Up

Source: offshorewind.biz

The Japan Marine United (JMU) shipyard delivered the GustoMSC designed and equipped offshore wind turbine installation vessel (WTIV) to Shimizu Corporation at the end of January.

Shimizu unveiled plans to build a wind farm installation vessel back in 2019. The vessel, which is of GustoMSC SC-14000XL design, is 142 metres long, 50 metres, wide, and can accommodate up to 130 personnel.

It is also equipped with GustoMSC variable speed rack and pinion jacking system, providing reliability, stability, and performance even in the harshest offshore conditions, said NOV.

GustoMSC also delivered what they say is the world's first fully integrated offshore telescopic leg encircling crane, which enables the vessel to install foundations and turbines.

When deployed in a retracted mode, the crane has a safe working load of 2,500 tonnes with a lifting height of 118 metres above the deck.

Keeping the crane boom in the retracted mode without an extension over the bow could avoid sailing and maneuvring restrictions during transit and in port areas, NOV said.

The crane can then easily transition to an extended mode to install turbines at a height of up to 158 metres above the deck and with a maximum safe working load of 1,250 tonnes.

The jack-up, named Blue Wind, can operate in depths of between 10 and 65 metres, and is capable of loading, transporting, and installing seven 8 MW, or three 12 MW wind turbines at a time.

Blue Wind was launched in October last year, and the first project that the vessel will work on is the 9 MW Nyuzen wind farm offshore Nyuzen Town, Shimoniikawa District, Toyama Prefecture.

The vessel's second project will be the 112MW Ishikari Bay offshore wind farm where she will transport and install 14 Siemens Gamesa 8 MW wind turbines expected to be operational by December 2023.

In the news 2023

NOV and GustoMSC Tapped for Second Havfram Mega Jack-Up

Source: offshorewind.biz

NOV has once again signed contracts with CIMC Raffles to supply a GustoMSC™ NG-20000X self-propelled wind turbine installation jack-up vessel design for Havfram's second vessel on order at the shipyard.

The NG-20000X-HF vessels are among the largest wind installation jack-ups in the industry, NOV said. They feature a 3,250-ton heavy lift crane and can install foundations up to 3,000 tons and wind turbines with tip heights over 300 metres in water depths up to 70 metres.

The vessel's large carrying capacity is said to reduce the vessel trips required per development, thereby improving project economics, and reducing carbon emissions per installed megawatt.

"Havfram's decision to partner with GustoMSC for the second time in their pursuit to establish themselves as a prominent player in the worldwide offshore wind sector is deeply appreciated. We are excited to collaborate with their skilled team and join in their enthusiasm to overcome a crucial hurdle in advancing clean energy production," **Nils van Nood**, Managing Director of GustoMSC, said.

Like the vessel currently under construction under the first contract, Havfram's second self-propelled jack-up vessel will be equipped with the NOV variable speed drive rack and pinion jacking system, including the latest regenerative power system technology that feeds the generated power back into the vessel's system.

"Our collaboration with GustoMSC on our WTIV new builds has been exceptional," **Even Larsen**, CEO of Havfram Wind AS, said.
"The team at GustoMSC is incredibly skilled and committed, consistently willing to discuss and accommodate Havfram specific needs and requirements. Our joint efforts have resulted in a top-of-the-line vessel offering modernity, efficiency, high capacity, and low emissions, providing the best assurance to the market for their coming wind farm construction projects."

In the news 2023

Platypus Marine to Build Damen-Designed Jones Act Vessel

Source: offshorewind.biz

Washington-based Platypus Marine has signed a Letter of Intent with Dutch shipbuilding group Damen Shipyards for the construction of a new Jones-Act compliant Fast Crew Supply (FCS) vessel.

The vessel will be built on specifications based on Damen's FCS2710 design.

The FCS 2710, unveiled in 2018, has replaced the FCS 2610, retaining the twin, axe bow hull design but being both one metre longer and higher.

This means that the FCS 2710 can be used in weather conditions with a wave height of over two metres, significantly increasing the operational window. The FCS 2710 also offers additional deck space, more tank capacity, and additional accommodation, according to Damen.

The FCS can carry 26 passengers in its standard configuration, as well as offer more flexibility, more tank capacity, greater usable deck space, and increased comfort, Damen said.

The design is in service with operators of crew transfer vessels in the UK, Ireland, and the Netherlands.

At the end of last year, offshore service provider, High Speed Transfers (HST) Marine, signed a contract with Damen Shipyards for the supply of three FSC2710 vessels.

6. Operations & Maintenance

Operations & Maintenance involves providing support during the lifetime of the wind farm to minimize downtime and ensure maximum energy production. Wind farms typically have an operating lifetime of 25 to 40 years.
The Dutch have significant expertise across the operations, maintenance and services value chain, with a large variety of main component and equipment suppliers as well as service providers.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6.1 Operations

The day-to-day operation of a wind farm is managed from an onshore base. Activities include day-to-day workflow management and data gathering and analysis. This allows owners to respond efficiently to failures when they occur and, where possible, to identify potential failures before they arise. The management of logistics (vessels, helicopters, personnel, specialist tooling and spare parts) is also an important part of the operations role.

For O&M, wind farm operators will typically look to use the nearest port that meets their specifications in order to minimise travel time and make the best use of weather windows. Vessels and equipment are therefore an essential component of this sub-element and an area where Dutch suppliers have significant expertise.

Crew transfer vessels (CTVs) typically provide transport for technicians and spares from the onshore base to offshore wind farms less than about 90 minutes transfer time from port. Some wind farms supplement CTVs with full-time helicopter support, for transporting technicians when the task in hand does not require heavy tools or spares, or when sea conditions are severe. Spare parts are stocked in onshore warehouses.

Service operations vessels (SOVs) are larger than CTVs, with a greater capacity, and are typically used for wind farms more than about 90 minutes transfer time from port. They are effectively a floating OMS base, accommodate between 60 and 90 passengers and contain workshops and storage for equipment, consumables and spares.

6.2 Maintenance

Maintenance and inspection services include both planned (and unplanned) visits to wind turbines and their foundations for the purposes of inspection maintenance and repair, performed by the wind farm's usual staff and equipment. Turbine maintenance typically involves a planned visit to each turbine once or twice a year. During these visits, technicians carry out inspection and maintenance activities, including checks on oil and grease levels and a change of filters, checks on instruments, electrical terminations, the tightness of bolts and statutory safety inspections. Foundations for wind turbines and offshore substations require structural inspection and maintenance on a regular basis, as bad seals and corrosion can cause severe damage that is both expensive and difficult to repair.

The oil and gas industry has developed a wide range of solutions for safe access to offshore structures. Inspection and repair activity is high within the North Sea sector with a high number of skilled and experienced technicians.

In the news 2023

SMST to Provide W2W Equipment for US SOV

Source: offshorewind.biz

SMST has been awarded a contract by Fincantieri Marine Group for the delivery of a motion-compensated gangway with tower and height adjustment on the newbuild service operation vessel (SOV) for CREST Wind, a joint venture between Crowley and ESVAGT.

The SMST gangway (Telescopic Access Bridge L-Series) with integrated crane function provides safe and smooth transfer of both people and cargo on board the SOV that will support the emerging US offshore wind industry, according to SMST.

"The ABS certified gangway we are supplying to Fincantieri will feature a 3D motion compensated hoist and travel system with increased lifting capacity. This allows the gangway to be used for 3D offshore lifting and container handling in port," said Jan Eelke van der Meulen, Sales Manager at SMST.

The SOV will be built by Fincantieri Bay Shipbuilding at its shipyard in Sturgeon Bay, Wisconsin.
The ABS-class vessel will be 88 metres long and 17.6 metres wide. The SOV will be able to carry 20 crew and 60 special personnel and will sail under the US flag.

The Jones Act-compliant ship will go into service in 2026 on a long-term charter deal with Siemens Gamesa, providing services for Dominion Energy's 2.6 GW Coastal Virginia Offshore Wind project in the US.

Dominion Energy plans to construct 176 14.7 MW Siemens Gamesa wind turbines and three offshore substations, generating enough clean, renewable energy to power up to 660,000 homes. It would avoid five million tons per year of carbon emissions compared with fossil fuel usage for power.

"With the combined expertise of ESVAGT and Crowley, we can deliver the best of service to the evolving clean energy sector in the U.S.," said Crowley's Marcus von Spiegelfeld, Director of Vessel Operations for Offshore Wind.

In the news 2023

Ampelmann's Gangways for World's Largest Floating Wind Farm

Source: offshorewind.biz

The Dutch offshore access provider, Ampelmann, has revealed that the company will deploy a second E1000 gangway to assist with the construction of Equinor's Hywind Tampen, the first commercial floating wind farm in Norway.

An E1000 gangway was fitted to the offshore subsea construction vessel (OSCV) Siem Barracuda in early December and within the next six months, a second Ampelmann gangway will begin its operations on the wind farm.

Hywind Tampen, the world's largest offshore wind farm, is located approximately 140 kilometres offshore the Norwegian coast.

Floating wind farms, like Hywind Tampen, require motion-compensated systems that can provide consistent and reliable offshore access, said Ampelmann.

The company added that the E1000 is Ampelmann's access solution for conditions like those at the floating wind farm since the gangway is ideally suited for work in variable sea conditions and to compensate for the divergent motions of vessels and floating turbines.

Able to withstand waves up to 4.5 metres, the gangway can convert into a crane within minutes and has a lifting capacity of one tonne.
The Hywind Tampen floating offshore wind project is the first wind farm that will supply electricity to oil and gas platforms. The project has a system capacity of 88 MW and is expected to meet 35 per cent of the electrical power demand on the Gullfaks and Snorre fields. This will cut CO_2 emissions from the fields by about 200,000 tonnes per year, according to Equinor.

6.3 Inspections, repairs

Unplanned service involves technician visits to a turbine in response to an alarm reported on the wind farm supervisory control. Large vessels are needed to undertake the removal and replacement of major components, such as turbine blades or gearboxes, during operation. This may occur following a failure or as part of a replacement programme for components nearing the end of their lives.

Equipment such as ROVs and support vessels is often rented and, in many cases, operated by a third party.

6.4 Port development, logistics

The availability of waterside (port) infrastructure is a prerequisite for much of the necessary new coastal manufacturing, assembly and installation infrastructure to deliver the anticipated offshore wind farms. Facilities may either be developed for manufacturing and installation activities, or as standalone installation facilities. Most Dutch ports are in public ownership and their investment decisions can consider the wider local economic benefits of a project, as well as the direct port revenue. This is in contrast to for example some UK ports, which are operated privately and make investment decisions purely on commercial factors.

Manufacturing and/or Installation

All larger NL ports have timely developed master plans that incorporate offshore wind installation facilities to contribute to the installation of commercial scale wind farms in the Dutch economic zone of the North Sea. Since the supply of finished wind farm components is relatively low, most ports in NL can be characterised as installation ports where the main wind farm components are stored and pre-assembly is completed before the components are loaded onto an installation vessel. In the Northern part of the Netherplands, the port of Eemshaven plays an important role regarding assembly and shipping activities of wind turbines. This resulted in a long track record: successively Alpha Ventus, Bard Offshore I, Borkum Riffgat, Borkum Riffgrund I, Trianel Windpark Borkum, Global Tech I, Gemini, Gode Wind I & II, Veja Mate, Race Bank (UK), Nordsee One, Borkum Riffgrund II, Merkur Offshore, Hohe See, Albatros, Trianel Windpark Borkum II, Hornsea Two and Kaskasi. Currently Eemshaven accommodates three offshore wind projects simultaneously: wind farm Hollandse Kust Noord, Gode Wind III and Borkum Riffgrund III.

Renowed operations and maintenance bases for offshore wind in the western part of the Netherlands companies include IJmuiden (Hollandse Kust (zuid), Hollandse kust (west) and Vlissingen (Borssele). A notable exception is the Port of Rotterdam where Sif has developed facilities for manufacturing of monopile foundations.

For more information on the specifics of the Dutch offshore wind hubs, please check:

- Port of Amsterdam: www.portofamsterdam.nl
- Port of Den Helder: www.portofdenhelder.eu
- Groningen Seaports: www.groningen-seaports.com
- Port of Harlingen: www.portofharlingen.nl/en
- Port of Rotterdam: www.portofrotterdam.com/offshore
- North Sea Port: www.northseaport.com
- Port of IJmuiden (Zeehaven IJmuiden): www.zeehaven.nl/en

For more information on port logistics, please refer to: www.windandwaterworks.nl/cases/port-developmentand-logistics

In the news 2023

Dutch Government Commissions Royal HaskoningDHV to Identify Offshore Wind Port Infrastructure Needs

Source: BreakbulkNews

Under the Dutch #NSEC presidency, the Netherlands Enterprise Agency (RVO) has awarded a contract to our member company, Royal HaskoningDHV, to conduct an inventory of the offshore wind port infrastructure needs.

This issue was highlighted by the Dutch Wind Energy Association (NWEA), Dutch seaports, and IRO – The Association of Dutch Suppliers in the Offshore Energy Industry in a joint letter to the Ministers of Economic Affairs and Climate Policy (EZK) and Infrastructure and Water Management (IenW) at the end of last year. During a panel debate on offshore wind in the North Sea, my colleague and vice-chairman Bert van der Lingen also emphasized the need for attention to be given to this issue: “no business case, no investment.”

The Netherlands has set ambitious targets for the development of offshore wind capacity in the North Sea, with plans to increase the capacity from the current 1.5 GW to 11.5 GW by 2030. This growth requires significant investment in offshore wind port infrastructure to ensure efficient transport of turbines, blades, and other components to and from the wind farms.

The inventory by Royal HaskoningDHV will provide insights into the current infrastructure and identify gaps that need to be addressed to facilitate the growth of the offshore wind industry. This will include a review of port infrastructure and facilities, including quays, berths, and jetties, as well as transport links to and from the ports, such as road and rail connections.

The Dutch Government’s decision to commission this inventory highlights the importance of the offshore wind industry to the country’s economy and its commitment to achieving its renewable energy targets. The insights gained from this inventory will be crucial in identifying the necessary investments required to support the growth of the industry in the coming years.

7. Dutch offshore wind innovators

The main driver for growth in the offshore wind industry is the ongoing decrease in the so-called Levelised Cost of Energy (LCOE), partly driven by initial innovations in offshore-specific turbine designs and bespoke offshore wind installation vessels. These cost reductions have encouraged Government policy and financial support to the sector, in order to address the decarbonisation of electricity production. Such efforts have, in turn, accelerated innovation, which has reduced costs, as well as boosted performance.

Dutch public and private parties have teamed up to design, develop, build and maintain high quality offshore wind farms in the North Sea. Together, they are proving that offshore wind is a powerful solution to achieve Dutch climate goals in a cost-effective manner. Through such cooperation, the Dutch offshore wind sector is also exploring ways of making offshore wind energy more competitive, for example, by developing more efficient production methods and increasing the yield and lifespan of offshore wind technology. Throughout the entire offshore wind supply chain, Dutch companies, academics and independent knowledge institutes conduct research into better and smarter solutions that can be applied in any offshore wind project worldwide.

This chapter lists the main offshore wind R&D actors in the Netherlands and highlights the latest cost-cutting and (near) market-ready offshore wind innovations with Dutch origin across the supply chain.

Empowering engineering and R&D excellence through energy education is also important in the highly multidisciplinary field of offshore wind. Dutch offshore energy education institute DOB-Academy trains national as well as international officials and industry professionals through lectures, classroom workshops, online modules and seminars. This enables people from different backgrounds to speak a common language, which is essential in a multidisciplinary field such as the offshore industry. Visit: https://www.dob-academy.nl/service

7.1 Dutch R&D actors

The Netherlands has a strong focus on innovations in the offshore wind industry, supported by knowledge institutes such as the Technical University Delft (TU Delft) and Netherlands Organisation for Applied Scientific Research (TNO), and by organisations like GROW, TKI Offshore Energy /Topsector Energie (Energy Innovation NL) that aim to bring actors together and initiate innovations and advise policy makers.

Some of the main R&D actors are listed below.

Topsector Energy/ Energy Innovation NL

The Dutch Government encourages energy transition innovations through tax benefits, innovation credit and (EU) grants. The Government also works together with the private sector, universities and research centers, in so-called Top Sector Alliances for Knowledge and Innovation (TKI) to support business sectors, such as the energy sector to get innovative products or services on the (inter)national market.

TKI Offshore Energy

The Wind at Sea programme plays an important role in Dutch innovations in offshore wind. TKI Offshore Energy boosts and facilitates offshore wind innovation in collaboration with RVO through research, development, and demonstration. The aim is to allow offshore wind energy to make a major contribution to the energy transition.

Technical University of Delft (TUD)

TU Delft (TUD) is involved in research into new materials and structures for offshore wind turbines, applying newly developed insights in the fields of wind loads, fluid mechanics and control engineering. TUD focusses on new concepts designed to reduce the loads on support structures, more reliable wind turbines and wind farm operations, and the optimisation of the entire energy supply chain from wind to the grid, including the incorporation of electricity from wind power plants within the European power grid.

Dutch innovation actors translate this knowledge into innovations for (amongst other things) wind turbine components and rotor blades and the so-called ‘balance of plant’ components such as foundations, substations and cables.

GROW

GROW is a joint research programme in offshore wind that initiates research and accelerates innovations. The consortium includes around 20 leading and committed business and academic partners that cooperate closely to conduct joint research. GROW partners work together to reduce the costs of offshore wind and to increase the value of wind energy in the energy system and the ecosystem. Furthermore, GROW creates the visibility of the projects and the partners involved by showing the innovative capacity of the Dutch offshore wind sector, such as through the SIMOX project.

TNO

TNO unit Energy Transition, Wind Energy Department – formerly known as ECN Wind Energy – has been active in wind energy for more than 40 years. It is the flagship of Dutch Research & Development on Renewable Energy and is one of the global leading knowledge institutes in the field of wind energy. The Wind Energy Department focuses on research/B2B collaboration in:

- wind turbine and foundation design, both bottom fixed and floating;
- wind farm design/wind turbine and wind farm control;
- energy system integration of large scale (wind) generated energy; power to X;
- installation and operations/maintenance strategy/ approach.

In the news 2023

Moray West Monopiles to Be Installed with CAPE Holland's Vibro Lifting Tech

Source: offshorewind.biz

The Netherlands-based CAPE Holland has announced that its Vibro Lifting Technology was selected for the 882 MW Moray West offshore wind project in Scotland.

The Moray West project, located in the North Sea, off the coast of Scotland, will utilise the CAPE Vibro Lifting Technology to install up to 62 monopiles in water depths ranging from 22 to 57 metres.

CAPE Holland's technology combines certified upending, lifting, and vibro driving to optimise the installation of foundation piles for offshore wind turbines, the company said.

This quiet installation technology is mainly used on the Moray West project to mitigate the risk of pile run which is an ever-increasing risk with the increase in size of the monopiles, according to the press release.

The CAPE Vibro Lifting Technology is a solution that combines a vibro hammer with a certified lifting tool. This allows for the monopile to be lifted and installed vertically, without the need for additional equipment to support the pile, reducing the risk of damage to the monopile.

The technology has been used on a number of offshore wind projects, including the Formosa wind farm in Taiwan and the Kaskasi project in Germany.

The monopiles will be manufactured by the Navantia-Windar consortium and China based Dajin Heavy Industry.

The monopiles will have an approximate length of 90 metres, a maximum diameter of 10 metres, and a maximum weight of 2,000 tonnes.

The Moray West offshore wind farm will comprise 60 Siemens Gamesa 14.7 MW wind turbines and two offshore substations, all installed on monopile foundations.

The project, set to start generating power in 2024, is being developed by Ocean Winds, a 50:50 joint venture between EDP Renewables and Engie.

7.2 No noise, no pile run monopile installation

Foundation installations, in particular, are receiving a lot of R&D attention. The traditional installation method uses hydraulic impact hammers, which create underwater noise, potentially damaging nearby marine life and ecosystems. Dutch innovations are aimed at minimising noise while retaining (and preferably improving upon) the speed and efficiency of the traditional method.

CAPE Holland's Vibro Lifting Tool (VLT)

The best way to reduce noise emissions is not to generate any noise in the first place. This is the core concept of vibro driving as an alternative installation method.
The Vibro Lifting Tool (VLT) is a certified offshore lifting tool with the ability to upend and drive the piles quickly with reduced noise emissions. The tool is able to pick up a pile, upend it to vertical position, place it overboard and lift it to installation position. While driving down, it will automatically measure and adjust to the exact vertical position. All in one single operation, without the need to switch to another tool.

CAPE Holland's VLT is used to install the monopile foundations at the Kaskasi offshore wind farm in Germany, making it the first wind farm in the world using the vibro driving technique to install all monopile foundations to target penetration. One of the advantages of the VLT is that there is no need for additional noise mitigation techniques.

Further development, to enlarge the workability and reduce costs, includes installation with VLT-U from a floating vessel using Dynamic Positioning and combining vibration and drilling technology to tackle any seabed and avoid pile runs at the same time.

AdBm Noise Mitigation System (Big Bubble Curtain)

Installing wind turbine foundations in the North Sea – and many other places worldwide – almost always requires pile driving. Without precautionary measures this methodology impacts underwater marine mammals near the construction site. To protect marine life, underwater noise emission limits will almost certainly become an important requirement for future wind farm constructions worldwide.
Supported by TKI Wind at Sea, the Dutch companies AdBm Technologies and Van Oord and Technical University Delft developed and extensively tested the so-called Noise Mitigation System (NMS). NMS reduces underwater noise resulting from offshore pile driving of wind turbine foundations, meaning less disturbance for marine mammals. The NMS uses special acoustic resonators designed and produced by AdBm Technologies, which reduce the noise from pile driving. As a result of this technology, specific

frequencies can be targeted which produce the most noise. In combination with a Big Bubble Curtain (air pockets that absorb the sound frequencies that produce the most noise during offshore pile driving) it works almost like window blinds, which can easily be raised and lowered. Another highlight of the NMS is the fact that waves and currents have virtually no influence on the system. This is due to the open yet robust design. The blinds simply go up and down.

The NMS meets the Dutch and Belgian standards (160 dB) – underwater noise limit for noise emissions at sea and turned out to be cheaper in the construction of offshore wind farms relative to existing systems.

Hydropower instead of steel ram

IQIP's Blue Piling Technology reduces underwater noise levels by creating a gentler blow, when compared to conventional impact hammers, to install offshore monopiles. This is done through the use of a large volume of water, which delivers a longer blow duration on the monopile. Combustion throws up this water column (large water tank) and under the force of gravity, it falls back on the pile, thereby delivering two blows. This cycle is repeated until the pile reaches its desired depth.

With the ever-increasing demands for larger wind turbines located at greater depths, alternative driving technologies such as Blue Piling will eventually become essential. Firstly, because it can provide a noise-mitigation solution where deep water and strong currents make Big Bubble Curtains unfeasible to protect marine life (mammals). Expensive noise reducing equipment is no longer needed. Secondly, because the gentle blow of a BLUE Hammer can significantly reduce pile driving fatigue (compared to the traditional steel impact hammering) and, thirdly, because it can, notably, install monopiles even larger than the current XXL monopiles.

Therefore, even very large concrete piles can be driven with the technology, due to the absence of tensile forces which are damaging for concrete piles. Considerable scalability will allow the largest piles in the world to be driven using this new technology.

The Blue Piling System will be compatible with existing installation vessels and interchangeable with conventional and hydraulic hammer technologies.

In the news 2022

Novel Wedge Connection Passes Offshore Test

Source: offshorewind.biz

Heerema Marine Contractors and C1 Connections have tested the C1 Wedge Connection offshore that can be used for offshore wind turbines.

The partners said that the conventional bolted L-flange connections are reaching their capacity limits and are complex to design, install, and maintain and this is where their technology is supposed to make a difference.

The technology can be used in offshore and onshore wind turbines, both in turbine towers and foundations.

During the offshore test, C1 Connections and Heerema Marine Connections demonstrated that the C1 Wedge Connection enables a safe disconnection of the tower from a grillage on a barge, the companies said.

The alignment and quick connection of the tower was performed without any personnel below the suspended load. The C1 Wedge Connection features pre-installed fasteners, and only lightweight tools are needed to finalise the connection, according to the joint press release.

The installation of the tower on board the crane vessel, Thialf, was performed as part of the preparations for the Arcadis Ost project, for which Heerema will install 27 wind turbines for the Belgian developer Parkwind.

Located northeast of the Island of Rügen in the German sector of the Baltic Sea, the 257 MW Arcadis Ost 1 offshore wind farm is scheduled to be fully operational in 2023.

The development of the C1 Wedge Connection started in early 2017 in close collaboration with Delft University of Technology (TU Delft). From the offset, the technology received support from the Dutch Government Agency (RVO), with several industry partners contribution to its further optimisation.

7.3 Low cost monopile installation

Slip joint monopile installation

Another challenge is to optimise the process of connecting turbine towers to the foundations. Current methods use bolts or grout, both of which require regular inspections and maintenance. Several Dutch companies are working on more elegant and lower cost alternatives. One such innovation 'wedges' the tower into place, resulting in substantial savings in installation and maintenance costs.

One of the most outstanding examples of Dutch innovations in the field of offshore wind is the Slip Joint. This technology uses the tower's weight to 'slide' over cone-shaped monopiles, without having to use grout or bolts in a process. This can save up to 20 million Euros in installation costs per wind farm. The Slip Joint therefore provides a rapid, simple, and safe installation solution. in combination with reduced maintenance for the duration of the project.

Slip joint basics

The Slip Joint connects a monopile and a transition piece by means of two conical sections placed on top of each other which can be produced using standard manufacturing methods. It is based on friction, with the weight ensuring firmness and stability. Installation takes place by sliding the wind turbine's foundation elements over the monopile, without having to use grout or bolts. The Slip Joint makes a submerged connection possible, allowing for a more balanced weight distribution between monopile and transition piece. As a result, the installation of larger foundations for the next generation of wind turbines is possible, using existing vessels.

The first ever offshore full-scale slip joint was installed at the Borssele WFS V project near the Dutch shore. It was the first time a submerged Slip Joint was used on a full-sized offshore wind turbine on a commercial basis.

TP-less monopile configuration

Until now transition pieces have been traditionally included in monopile foundations. However, as the offshore wind industry develops, continuous improvements in offshore installation procedures, techniques and technology, means TP-less solution have also come into play. These eliminate a bolted (or grouted) connection and allow faster installation and cost reductions, for example, through reduced inspection durations during the O&M phase.

In the news 2023

Final TP-Less Monopile In Place at Hollandse Kust Noord Offshore Wind Farm

Source: offshorewind.biz

Van Oord has installed the final monopile for CrossWind's Hollandse Kust Noord (HKN) offshore wind farm at the construction site some 18.5 kilometres off the coast of Egmond aan Zee in the Netherlands.

Van Oord, as a Balance of Plant contractor for CrossWind, installed all 70 monopiles at the construction site with the first unit being placed on the seabed in October last year.

Van Oord engaged DEME to deploy the jack-up vessel *Innovation* to install the monopiles. Sif Group was responsible for the fabrication and supply of monopiles for the 759 MW offshore wind farm.

With a combined weight of 64,356 tonnes, the monopiles are designed in such a manner that they do not require transition pieces. The design is said to allow faster installation and cost reductions.

"The installation of the monopiles was an immense operation, with the monopiles weighing between 788 tons and 960 tons each. During the installation works CrossWind and Van Oord promoted and maintained an open culture, in which we acted as one team", said **Wybren de Vries**, Balance of Plant Package Manager at CrossWind.

The TP-less monopiles, which were manufactured at Sif's Maasvlakte facility in Rotterdam, will support Siemens Gamesa's SG 11.0-200 DD 11 MW wind turbines.

Van Oord will deploy the cable-laying vessel Nexus to install the cables starting in March this year.

"With the supply of secondary steel and inter array cables on target and our offshore installation vessels fully operational, the construction of the Hollandse Kust Noord offshore wind farm is progressing well on schedule", said **Roeland Ris**, Project Director Van Oord.

The Hollande Kust Noord offshore wind project will be built and operated by the CrossWind consortium between Shell and Eneco, which won the tender in July 2020, without Government subsidies.
The consortium plans to have the offshore wind farm operational in 2023, from when it will be generating at least 3.3 TWh per year.

7.4 Balance of Plant innovations

Because of a strong history in maritime oil and gas operations, Dutch companies have built significant expertise in the global transportation and installation of offshore wind farms. This also translates into several innovations for 'Balance of Plant' components related to turbines, foundations, substations and cables.

In the news 2022

Thialf Installs First V174-9.5 MW Turbine at Arcadis Ost 1 Using Floating Installation Method

Source: offshorewind.biz

The first of the total of 27 Vestas's V174-9.5 MW wind turbines that will be installed at the Arcadis Ost 1 offshore wind farm in the Baltic Sea is now up.

The offshore wind farm is developed and owned by Belgian developer Parkwind, for which this is its first project in Germany.

The 257 MW Arcadis Ost 1 has now also marked a few other 'firsts', as this is the first 9.5 MW Vestas turbine with a 174-metre rotor to be installed on a commercial project, the first time Heerema Marine Contractors' Thialf entered the Baltic Sea, and the first time a wind turbine was installed using a novel floating installation method.

The novel floating installation method at Arcadis Ost 1, which was first tested in the Dutch North Sea last year onboard Heerema's crane vessel Sleipnir, starts with assembly and lifting operations that are being performed in parallel.

One of the Thialf's two main cranes lifts the pre-assembled wind turbine tower onto the foundation, while the second main crane is used to pre-assemble the wind turbine at the same time.

For the pre-assembly of wind turbines, Heerema developed a method where the Rotor Nacelle Assembly (RNA) lift takes place on a "support" tower on board of the crane vessel. The support tower provides a stable platform to allow a fast and secure assembly of the nacelle and the blades, according to the developer.

Once pre-assembled, the complete RNA is lifted as one piece onto the wind turbine tower in only one lift. The reduced number of lifts between the vessel and the structure eliminates key risks of the floating installation, Parkwind says.

To support the offshore floating installation at Arcadis Ost 1, Vestas has delivered RNA lift-feasible components by developing new tools.

This method has two main advantages, according to Parkwind; The first is zero seabed interaction, especially important in areas of significant water depth or challenging soil conditions; and the second advantage is a shorter installation cycle.

For the wind turbine installation work, Thialf, the world's second-largest semi-submersible crane vessel (SSCV), recently made its first entrance into the Baltic Sea, an occasion for which the vessel's A-frames needed to undergo modifications to enable passage under the Storebaelt Bridge, known as the "gate to the Baltic Sea".

The Arcadis Ost 1 offshore wind farm is located in the German territorial waters of the Baltic Sea, northeast of the island of Rügen, where offshore construction started in June 2022.

The 257 MW wind farm is expected to be fully commissioned in 2023, as of when it will generate enough green energy to power the equivalent of up to 290,000 households.

In the news 2023

Siemens Gamesa and Huisman Launch Solution to Stabilise Wind Turbine Blades During Installation

Source: offshorewind.biz

Huisman and Siemens Gamesa have developed a solution to stabilise wind turbine blades during installation, but also nacelles and tower segments. The solution, called the Travelling Load Stabilising System, is universally applied in heavy-lifting cranes and can mitigate operational downtime and increase the integrity of the delicate wind turbine components, according to Huisman.

The system functions as an integral part of the crane and could be operated from the crane's cabin as well from an optional walk-around box (WAB).

According to Huisman, the company's latest crane designs also have provisions allowing a retrofit of the Travelling Load Stabilising System.
The new solution consists of a combination of two pairs of tuggers working in unison to control the position of the load.

One pair is fitted on independent trolleys travelling along an integrated rail along the crane's stiff boom. The trolleys automatically follow the main block to maintain an optimal tugger line configuration. The second pair of tugger lines is deployed from the crane tip providing a force perpendicular to the first pair of tuggers.

By approaching the load from two different directions, the system provides significantly more control than a conventional single pair of tuggers. A specially designed control system holds the actual position of the load, resulting in a much stiffer restraint, and therefore a higher position accuracy compared to conventional tugger systems that rely on constant tension. In case of an unexpected overload, the system will give way but will return to its position setpoint when the force drops below the threshold again.

"Siemens Gamesa sees the system as a potentially new industry standard with benefits for the whole wind industry, providing more productive vessel days, while at the same time reducing (de-)mobilisation times. Hence, Siemens Gamesa will consider the availability of the new Travelling Load Stabilising System on installation vessel cranes as a significant factor in decision making when selecting/hiring appropriate installations vessels in the future", Siemens Gamesa's **Jesper Moeller** said.

In the news 2022

DEME and Barge Master Develop Feeder Solution for US Offshore Wind Projects

Source: offshorewind.biz

DEME Offshore US and Barge Master have entered into a long-term agreement to jointly develop a Jones Act compliant feeder solution for the upcoming offshore wind projects in the USA.

DEME Offshore US has partnered with US company Foss Maritime in the development of the smart feeder barge concept to ensure that it is fully compliant with the Jones Act.
This solution is expected to enable the wind turbine components to be transported from US ports to DEME's specialised offshore installation vessels. When arriving alongside the installation vessel, the Barge Master motion compensation technology will ensure safe lifting operations – even for these giant components – and increases workability, DEME said. The barges will also be towed and pushed by US-flagged tugs.

7.5 Floating wind innovations

Floating offshore wind provides opportunities to move into deeper coastal waters and shallower waters with challenging seabeds, where fixed-bottom foundations cannot be deployed. The floating support structure consists of a floating platform and a platform anchoring system. The platform has a transition piece on top of which the tower is installed.

Although floating offshore wind still is in a pre-commercial phase, development activities as well as tender activities have continued to accelerate in several markets. In its Global Offshore Wind Report 2022, GWEC expects that Europe will initially take a front runner position in floating offshore wind development – this is mainly instigated by the success of the UK's ScotWind seabed leasing round, where 15 GW out of 25 GW of sites awarded leasing contracts are for floating projects. Also in France, Greece, Italy, Norway, Portugal and Spain, floating projects are getting started.

By the end of the decade, GWEC expects South Korea, the UK, the US, Spain and Ireland to be the top five global floating markets.

Floating wind turbine innovators

As there is (as yet) currently no clear path for a leading floating wind turbine or foundation technology to reach utility-scale commercial deployment and only a few international OEMs have publicly announced programmes of in-house floating wind development, there is room for innovative SMEs. Several Dutch companies have already taken the challenge to further reduce the LCOE while, at the same time, looking at other offshore opportunities for floating wind.

Some of them focus on developing integrated floating wind turbines, others focus on innovative floating foundation designs.

In the news 2023

MPS Floating Platform to Feature FibreMax Tendons

Source: offshorewind.biz

Welsh company Marine Power Systems (MPS) has joined forces with FibreMax to provide integrated floating foundation and tendon solutions to the growing floating offshore wind sector.

The tendon solution will be used in the anchoring and moorings of MPS' tension leg platform (TLP), called PelaFlex, to deliver the highest system stability and zero tilt, the partners said.

It will be the "world's first" TLP with FibreMax tendons, made with Twaron fiber from Japan-headquartered Teijin. Compared to traditional steel moorings synthetic cable offers a much better strength-to-weight ratio, longer operational life, and lower levels of maintenance, according to the partners.

"We're proud to be part of the Marine Power Systems team and delivering our unique tendons for the World's first TLP with synthetic tendons. This brings together two unique and innovative technologies, the PelaFlex floating platform and the FibreMax tendons made with circular Twaron (Aramid) fibres made by Teijin", said **Sander van Helvoort**, Director Renewable Energy at FibreMax.

MPS' floating offshore platform technology offers best-in-class cost compared to its peers due to the significantly reduced system mass, the companies said.

According to the press release, its modular and flexible design enables optimum local content delivery through a decentralised logistics model.

Floating wind foundation innovators

Although floating foundations are already a proven technology in the oil and gas sector, platform designs for offshore wind require adaptation to accommodate different dynamic characteristics and a distinct loading pattern. This is something that has already occurred, to a great extent, for fixed-bottom foundations, including monopiles, jackets and gravity based designs.

Currently, floating wind farms still have a higher (levelised) cost of energy than fixed, as floating foundations need to be assembled in port at the quay side and coastal areas. This requires it's own major supply chain investments in manufacturing sites and related infrastructure. Still, there is growing confidence that they could be competitive by 2030, also because floating designs can partly be facilitated from existing oil and gas technologies such as semi-submersibles, barges, tension leg platforms (TLPs), and spar buoys. Other potential advantages are the lower installation cost and the ability to standardise designs within and between wind farms.

In the news 2023

DP Energy, SBM Offshore Reveal Floating Wind Plan in Canada

Source: offshorewind.biz

DP Energy and SBM Offshore have formed a joint venture to pursue floating wind opportunities in Nova Scotia, Canada.

The two partners now plan on taking early steps that would help establish a floating wind industry in Nova Scotia, including contributing to the implementation of the environmental, regulatory, supply chain, workforce, and construction best practices, according to a press release from the joint venture.

DP Energy and SBM Offshore have emphasised the role of engagement and local dialogue with key stakeholders and said first nations and other interested parties would remain a priority throughout their endeavours.

The two companies state that, together, they have experience in both the design and construction of offshore floating facilities for the energy industry and working in Nova Scotia *"to help advance the region's offshore energy journey"*, including an in-depth understanding of local regulatory specificities and a track record in local partnerships and growing local businesses.

DP Energy is currently developing the Gwynt Glas floating offshore wind project in the UK, together with EDF Renewables, with which the companies plan to bid in the 4 GW floating wind auction in the Celtic Sea. The Irish company also has plans in Ireland, as well as Australia.

The Dutch company SBM Offshore is the developer of floating wind foundations, which will soon be installed at the French Provence Grand Large floating offshore wind farm.

Nova Scotia has opened up for offshore wind with a concrete step made last year, when the Canadian province's government announced that it would offer seabed leases for 5 GW of offshore wind energy by 2030, starting in 2025, with an ultimate aim to support green hydrogen production.

In the news 2023

Dutch Floating Wind Tech Developer to Test Small-Scale Prototype, Strengthens Collaboration with Japanese MOL

Source: offshorewind.biz

Dutch start-up TouchWind, the developer of a floating wind turbine with a tilting, angled one–piece rotor, is installing a small–scale prototype at Fieldlab Green Economy Westvoorne, the Netherlands, for testing that is set to start this month.

The field lab, located on the north bank of the Oostvoornse Lake in the southwest of the Netherlands, facilitates underwater and nearshore research for innovations that contribute to a green economy.

TouchWind's prototype that is currently being installed there has a rotor diameter of 6 metres and will be tested for the installation, mooring and anchoring, as well as for the ecological impact on the location at the lake.

The turbine will be anchored with ecological hybrid anchors made by the start-up Coastruction which manufactures the anchors using 3D print technology and location-specific materials such as sand and shells from the Oostvoornse Lake. TouchWind and Coastruction recently received a EUR 75,000 grant for the demo project through the "Energie & Klimaat" programme from Innovation Quarter.

TouchWind is developing its technology together with partners VDL, NIDEC, TU Delft, We4Ce, Enersea, EJ Projects, Mitsui O.S.K. Lines (MOL), the Netherlands Enterprise Agency (RVO) and the Dutch test centre MARIN, where the company recently completed the first floater tests.

On 9 May, TouchWind also announced that it had strengthened its alliance with Japanese MOL. The two companies last year signed a memorandum of understanding (MoU) for the joint development of floating wind technology with a primary focus on the further development of TouchWind's one–piece rotor floating wind turbine.

Now, following the progress in developing TouchWind's technology and the upcoming testing, the parties agreed to collaborate closer towards the next–stage development of the floating turbine.

In the news 2022

Dutch Company Working on Two Floating Wind Projects Offshore Northern Ireland

Source: offshorewind.biz

Dutch marine engineering and offshore energy company, SBM Offshore, has taken the first step towards applying for a marine licence to build two floating wind farms offshore Northern Ireland.

SBM Offshore, which has set up a company named North Channel Wind to develop and build the projects, has completed site characterisation and commenced a scoping exercise in consultation with Northern Ireland's Department of Agriculture, Environment and Rural Affairs (DAERA).

The wind farms are planned to be sited in areas between 12 and 27 kilometres from the coasts of counties Antrim and Down, with the best location for grid-connecting the projects still being investigated.

The two wind farms, named North Channel Wind 1 and North Channel Wind 2, would be built in water depths of approximately 120 metres and are expected to have an installed capacity of 300 MW and 100 MW, respectively.

The number of units depends on the selected turbine model, meaning that SBM Offshore could install wind turbines of an output of up to 20 MW.

The floating foundations to be used are designed by SBM Offshore, which says its lightweight steel floating tension leg platform (TLP) is easily installable with light and standard means, and that it also has a reduced seabed footprint and is simple to decommission, leading to a a reduced environmental impact and a competitive cost of energy.

SBM Offshore is also developing two floating wind projects in the Celtic Sea, following an award by the Crown Estate last year.

In the news 2022

Bluewater to Test Its Tension Leg Floating Tech Offshore Norway

Source: offshorewind.biz 2022

The Marine Energy Test Center (METCentre) and Bluewater Energy Services have signed an agreement for a berth option to deploy an innovative floating wind system offshore Norway.

Bluewater has developed the Tension Leg Platform (TLP) type floating foundation to support offshore wind turbines cost-effectively and this project will showcase the solution in the deeper waters of the North Sea, said the developer. The company's floating system is planned to be installed in the North Sea offshore Karmøy, Norway, where it will produce renewable energy for the Norwegian electricity grid.

The floating wind TLP foundation was developed for the industrial deployment of wind turbines in floating offshore wind farms, with a focus on harsh environments. The foundation is scalable, lightweight, and supports wind turbines with minimal floater-induced nacelle motions, Bluewater said.

The tension leg mooring system has a small seabed footprint that could provide optimal use of the sea.

"Norway has a very good resource for floating offshore wind farms and we believe that our technology can play a key role in achieving energy transition goals in Europe and the rest of the world", said Bram Pek,, Business Development Manager at Bluewater Energy Services.

METCentre assists companies with facilities for the testing of new floating offshore wind technology. The test centre was recently awarded a concession for extending the capacity for demonstration projects. The test capacity at the centre's Karmøy site is six turbines and power export will be provided via a 66 kV subsea cable.

7.6 Offshore solar innovations

As well as floating wind, offshore floating solar has the potential to become an exciting area of renewable energy development and is poised to play an important role in the energy transition. The Dutch offshore wind farms, Hollandse Kust Noord and Hollandse Kust West, will be the first wind farms in the world iro include an offshore solar farm in between the offshore wind turbines.

In the news 2023

Oceans of Energy to Build Offshore Solar Array at Hollandse Kust Noord Offshore Wind Park

Source: offshorewind.biz

Oceans of Energy has been awarded the contract for installing and operating offshore solar farm inside the Hollandse Kust Noord offshore wind park being developed by CrossWind, a joint venture between Shell and Eneco.

This is set to be the first offshore solar farm in the world to be connected, installed, and operated within a wind farm in high wave conditions. The offshore solar farm will be realized in 2025, while the wind park will be operational by the end of 2023, according to Oceans of Energy.

With offshore solar added to offshore wind, it is possible to also produce energy on sunny but less windy days and hence increase the utilization of the offshore power grid infrastructure.
The solar panels will be situated in between the offshore wind turbines, an efficient way of sharing the sea space.

CrossWind's Hollandse Kust Noord project is a 759 MW offshore wind park that will use cutting-edge technologies and engineering solutions to improve the flexibility of offshore wind parks.

The project has many first-offs, including being the first wind park in the world with an offshore combination of battery storage and round-trip green hydrogen produced from offshore wind power on a megawatt scale.

Once constructed, the offshore wind farm will be generating at least 3.3 TWh of clean energy per year.

In the news 2022

RWE to Test Floating Solar Tech on Dutch Offshore Wind Farm

Source: offshorewind.biz

RWE has selected SolarDuck as an exclusive provider for offshore floating solar technology with integrated storage in the company's bid for the Hollandse Kust West (HKW) site VII in the Netherlands.

Earlier in 2022, RWE announced that it is participating in the Dutch offshore tender for the Hollandse Kust West (HKW) sites VI and VII.

The areas are located in the North Sea, about 53 kilometres off the Dutch coast. The sites will each deliver more than 760 MW of offshore wind capacity.

SolarDuck and RWE also signed a collaboration agreement to develop the use of floating solar parks at sea.

RWE plans to accelerate the commercial application of new technologies by supporting a vast amount of innovators and startups in demonstrating their innovation in an operational environment.

To this end, RWE decided to invest in SolarDuck's full-scale offshore pilot in the North Sea, called Merganser, which lays the foundation for a larger demonstration project at the Dutch offshore wind farm.

"RWE is constantly looking for innovative ways to further improve the production of renewable energy offshore. We are very keen to further explore the potential of offshore floating solar together with our partner SolarDuck", said **Sven Utermöhlen**, CEO Wind Offshore of RWE Renewables.

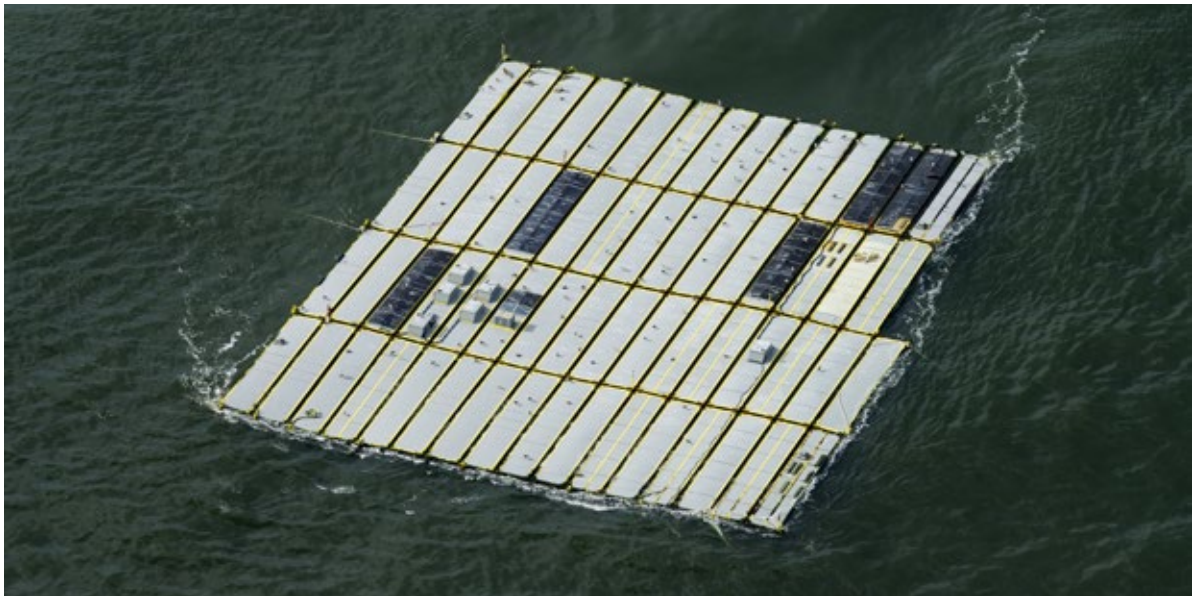
"For countries with lower mean wind speeds but high solar irradiation, this opens up attractive opportunities. We want to contribute to accelerate the energy transition, have a positive impact on marine ecology and help to integrate energy systems".

A winning bid for the HKW site VII will realise the integration of an offshore floating solar plant at a pre-commercial scale with 5 MWp combined with innovative energy storage solutions into the offshore wind farm.

Further building on the collaboration with project *Merganser* and HKW, RWE and SolarDuck will explore new opportunities with the objective to develop commercial offshore floating solar parks, both stand-alone and hybrid.

The integration of offshore floating solar into an offshore wind farm is a more efficient use of ocean space for energy generation (using the space between the wind turbines) and allows for synergies with regard to the construction and maintenance of the multi-source renewable energy plant, RWE said.

The result is a more balanced production profile due to the complementary nature of wind and solar resources, according to RWE.



8. Offshore wind to hydrogen innovators

Hydrogen from renewables as a clean-burning gas that emits only water at the point of combustion, will be key in achieving the world's post-2050 climate goals. Green hydrogen can decarbonize heavy industry (steel, chemicals, refineries etc.) and long-distance shipping and aviation, can be readily stored in salt caverns or depleted gas fields to counteract the effects of renewable intermittency and – last but not least – can be transported through (existing) pipelines much cheaper – and with less coastal landing impact – than electricity cables. In Northwestern Europe, offshore wind is the most suitable renewable energy source for direct coupling of large-scale electricity generation to industrial-scale hydrogen production.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8.1 Frontrunner in offshore hydrogen production

The Netherlands is set to become the global first large scale offshore wind-to-hydrogen producer in the world. In March 2023, the Dutch Government selected a site at Ten Noorden van de Waddeneilanden, offshore from the Groningen province, for the development of a 700 MW offshore wind farm for the on-site production of 500 MW hydrogen to be transported to land. The offshore hydrogen production plant is planned to be operational around 2031.

8.2 Onshore versus offshore electrolysis

Green hydrogen from North Sea wind energy can technically be converted directly at the source offshore (i.e. platform, artificial island, integrated in turbine) or at more distant onshore locations. Up to 2030, the focus in the Netherlands will initially be on onshore conversion of electricity surpluses from offshore wind farms in areas that are relatively close to the coast. After 2030, large scale offshore wind farms will largely be located in remote areas far out in the North Sea and equipped with energy hubs for offshore conversion into green hydrogen. By that time offshore conversion is expected to be economically more attractive for far-from-shore projects – by then, offshore hydrogen pipelines will be cheaper, more robust and less complex to roll out and with less environmental impact on coastal areas than electrical cables. This transportation differential may well offset the higher cost of producing hydrogen offshore instead of onshore.

The Netherlands can currently be considered the international testing ground on green hydrogen production, given the following list of 'global first' demonstration projects in both onshore electrolysis and offshore electrolysis.

8.3 Onshore hydrogen production from offshore wind

Onshore electrolysis: NortH2

In February 2020, the NortH2 project was launched by Shell, Groningen Seaports, Gasunie and the province of Groningen. This project aims to produce green hydrogen using electricity from about 4 GW of offshore wind off the coast of the Netherlands by 2030 and 10+ GW by 2040. The NortH2 partners intend to jointly establish a system of offshore wind farms, electrolysers, gas storage and pipelines to convert offshore wind power into green hydrogen, store it and transport it to industrial clusters in north-western Europe. NortH2 will have a capacity of 1 GW in 2027, 4 GW by 2030 and 10+ GW by 2040 for electrolysis. This equates to 0.4 million tonnes of green hydrogen production in 2030 and 1 million tonnes of production by 2040. Since the beginning of the project, Eneco, Equinor, chemical company OCI and wind developer RWE have joined the consortium.

In the news 2023

The Netherlands Chooses Site for World's Largest Offshore Wind-to-Hydrogen Project

Source: offshorewind.biz

The Dutch Government has designated an area for what will become the world's largest offshore hydrogen production project. That area is Ten noorden van de Waddeneilanden (the North of the Wadden Islands), identified earlier for offshore wind development and deemed most suitable for providing 500 MW of electrolysis capacity and for the transport of hydrogen to land.

The Government announced on 20 March that it designated the offshore wind area for large-scale offshore hydrogen production since a wind farm at Ten noorden van de Waddeneilanden, offshore the Groningen province, was already planned for the production of electricity, an existing natural gas pipeline in its proximity could be reused for green hydrogen transport to land, and it can be properly connected to the onshore hydrogen network.

The project, which is said to mark the first application of offshore hydrogen production on a large scale, is planned to be operational around 2031.

Before any tenders are issued, the Ministry for Climate and Energy Policy will first work with the Groningen region, stakeholders in the Wadden Sea region and other stakeholders on matters such as the landfall of the pipeline to bring the hydrogen from the offshore wind farm ashore and environmental aspects of the project.

The Ten noorden van de Waddeneilanden site, marked as having a potential capacity of 700 MW, will be auctioned off in 2026 or 2027, with a commissioning year set as 2031.

Onshore electrolysis: FlexH2

In April 2022, an international consortium – comprising Shell, Van Oord, TKF, TNO, and DNV plus General Electric, ABB, VONK, Technical University of Eindhoven, and Technical University of Delft – kicked off the Shell-led research project FlexH2, which stands for Flexible Offshore Wind Hydrogen Power Plant Module.

In the news 2022

Dutch Offshore Wind-to-Hydrogen Project Ready to Take Off

Source: offshorewind.biz

The Netherlands Enterprise Agency (RVO) has announced that the GROW consortium FlexH2 project was awarded a grant as part of the MOOI-SIGOHE tender scheme.

The Shell-led research project FlexH2, which stands for Flexible Offshore Wind Hydrogen Power Plant Module, intends to develop and demonstrate technology that will accelerate the scale-up of offshore wind to green hydrogen production and its integration in the energy system. FlexH2 is based on three key technological innovation pillars: a grid-forming offshore wind farm, a high-performance AC/DC solid-state transformer for large-scale electrolysers, and a multi-terminal hybrid HVDC transmission system and its energy system integration.

The proposed wind-to-hydrogen solution, which will be tested in laboratories at a Medium Voltage kW-scale, enables direct sourcing of renewable electricity to green hydrogen production. It is expected to be scalable and can be operated independently from a local or national power grid, thus reducing the time-to-market significantly by 5 to 10 years. The integration of the various proposed innovations – varying from the offshore wind turbines to the transport and delivery of the power to an onshore electrolyser – could reduce the cost of hydrogen production by at least 10 per cent and well before 2030, the consortium said. The results of this research project could provide the basis for the accelerated development of Power-to-H2 projects in the Netherlands.

General Electric, ABB, VONK, Technical University of Eindhoven, and Technical University of Delft will develop the electro-technical innovations. Shell, Van Oord, TKF, TNO, and DNV will use their expertise related to hydrogen electrolysis, balance of plant, market/flexibility, and key component design, transport and installation expertise, respectively.

Onshore elecytrolysis: Holland Hydrogen 1

In January 2022, Shell announced the construction of the Holland Hydrogen 1 project in the Port of Rotterdam. This is a 200 MW electrolysis plant using electricity from the 760 MW Hollandse Kust Noord offshore wind farm, by means at guarantees of origin. The intended start of production of the Holland Hydrogen 1 facility is 2024. The facility will cover two hectares, which is equivalent to the size of three football fields.

In the news 2022

Shell to Start Building Europe's Largest Offshore Wind-to-Hydrogen Plant in Netherlands

Source: offshorewind.biz

Shell Nederland and Shell Overseas Investments, both subsidiaries of Shell, have taken the Final Investment Decision (FID) to build Holland Hydrogen I, which is said to be Europe's largest renewable hydrogen plant once operational in 2025.

The 200 MW Holland Hydrogen I electrolysis plant will be constructed on the Tweede Maasvlakte in the port of Rotterdam, the Netherlands, and will produce up to 60,000 kilograms of renewable hydrogen per day, Shell said.

The hydrogen production will be powered with electricity coming from the 759 MW Hollandse Kust Noord offshore wind farm, which is being developed by the CrossWind consortium of Shell and Eneco and is scheduled to be put into operation next year.

The hydrogen is planned to be transported through the HyTransPort pipeline, which will form a part of the Netherlands hydrogen infrastructure, with a length of about 40 kilometres that will run from the plant to Shell's Energy and Chemicals Park Rotterdam, where it will replace some of the grey hydrogen usage in the refinery.

In the news 2023

Shell & Eneco Order Ballard Fuel Cell System for Hollandse Kust Noord Hydrogen Energy Storage

Source: offshorewind.biz

CrossWind, a joint venture between Shell and Eneco and the developer of the Hollandse Kust Noord (HKN) offshore wind project in the Netherlands, has ordered a fuel cell system from Canadian company Ballard Power Systems to integrate it into the offshore wind farm, which will use water electrolysis to convert wind power into green hydrogen for energy storage.

The 759 MW offshore wind farm, currently under construction, will be able to generate at least 3.3 TWh per year. Along with offshore wind turbines producing electricity and powering Dutch households, Hollandse Kust Noord will also comprise additional energy solutions, including offshore hydrogen production and power generation from floating solar panels.

For the part of the project set to use green hydrogen as energy storage, Ballard will supply a containerised fuel cell power solution with a peak power capacity of 1 MW. The system, expected to be delivered in 2024, will use the green hydrogen as fuel to regenerate stable and dispatchable power.

Maria Kalogera, Crosswind's Innovation Manager, said: *"In CrossWind, we are committed to demonstrate baseload power on a megawatt scale for a single full-scale wind turbine generator. We will introduce, for the first time, an offshore combination of battery storage and round-trip hydrogen integrated in an offshore wind farm".*

Ballard says that this is its second stationary power project deployed in Europe for peak shaving power generation applications.

"Hydrogen plays a critical role to support the energy transition. This project is an exciting proof point on how hydrogen and PEM fuel cells can provide an effective storage, load-following and firming solution for intermittent renewables. We are excited to be a part of this milestone demonstration project with CrossWind to prove out the reliability and efficiency of Ballard fuel cells, initially at megawatt scale", said **Søren Østergaard Hansen**, General Manager, Marine and Stationary, Ballard Power Systems Europe.

8.4 Hydrogen production at sea

Offshore electrolysis: PosHYdon

PosHYdion is the first offshore hydrogen project in the Netherlands. The purpose of the pilot is to gain experience of integrating working energy systems at sea and the production of hydrogen in an offshore environment.

In the news 2022

Work on Dutch Offshore Wind-to-Hydrogen Pilot

Source: offshorewind.biz

The Netherlands Enterprise Agency (RVO) has awarded a subsidy of EUR 3.6 million to the PosHYdon offshore green hydrogen pilot project, allowing for the start of activities to bring the project to life.

The project, which will integrate offshore wind, offshore gas and hydrogen production, is the world's first offshore green hydrogen pilot on a working platform, according to the project consortium.

PosHYdon seeks to validate the integration of the three energy systems in the Dutch North Sea and will involve the installation of hydrogen-producing plant on the Neptune Energy-operated Q13a-A platform, located approximately 13 kilometres off the coast of Scheveningen (The Hague).

Electricity generated by offshore wind turbines will be used to power the hydrogen plant on the platform, converting seawater into demineralized water, then into hydrogen via electrolysis.

The green hydrogen will be mixed with the gas and transported via the existing gas pipeline to the coast.
The 1 MW offshore electrolyser, to be delivered by Norwegian company NEL Hydrogen, will produce a maximum of 400 kilograms of green hydrogen per day.

Offshore electrolysis: H2atSea (H2opZee)

In February 2022, Neptune Energy and German offshore wind developer RWE announced an offshore wind-to-hydrogen demonstration project in the Dutch North Sea. The companies plan to have the project up and running before 2030.

In the news 2022

Neptune Energy, RWE Unveil Offshore Wind-to-Hydrogen Project in the Netherlands

Source offshorewind.biz

Neptune Energy and RWE have signed a Joint Development Agreement to develop a green hydrogen project which will use offshore wind energy for the production of hydrogen in the Dutch sector of the North Sea and an existing pipeline to transport the hydrogen to land.

The project, called H2opZee and supported by the Dutch Government as an initiative of TKI Wind op Zee, consists of two phases.

In the first phase, the newly established consortium will perform a feasibility study and set up and an accessible knowledge platform, with an objective to start the roll-out of hydrogen at sea in the Netherlands. In the second phase, the project will be implemented, with the tender methodology yet to be defined.

H2opZee is a demonstration project which aims to build 300-500 MW electrolyser capacity in the North Sea to produce green hydrogen using offshore wind and to transport the hydrogen to land through an existing pipeline.
The pipeline has a capacity of 10-12 GW, so it is already suitable for further roll-out of green hydrogen production at gigawatt scale in the North Sea, according to the consortium.

Sven Utermöhlen, CEO Offshore Wind at RWE Renewables, said that hydrogen was a gamechanger in the decarbonisation of energy-intensive sectors and that the H2opZee project was a world-first of this kind and scale.

9. Wind & water works business partners

Wind & water works highlights the Dutch offshore wind energy sector around the globe via trade events, consulates, NBSO network and embassies. Wind & water works represents Dutch Government, businesses and knowledge institutes in the wind sector.

The platform is designed to enhance international visibility, reinforce the network and enable an exchange of knowledge within the global wind community.

Find your business partner in the directory or contact us via windandwaterworks@nwea.nl.

9.1 Wind farm development

Project development

AFRY

AFRY is a leader in engineering, design, and advisory services, with a global reach. With 19,000 experts in the fields of infrastructure, industry, energy, and digitalization, AFRY is committed to accelerating the transition towards a sustainable society.

The acquisition of BLIX Consultancy in 2023 resulted in a dedicated business unit: AFRY Wind & Solar. AFRY Wind & Solar is a one-stop shop for offshore wind projects, encompassing the full project lifecycle, including strategic advice, development, contracting, financing, construction, operations and maintenance. Moreover, we offer full bid support and tender management, to help you win concession tenders.

Our proficiency in offshore wind is demonstrated through eight prominent knowledge clusters: Environmental Impact & Permitting, Site Investigations & Wind Resource Assessment, System Integration, Nature-Inclusive Design, Package Management & Owners Engineering, Floating Wind, Electrical Grid Integration and Contracting & Procurement. These knowledge clusters and areas of expertise collectively reinforce our capacity to deliver comprehensive solutions that address every aspect of offshore wind energy projects.

The seamless integration with AFRY's industry recognized divisions like Management Consulting, Transmission & Distribution and PtX Process Engineering ensures that we provide a unique approach that goes beyond solely offshore wind farm development.

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DNV

DNV is an independent assurance and risk management provider, operating in more than 100 countries. Through its broad experience and deep expertise DNV advances safety and sustainable performance, sets industry standards, and inspires and invents solutions.

Whether assessing a new ship design, qualifying technology for a floating wind farm, analysing sensor data from a gas pipeline or certifying a food company's supply chain, DNV enables its customers and their stakeholders to manage technological and regulatory complexity with confidence. Driven by its purpose, to safeguard life, property, and the environment, DNV helps its customers seize opportunities and tackle the risks arising from global transformations. DNV is a trusted voice for many of the world's most successful and forward-thinking companies.

In the energy industry
We provide assurance to the entire energy value chain through our advisory, monitoring, verification, and certification services. As the world's leading resource of independent energy experts and technical advisors, we help industries and governments to navigate the many complex, interrelated transitions taking place globally and regionally, in the energy industry. We are committed to realizing the goals of the Paris Agreement, and support our customers to transition faster to a deeply decarbonized energy system."

contact.energysystems@dnv.com
www.dnv.com

IX Renewables

IX Renewables has been supporting clients in all life stages of onshore wind power plants since 2004, and in offshore wind since 2006. IX excels in bridging the gap between technical, commercial, and legal worlds.

As owner's and bank's engineer, the company's services include contract management, risk assessment, and O&M strategies. By identifying key risks, optimizing OPEX versus power production, and presenting more accurate cash flow projections, risks are minimalized and profits increased.

As techno-economic advisor and consulting engineers, IX ensures our client's capability to make well-informed decisions, for example, through due diligence and procurement services.

In 2020, the full responsibility for decommissioning and repowering of wind power plants was added to the IndeX of services. From our offices in the Netherlands, Taiwan and Japan, we serve our clients with an adaptive attitude and a holistic approach.

IX Renewables, your global renewable energy partner.

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www.ixrenewables.com

Liberty Mutual Surety

LIBERTY MUTUAL SURETY. LOCAL CONNECTIONS, GLOBAL REACH - Since 1893, Nationale Borg has been the bond supplier of the best businesses in the Netherlands and Belgium. Trusted clients that could expand their markets because our guarantees helped them to do their business fast and efficiently.

Nationale Borg is now Liberty Mutual Surety
Since October 2019, Nationale Borg is part of Liberty Mutual Surety, a unit within Liberty Mutual Insurance, the largest surety in the world. With underwriting offices in 18 countries and bonds issued throughout the world, Liberty Mutual Surety has the ability, experience and resources to underwrite all types of contractors and corporations for local, regional, national and multinational customers.

Your company will not be burdened with capital being blocked
Working with Liberty Mutual Surety in the Netherlands offers you major advantages. In principle, we will not ask for collateral to cover your guarantee risk. We work on the basis of trust. A Liberty Mutual Surety guarantee, therefore, should not block any of your financial space leaving you free to deploy your working capital optimally. We specialize mainly in issuing performance guarantees and advance payment guarantees, as well as in issuing guarantees regarding import duties and excise duties.

Liberty Mutual. SURETY

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Pondera

Pondera is a globally operating consulting and project development firm. Since the company's start up in 2007, we have been supporting clients in developing onshore and offshore renewable energy projects. Pondera's well recognized track record dates back to one of the world's first offshore wind farms. In recent years our expertise in renewable energy generation has expanded into energy conversion (e.g. green hydrogen) and energy storage (e.g. utility-scale grid batteries).

We offer over 15 years of experience in technical and commercial consultancy. Through the years, our total project portfolio increased to 16GW of installed capacity. Pondera's experts are skilled to identify and mitigate risks at an early project stage. We provide strategic advice and hands-on delivery support to projects in all stages of the project life cycle, from the initial feasibility phase through concept design, licensing, contracting, construction to successful operations.

Pondera has worked on iconic projects such as the development of the Haliade-X 12+ MW wind turbine, one of the world's most powerful offshore wind turbines, featuring a 14.5 MW capacity and a 220-meter rotor. Together with Sif Group and GE Renewable Energy, Pondera is now working on Amphytrite, an offshore demo project. The objective is to contribute to affordable large-scale green hydrogen production at sea, thereby supporting decarbonization and accelerating the energy transition.

PONDERA

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Ventolines

Ventolines, founded in 2007, is an integrated service provider in the renewable energy sector with a clear mission: we aim for a world in which renewable energy is of value to everyone. With a staff comprising more than 100 experts, we develop, build and manage wind, solar and energy storage projects and combinations of assets. We do this with commitment and precision, while keeping a keen eye on the interests of the key stakeholders.

Ventolines, headquartered in The Netherlands, has become a significant player in renewable energy in its home country and is now expanding internationally. We have experience in every phase of wind, solar and large-scale energy storage projects and have guided clients through the development, construction and asset management of more than 2 GW installed renewable energy capacity. Our projects include the largest onshore and nearshore windfarms in Europe and offshore projects in the USA and Australia. We work integrally with our own business experts, engineers, communication advisors, financial specialists and lawyers. The continuous exchange of knowledge enables us to work with clients across the entire scope or parts thereof and to achieve the best possible results for our clients and for society as a whole.

Ventolines

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Project research

Deltares

Deltares is a not-for-profit, world-leading, and mission-driven Dutch knowledge institute for water and the subsurface. We work throughout the world, and we are guided by the major societal issues, for which Deltares' knowledge is indispensable. This is what drives our highly qualified workforce of 800 colleagues, which is comprised of over forty different nationalities.

The challenges for offshore wind energy lie in scaling up, ecological impact, multifunctional use, and balancing the needs of a growing number of stakeholders. Deltares collaborates with industry and other knowledge institutions on research and advice on ecological and technical aspects, such as hydrodynamics, geology, foundations, cables, corrosion, and impact on the ecosystem. The future generation of wind farms will face new installation challenges in deeper and increasingly more hostile environments. Whether you are an offshore contractor, energy utility, or engineering company, we can assist you throughout your design, installation, operation & maintenance, and decommissioning phases.

We develop knowledge and tools for the industry that mitigates and minimizes risks to guarantee safe, reliable, sustainable, and cost-efficient operations. We are always actively looking for (industry) partners to collaborate on Joint-Industry Projects to further accelerate achieving the ambitious global targets related to the energy transition.

Deltares

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Fugro

Fugro is the world's leading Geo-data specialist. Through integrated data acquisition, analysis and advice, Fugro supports clients in mitigating risks during design, construction and operation of their assets at sea. With our 'triple A' approach, we add value throughout the complete asset life cycle by reducing uncertainty and client exposure to subsurface risk. We contribute to a safe and liveable world by delivering solutions in support of the energy transition.

With our team of dedicated experts, specialised assets and cutting-edge digital technologies, we offer our services to a broad spectrum of clients.

For over 25 years, Fugro has provided solutions for the development of offshore windfarms. We support our clients leveraging our long-standing relationships as they grow their renewables business. We offer a wide range of site characterisation and operations and maintenance services such as soil investigations and geoconsulting for wind turbine foundations and integrity assessments to support life-time assessments. Our growing fleet of uncrewed surface vessels (USVs) and remotely operated vehicles is leading the industry transition to more sustainable operations. With a 95% reduction in carbon emissions, safer operations and access to real-time data, USVs and remote and autonomous solutions play an important part in a successful energy transition.

FUGRO

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Geomil Equipment

For over 85 years, Geomil has been developing and manufacturing Cone Penetration Testing (CPT) equipment, enabling high-quality and effective geotechnical site investigations. CPT data is fundamental for reliable offshore soil profiling as it sets the basis for cost effective project realization.

The most commended Geomil systems are the Manta-100, Manta-200, Orca-90/125 and Marlin-120.

- Geomil Manta's are seabed CPT systems which can operate anywhere from shallow to deep waters. At the heart of the Manta is the unique Continuous Drive System (CDS), providing unrivalled push capacity. The latest addition to the product range is a Seismic Source Frame allowing for seismic CPT.
- The Orca is a downhole CPT and soil sampling system compatible with most common drill rigs. The Orca can provide real-time data and has proven to ensure high efficiency and repeatable test data.
- The Orca can be supported by a Marlin seabed template.
- All Geomil offshore equipment is modular such that key components can be used with different systems in the portfolio.

Geomil is looking for partners with the ambition to develop the market for offshore wind, using CPT technology. We are specifically interested to collaborate with:

- Geotechnical companies.
- Survey companies with an interest to step into geotechnics.
- Vessel owners with the ambition to equip their vessel for CPT.
- Companies interested to act as a (service) reseller.

Geomil equipment

sales@geomil.com
www.geomil.com

Maritime Research Institute Netherlands (MARIN)

MARIN is a globally recognised top institute for maritime research. Our mission is 'Better Ships, Blue Oceans': we stand for clean, smart and safe shipping and sustainable use of the sea. We do this as an independent knowledge partner for the maritime sector, government and society. We offer integrated solutions, from concept development and design to operation, making optimal use of our model testing facilities, computer simulations, simulators and full-scale measurements. In developing, applying and sharing our knowledge, we stimulate innovation and global collaboration. The knowledge and involvement of our people are our strength.
In the future we will continue to support our mission, focusing on an even stronger base of knowledge, reliable tools and modern facilities. With this strengthened base we will optimise the entire maritime operation, the ship, the (floating) wind turbine as a system and the human role in this. Our knowledge and ideas will stimulate the development of a safer and cleaner shipping industry, as well as encourage the sustainable use of the ocean for the extraction of energy, food and raw material and the development of cultivated life and autonomous systems at sea.

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Periplus Company Profile

Over the past 20 years the Periplus Group has provided specialized IT-solutions, personnel and know-how in the field of hydrography and related disciplines.

Besides the "traditional" expertise on hydrographic issues, we focus on providing our clients with high quality applications, consultancy services and project support. Especially we can provide your Offshore Wind project with expertise in geology, geophysics, engineering support, environmental issues, underwater archaeology, GIS, data processing and data management.

With regards to our IT-solutions, our team of inhouse software developers specialized in solutions inside the geographical domain are ideally positioned to develop applications within the marine environment. Combining this with our roots in hydrography, we developed the innovative online data platform **GR:Dit** which is designed to help you to visualize and analyze asset-related offshore subsea data. It utilizes a combination of historical information and current inspection results to provide you with comprehensive tools to assess the condition of your assets and their environment.

We are proud to have been involved in 300+ projects in the Offshore Wind, Oil&Gas, Dredging, Construction, and Government sectors.

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Pondera

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Dutch Marine Energy Centre (DMEC)

DMEC is an accelerator for marine energy solutions. Marine Energy, energy generated from our oceans, seas, and rivers, is the world's largest untapped source of clean energy. By advancing innovation, mobilising capital and shaping policies, DMEC creates multipurpose energy solutions for a wide variety of markets.

DMEC
DUTCH MARINE ENERGY CENTRE

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Witteveen + Bos

Witteveen+Bos is an engineering and consultancy firm headquartered in the Netherlands with a staff of around 1,500 professionals operating worldwide. We have a proven track record in the onshore and offshore wind sector for over a decade, delivering engineering and environmental consultancy services.

Clients value Witteveen+Bos's multidisciplinary approach and recognise it as one of our distinctive qualities. Our scale means we can form tailor-made teams of in-house experts to achieve the best possible solution every time.

Our offshore team consists of more than 120 academically trained professionals with combined experience on over 100 projects.

Our services in the offshore wind sector include:

- Feasibility Studies
- Environmental Impact Assessments (EIA) and Permitting
- Metocean Studies and Wind Resource Assessments
- Nature-Inclusive Design
- Floating Wind Technology
- Geosciences and Geotechnical Engineering
- Foundation Design
- Cable Design and Installation
- Grid Connection and Integration
- Logistics and Supply Chain Management

Witteveen + Bos

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The Rich North Sea

The Rich North Sea takes advantage of the unique opportunity which offshore wind farms offer to enhance nature in the North Sea.

We are helping our planet in two ways: renewable energy generation to stop climate change, and nature development for more biodiversity in the North Sea. The biodiversity of our largest nature reserve has been reduced by overfishing and diseases, leading to the disappearance of almost all natural reefs. If we want to bring back these reefs, active intervention is needed.

In close collaboration with the wind sector, offshore industry, and science we are building artificial reefs for oysters, tube worms, and Northern horse mussels at various locations in Dutch offshore wind farms. In so doing we help marine life thrive and investigate the ideal conditions for optimal nature development. The goal is to apply the acquired knowledge in all wind farms in the North Sea.

The Rich North Sea

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Waardenburg Ecology

Waardenburg Ecology, founded in 1979, is an independent consultancy firm for research, advice and design in the field of ecology, nature restoration and landscape.

With over 150 employees, they work across the full spectrum of ecology and the impact to changes in the environment. Waardenburg Ecology has been involved with investigating the effects of wind energy projects on wildlife for over 25 years, both offshore as well as onshore.

Since 1992, they are leading in the use of innovative radar technology for bird research. In addition, they have 40 years of knowledge on hard-structure biodiversity. This knowledge, combined with professional scientific divers, innovative camera techniques and practical creative mindsets, enables them to identify opportunities to enhance biodiversity, like ecofriendly scour protection.

WAARDEN BURG Ecology

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Project, contract, finance support

Bird & Bird

Bird & Bird is an international law firm which supports organisations being changed by the digital world or those leading that change. We combine exceptional legal expertise with deep industry knowledge and refreshingly creative thinking, to help clients achieve their commercial goals. We have over 1400 lawyers in 31 offices across EMEA, North America and Asia Pacific, as well as close ties with firms in other parts of the world.

We believe we have one of the leading international renewable energy practices in the world and are continuously ranked as the most active legal advisers on both renewable energy M&A and project transactions in Europe. We are an international cohesive and expert team who understand how to work together to complete renewables projects to international investor standards.

In the Netherlands, our Energy team is trusted by clients for their energy industry knowledge and ability to solve complex problems through deep sector expertise and specific technical abilities. We provide tailored and commercially oriented advice and assist our clients in high profile ground-breaking and complex transactions and projects such as multi-billion offshore wind parks, (combination of) large solar parks and battery storage systems, hydrogen facilities and innovative projects such as nuclear technology and blockchain enabled energy projects.

Bird & Bird

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ESP Renewables

ESP Renewables is a project- and consultancy company formed from a common goal, to come together to share knowledge and expertise.

Our professionals believe, when we are working together, continuously developing our skills, providing the right services to our clients, and expanding the organization with professionals, we can create impact in the renewable industry together.

We always work in a safe and sustainable environment for our professionals and stakeholders.

Building a trusting network of consultants with experience in the renewable energy industry, where we value integrity, long-term partnerships and delivering quality always keeping in mind we are on the journey to net-zero.

‘Strength by Knowledge’ is our motto, where we believe in the connection within our network to be able to provide the knowledge you need. We have been involved in both onshore and offshore wind farms, solar energy and hydrogen power, always keeping in mind the journey to net-zero and developing a sustainable future together.

ESP RENEWABLES

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Flux Partners

Flux Partners, an advisory company founded in 2014 with tender management, non-price criteria, contract management and sustainability as core competencies, is committed to realize healthy energy and infrastructure projects for its clients. We deliver high-quality and hands-on tender and sustainability advice over the width of the energy transition, including offshore wind, grid and port infrastructure, subsea cables, and hydrogen.

Achieving lasting impact, achieving sustainable results. Our committed team of 90+ advisors constantly considers how things can be done even better. Our clients include developers and contractors, energy system operators, (local) governments and technology providers.

We participated in hundreds of non-price criteria plans for public tenders and have a strong track record in wind.

Flux, headquartered in the Netherlands, operates in Europe and beyond.

Flux Partners

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Intramar Insurances

INTRAMAR insurances was found in 1994 to service suppliers and contractors in the (offshore) energy industries. From the office based in the offshore port of Den Helder, the dedicated INTRAMAR team is able to provide services for a Clients working worldwide.

Facing the complexity of energy contracts, Clients can rely on the specialists at INTRAMAR to obtain tailor made advice and adequate insurance solutions.

Particular with respect to requirements regarding Offshore Liability, including contractual liabilities, employers liability, products and professional liability, the experienced brokers will be at your service to respond with expert advice. Insurance certificates as proof of insurance are supplied to all Clients, stating the major insurance and contractual elements like Principals as co-Assureds, waiver of subrogation rights, etc.

Further, for all kind of your precious (subsea) equipment, vessels, tools, etc. the INTRAMAR team is able to arrange comprehensive cover within the timeframe required.

Last but not least, INTRAMAR will be happy to arrange cover for your personnel, hired staff, etc. as required for all specific working locations, including cover for medevac from offshore locations and cover for high risk areas.

INTRAMAR® INSURANCES International Insurance Brokers

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www.intramar.nl

OutSmart

Are you interested in predicting the short and long-term costs of your wind and solar project? It may seem challenging, but at OutSmart, we excel in this area. As experts in the field, our primary focus lies in the operational phase of your projects, performing our services 24/7, 365 days per year. We provide support to investors, owners, fund managers, and industrial off-takers, helping them effectively operate their assets and optimize returns.

Since 2008, we have been at the forefront of the energy transition. Our operations span across the Netherlands, Germany, Belgium, Taiwan and the United Kingdom.
The market recognizes us for our extensive knowledge and experience in the operational management of both onshore and offshore renewable energy projects.

Our team consists of >40 specialized employees, each proficient in their respective disciplines, such as technical analyses and advises, technical and commercial reporting, marine and flight coordination, as well as Permit to Work, HSE and IT management. We collaborate closely with partners on technical solutions for wind turbines and solar parks. Drawing from our experience, we understand how to accurately predict and influence efficiency in the short and medium term.

OutSmart
Power of Predictability

nederland@out-smart.eu
www.out-smart.eu/

Rebel

Building on our experience in infrastructure, we started our renewable energy practice in 2008. We apply our financial, economic and strategic expertise in renewable energy sectors such as wind energy (offshore and onshore), district heating and cooling, water, geothermal energy, biomass, biogas, solar and energy efficiency.

Rebel provides the complete package of financial advisory services for all stages of offshore wind projects. We support clients with financial modelling, project structuring & contracting, arranging debt and equity, strategic advisory, mergers and acquisitions and concession tenders.

REBEL

Stephan.vanOs@Rebelgroup.com
www.rebelgroup.com

9.2 Wind Turbines

Component supply, engineering support

Boltlife BV

Boltlife specializes in ultrasonic bolt load measurements and procedures for closing bolted ring flange connections. Our procedures cover all critical bolted connections used in wind turbines and supporting structures.

We offer consultancy, training, tooling, remote support and technical personnel during the preparation, installation and operational phases of a project.

Our methodologies offer solutions that can be implemented at any point in time during the lifetime of your turbines. Boltlife provides you with fully documented and traceable insights in the quality of the bolted connections in your project.

Our basic service consists of project preparation, training and supervision for local technicians complemented with QA/QC and reporting from the data generated. Quality, efficiency and safety are the key words for our procedures. Reduce 40 to 80% in offshore time and eliminate the use of heavy hydraulic equipment during the O&M phase while increasing the quality and lifecycle of the bolted connections.

chielvanrooijen@boltlife.com
www.boltlife.com

C1 Connections BV

C1 Connections has developed a new connection technology, the C1 Wedge Connection (TM) to connect large wind turbine components such as the connection between monopile and transition piece and the connection between foundation and tower.

The C1 Wedge Connection(TM) has a higher ultimate and fatigue capacity than conventional connections. The C1 Wedge Connection(TM) can be installed safer and faster than conventional connections and does not require maintenance, saving on OPEX. The C1 Wedge Connection(TM) allows direct CAPEX savings compared to all alternatives.

The C1 Wedge Connection(TM) has been certified by DNV.

info@c1connections.com
www.c1connections.com

EJ-Projects B.V.

In 2007, Eric Jansen established EJ-Projects with the aim of providing integrated design analysis services. With a background in aerospace, turbo-machinery, and wind energy, he specialises in computational mechanics, including loads, hydrodynamics, aeroelasticity, control engineering, and structural dynamics.

EJ-Projects specialises in delivering independent technical engineering consultancy services with a strong focus on providing scientifically robust and technically sound solutions for dynamic load scenarios, aeromechanical systems, and wind energy conversion systems. The project portfolio includes collaborations with both established OEMs and technology start-ups in various product development initiatives.

Integrated Load Analysis (ILA)
EJ-Projects offers dedicated ILA services for wind turbines and their foundations across their entire life cycle, covering design, certification, and operational phases. The process involves advanced calculations using multi-physics models, along with numerical simulations. These calculations take into account factors such as met-ocean conditions, controller dynamics, and the load-carrying component dynamics. They adhere to international guidelines and regulations, ensuring compliance with turbine class or site-specific requirements.

Advanced R&D Initiatives
EJ-Projects' mission goes beyond traditional engineering – it encompasses the creation of trouble-shooting models for in-depth analysis, as well as the technical de-risking of novel turbine and foundation concepts. After all, pioneering technology stimulates innovation.

info@ej-projects.eu
www.ej-projects.eu

Hetraco

“We make special fasteners an experience”

We produce fasteners from M5 till around M200, and other thread related dimensions! We’ve a large and widt variety of raw-materials on stock. These materials are standard steels, high pressure, high temperature, stainless steel till the nickel alloys. We’re able to produce orders with delivery date the same day and can offer small quantities.

Our company is also experienced with all Classifications like Lloyd’s, Bureau Veritas, etc.

Hetraco

sales@hetraco.com
www.hetraco.com

LiftWerx Europe

Based in North America and Europe, LiftWerx provides turnkey services for Wind Turbine major repairs. We use fully-electric crane-less technology to perform the following types of repairs: Main Bearing Exchanges, Gearbox Exchanges, Generator Exchanges, Blade Exchanges, Pitch Bearing Exchanges and Yaw Drive Exchanges.
We perform work on turbine types such as Siemens, Vestas, Gamesa, Senvion, GE and more.LiftWerx is the world’s first contractor to offer crane-less technology for offshore wind turbines. Our technology avoids the use of large jack-up barges and specialized heavy-lift vessels.
By using proven crane-less technology which can be deployed from small vessels, large corrective repairs can be performed at a much lower cost and in high wind speeds. Our solution is safe, efficient, and reliable.

LIFTWERX

info.europe@liftwerx.com
https://liftwerx.com/

Pentas

Pentas is one of the most modern and advanced companies in Europe in the field of producing plastic products by rotational moulding. We have 11 rotational moulding machines and 8 milling machines. Since our establishment, in 1975, we see technology as the basis for the optimal delivery of customer-specific plastic products.

We consist of a team of 150 professionals with a heart for technology and are very committed to the world around us. So we look beyond technical specifications. We want our products to perfectly match the customer’s requirements, while also taking into account the end user and the impact of our products on the environment.

Among other things, Pentas produces large water tanks for offshore wind turbines to create a dampening effect against vibrations in the tower.

PENTAS

info@pentas.nl
www.pentas.nl

Pontis Engineering

Pontis Engineering is a leading international company, active in the rapidly growing industry of advanced composite products.
We specialize in integrated engineering solutions for the development of large fiber reinforced composites, excelling in innovative power, cost effectiveness and quality. To this end we supply a wide range of services covering the entire process from conceptual design to (serial) production and transportation.
We add value to our partners by leveraging on our extensive industry knowledge and network, highly expertised workforce and international presence. Our services cover various growth markets for advanced composites, including the wind power, aerospace, transport and marine sector. With over 20 years of experience in composites, a dedicated in-house design team and our worldwide network of engineers, materials suppliers and knowledge institutes, we are your highly qualified partner in developing state of the art composite structures.

PONTIS ENGINEERING

info@pontis-engineering.com
www.pontis-engineering.com

Robin Radar Systems BV

Robin Radar's mission is to provide actionable information that increases safety and security for both humans and birds. We do that by combining purpose-built radars with unique software algorithms. We are Robin Radar Systems: technology leader in the tracking and classification of small objects. With more than 30 years of applied radar science, we are proud to have in our environmental and wind sector client portfolio, international companies onshore and offshore such as: Equinor, Orsted, Gemini, Waardenburg Ecology, Nina, 3BIRD, Bluebear, Rijkswaterstaat, Fino, Takkolluoto Wind farm, EVN, Luminus (EDF group), Wind Park Friesland and Woolnorth.

robin
radar systems

info@robinradar.com
www.robinradar.com

We4Ce – The Rotorblade Specialist

Since 2008 We4Ce is the only remaining independent rotor blade design company of the Netherlands for onshore and offshore blades.

Where the core business started with complete blade designs from aerodynamic performances up to structural blade design and certification, already from the start it expertized itself in the blade root to turbine connection. This connection technology, called the We4Ce bushing is implemented in thousands of wind turbines already with great success. The success story of this is extending itself now also to existing blades suffering from loose inserts/ bushings.

Latter technology is referred to as "Re-FIT technology" and makes the blades that presently suffer from loose inserts to last longer: instead of creating waste the vision of We4Ce is to refurbish.

A second technology to offer is AdapTIP. This technology for sure will become a new demand for future blades to be ordered, where the tip part of the blade can be exchanged rapidly for maintenance and optimum power control.
The first application is scheduled for early 2024 for reaching a Technical Readiness Level (TRL) 7.

WE4CE
THE ROTORBLADE SPECIALIST

Arnold.timmer@we4ce.eu
www.we4ce.eu

Torc-nology BV

Torc-nology BV is a customer and service-oriented organization specializing in providing high-quality solutions for the safe and efficient tightening of bolted connections. Our core competencies include the sale and rental of torque tools, as well as development and design, maintenance, repair, calibration, and comprehensive consulting and service.

Logistics Expertise
As a rental service provider, Torc-nology is flexible and versatile. We swiftly provide the necessary tools to our clients for a day or offer fully equipped containers with all the required tools for extended periods. With our extensive experience as rental experts, we understand the logistical challenges involved. We are aware that tools often need to be quickly available on-site since demand can be challenging to predict. Management is facilitated through software, which also tracks and documents maintenance and inspection intervals.

Custom Solutions by Our In-House Engineers
Torc-nology recognizes that the right solution is not always readily available. This is why we maintain our own engineering department, comprising mechanical engineers, plant engineers, and torque specialists. They design solutions at both the detailed and system levels, including support arms for torque tools. Additionally, we internally design and calculate offset gearboxes and hydraulic links.

TORC-NOLOGY

sales@torc-nology.com
www.torc-nology.com

Integrated Wind turbine concepts

Touchwind

It's TouchWind's mission to make wind energy affordable, everywhere and for everyone. TouchWind's unique tilting angled one-piece rotor floating wind turbine can handle wind speeds of up to 70m/s and allow more compact floating offshore wind farms. This leads to an enormous increase of the energy potential for offshore wind farm by using the TouchWind concept. Next to this, maintenance can be carried out quicker and safe during harsher weather conditions.

TouchWind BV

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www.touchwind.org

9.3 Foundations

Foundation supply Bottom fixed

Sif Netherlands BV

Sif is a pioneer in the field of offshore foundations. With 75 years of experience, technical ingenuity and the daily commitment of our craftsmen and women, Sif has acquired a leading position in the supply chain for offshore wind farms. Our main product, the monopile, is the most common and most economical solution for installing offshore wind turbines. By delivering quality on time, safely and within the agreed budget for years, we are co-determining the speed with which the energy transition can take place. We have proven this: Currently, there are 2,400 Sif foundations anchored in the seabed. We are proud of that, because they are crucial for achieving our objectives in the energy transition.

Global politics faces a huge challenge: the energy transition. Sif lays the foundation needed for this – literally and figuratively. Sif dares to lead the way and not only to propagate its mission and vision, but also to follow through with actions. 20.2 million households already receive power from offshore wind turbines that stand on our foundation. Sif's monopiles enable these turbines to supply power under all circumstances; And that while the wind can blow at a speed of 70 km/h and the waves can reach a height of 6 meters. The energy transition builds on Sif.

Sif

info@sif-group.com
www.sif-group.com

Smulders

Smulders is an international steel construction company with more than 1,500 employees working across production and assembly facilities in the Netherlands, Belgium, Poland and the United Kingdom. Smulders has a proven track record in the engineering, construction, supply and assembly of heavy, technical complex steel constructions.

Smulders offers a full range of services from engineering and fabrication to the complete turnkey solutions (EPCI) of substations and foundations (transition pieces, jackets, floating foundations) for offshore wind farms.

We have a track record of over 2,400 transition pieces, 160 jackets, 40 substations and 6 floating foundations. Our projects can be found at the coasts of Western Europe, Asia and the United States.

Central base of operations
In 2023, Smulders acquired a production and assembly site in Vlissingen: Smulders Projects Netherlands. Vlissingen is the perfect base to e.g. further develop our offshore activities. At this strategic location, we will be assembling bridges, as well as substations (AC and DC) and their jacket foundations. This waterfront site offers plenty of potential to realise our further growth ambitions.

EIFFAGE SMULDERS

info@smulders.com
www.smulders.com

SPT Offshore

SPT Offshore is a Business Unit within DEME Offshore specialized in suction pile foundations and anchors. In our 25 years of existence, we were involved in the design, supply and/or installation of over 1,000 suction piles, including 118 wind turbine foundations up to 10 MW.

Suction pile installation is silent. The installation force is generated by water pressure difference hence a minimum of energy is required to install a suction pile foundation. Suction pile structures can be fully decommissioned and even be reused. Combined with the one-piece lift solutions it can be considered as the most energy effective and silent foundation solution.

For floating offshore wind suction pile anchors will be on many occasions the most advantage solution. As suction piles anchors combine the following advantages, besides the noise free and fast installation:

- Large holding capacity also in vertical direction for tension leg moorings
- Multiple anchor lines to one anchor
- Shallow foundation design in case limited sediment layers above bedrock are present.

SPT OFFSHORE

info.spt@deme-group.com
www.sptoffshore.com/

Foundation supply Floating

GustoMSC

The pioneers of offshore engineering

NOV is a leading provider of technology and equipment to the global energy industry. GustoMSC, part of the NOV Marine and Construction business, is recognized for providing advanced design & engineering consultancy for mobile offshore units such as Wind Turbine Installation Vessels, Blade Installation Vessels, Feeder Vessels, and Floating Offshore Wind Foundations. The company also specializes in reliable equipment like jacking systems and heavy lift cranes. In close cooperation with our clients, we translate experience, science, and technical knowledge into realistic & innovative ideas.

The performance of new and existing jack-ups, vessels and semi-submersibles is further optimized by our operational support and engineering consultancy. In this way, GustoMSC enables and supports safe and efficient operations at sea, contributing to a sustainable future.

Based on its expertise and track record GustoMSC is well positioned to support clients in conceiving and realizing dedicated and integrated solutions to meet today's challenging requirements of the floating and fixed offshore wind markets.

GustoMSC | NOV

info.gustomsc@nov.com
www.nov.com/gustomsc

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- Shallow foundation design in case limited sediment layers above bedrock are present.

SPT OFFSHORE

info.spt@deme-group.com
www.sptoffshore.com/

Component supply, engineering support

Circular Covers by CCM B.V.

Circular Cover Manufacturing is a truly Dutch designer and fabricator of new kinds of monopile hardcovers. Our hardcovers are an essential piece of equipment during the construction of offshore wind farms. The hardcovers are tailormade and can be adjusted to meet the most challenging key performance requirements of any project. CCM hardcovers are made of high-quality materials, do not require any maintenance and are price competitive.

We've got you covered

The innovative design and the used materials ensure a pleasant working environment for all on- and offshore personnel. Natural ventilation on top ensures the flow of fresh air into the working area which also prevents the growth of moulds. All the installed hatches are translucent, can be easily removed, safely stored, and reinstalled because of the lightweight materials used. Our design is also strong enough to allow the hardcover to be lifted with only three slings, even when stacked. The covers can be mechanically connected and can be lifted and stacked, up to five pieces. The construction of these stacks is also suitable for transportation on seagoing vessels. Due to these advantages Vattenfall has chosen CCM hardcovers for the 'Hollandse Kust Zuid Offshore Wind Farm'.

CCM circular covers

info@circularcovers.com
www.circularcovers.com

GustoMSC

The pioneers of offshore engineering

NOV is a leading provider of technology and equipment to the global energy industry. GustoMSC, part of the NOV Marine and Construction business, is recognized for providing advanced design & engineering consultancy for mobile offshore units such as Wind Turbine Installation Vessels, Blade Installation Vessels, Feeder Vessels, and Floating Offshore Wind Foundations. The company also specializes in reliable equipment like jacking systems and heavy lift cranes. In close cooperation with our clients, we translate experience, science, and technical knowledge into realistic & innovative ideas.

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Based on its expertise and track record GustoMSC is well positioned to support clients in conceiving and realizing dedicated and integrated solutions to meet today's challenging requirements of the floating and fixed offshore wind markets.

GustoMSC | NOV

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www.nov.com/gustomsc

Finsulate

Finsulate provides an environmental friendly, non-toxic and easy to clean anti-fouling solution for bottom fixed and floating offshore wind foundations. By applying specialized short fibers to the structure's surface, Finsulate minimizes the attachment of marine organisms, such as mussels and barnacles, thereby preventing accelerated wear and tear and ensuring long-lasting protection for the structures. With its advanced adhesive technology, Finsulate offers a lifespan of 20-30 years.

The growth of marine organisms on submerged structures poses significant challenges, including difficult and time-consuming inspections, with cleaning accounting for over two-thirds of inspection costs. However, Finsulate's innovative solution addresses these difficulties and simplifies inspection processes and substantially decreases associated costs.

In addition to offshore wind power structures, Finsulate is suitable for various other offshore wind related equipment, including Anchoring Cables, Crew Transfer Vessels (CTV's), Tugs, Service Operation Vessels (SOV's), and Wind Turbine Installation Vessels (WTIV's). Not only is Finsulate environmentally friendly, but it also lowers operating costs and saves valuable time.

With a proven track record in ship applications and through a successful Offshore Wind demonstration project, Finsulate is a reliable and smart choice for offshore structures, offering exceptional longevity.

FINSULATE
ANTIFOULING FOR CLEAN AND HEALTHY WATERWAYS

ffshorewind@finsulate.nl
www.finsulate.com

Heerema Engineering Solutions

Heerema Engineering Solutions (HES) is an engineering and consultancy firm focusing on the offshore construction of renewable projects. We aim to create new solutions and add value to sustainable offshore projects by translating our theoretical knowledge into practical solutions. HES plays a key role in offshore renewable projects from early phase development through the entire life cycle to decommissioning.

Our approach combines years of engineering experience with automation to deliver reliable, relevant solutions for our clients. By engineering the tools of the future, we can focus on the successful delivery of renewable projects worldwide. Examples of HES' work include developing robust and cost-effective construction strategies for clients, assisting in solving industry challenges related to floating offshore wind, and applying our engineering and operational knowledge to design components and equipment.

Our core team of around 40 colleagues specialize in the offshore (renewables) industry and provides various engineering disciplines. We look forward to bringing inspiration and innovation offshore to achieve our mission of using *our deep understanding of working at sea to cerate new solutions that accelerate the world's transition to green energy.*

ENGINEERING SOLUTIONS

info@hes-heerema.com
http://hes.heerema.com

Mooreast Europe BV

Mooreast is a designer, manufacturer and supplier of mooring systems. Providing services worldwide, Mooreast is a leading company for total mooring solutions under different classification, various load and soil conditions. Predominantly active in the offshore oil & gas market, Mooreast has a leading role in providing mooring systems to the offshore renewable energy market. International services are provided by Mooreast since 1993 to engineering companies (FPSO/CALM), drilling contractors, dredging, -installation and pipe lay contractors as well as operators. Mooreast works with two production locations (Netherlands and Singapore) to serve the project's best logistic and timely delivery.

Anchors
Mooreast supplies its own design MA5 and MA7 drag embedment anchors used in various applications with classification authorities.

Buoys
Mooring buoys, surface buoy; Mooreast has developed its own design and provides standardized types and special design with different layout to fit the project.

Rental
A rental fleet of anchors, buoys and mooring lines is available for immediate supply and special design equipment will be considered upon request.

Rigging
The newly established rigging department is providing hoisting materials, wire rope- and synthetics slings, shackles and connectors of major brands and keeps stock of commonly used size and types. Material testing is provided by the newly installed testing bed up to 600 mT.

MOOREAST

roderick@mooreast.com
www.mooreast.com

Selmers

"Selmers delivers tailor-made process solutions for the handling, cleaning, and coating of steel objects. Their advanced focus lies in the integration of mechatronic equipment, robotics, and a high degree of automation. Specializing in surface treatments for conduits, pipes, profiles, monopiles, and wind towers, Selmers stands at the forefront of the pipe industry. Their rich legacy, spanning over 50 years, underpins their global leadership position.

Selmers' holistic approach encompasses robust in-house engineering capabilities across all relevant disciplines. A notable strength is their expertise in IT/OT integration, supplemented by a state-of-the-art data management software platform and immersive VR simulations.

Driven by a deep-rooted commitment to sustainability, Selmers strives to produce solutions that conscientiously conserve our planet's resources. This ensures the safe and sustainable use of vital resources like oil, biogas, hydrogen, water, and wind energy. It is Selmers' enduring ambition to be more than just a service provider; they aim to be a trusted partner that significantly elevates their clients' operational excellence."

SELMERS

mail@selmers.com
www.selmers.com/

TNO Energy Transition

TNO, the Netherlands Organization for Applied Scientific Research, was founded by law in 1932 to enable business and government to apply knowledge. As an organization regulated by public law, TNO is independent: not part of any government, university or company.
Since April 1st 2018, the Energy Research Centre of the Netherlands, ECN, has joined forces with TNO and has become TNO Energy Transition.

ECN (Energy research Centre of the Netherlands) has been the Netherlands flagship R&D and services centre for sustainable energy technologies. In the field of wind energy, ECN was a true pioneer and technical authority. It's internationally leading position has been built up through 40 years of dedicated investment and experience. At present as TNO Wind Energy, in-depth knowledge of the whole wind power plant system is combined with world leading full scale test facilities and accredited measurement experts.

Today, TNO Wind Energy's core mission is to reduce the cost of offshore wind energy. This is achieved by applying innovative solutions in the industry and driving ground breaking R&D forward. TNO Wind energy supports companies at the design, implementation and operational level.

info@tno.nl
www.tno.nl/en

Tree Composites

Tree Composites introduces the TC-joint, a novel technology based on composite as an alternative to the complex welded joints in multi-membered tubular structures. We provide solutions to realise dynamically loaded structures with higher fatigue resistance. Additional advantages include substantial steel reduction, lower pricing, reduced carbon footprint, and simultaneous increase of structure manufacturing speed at the construction site.

In 2020 we incorporated Tree Composites to bring this technology designed by TU Delft to the market and obtained a statement of feasibility issued by offshore certification body DNV. The team currently consist of 15 people that bring together experience in offshore wind structures, composite design and composite manufacturing.

The TC-joint is applicable to a wide variety of industries, but we put our efforts in the industry where we can make the greatest impact, offshore structures. Continuous effort is put into reaching new levels of certification, developing new tools and knowledge. From this point on, we look forward to develop our joint technology to its full potential: paving the path towards more sustainable renewable energy.

admin@treecomposites.com
www.treecomposites.com

Trelleborg

Trelleborg Infrastructure's polymer sealing and damping solutions are built on decades of craftmanship. When it comes to offshore wind, immersed tunnelling, dredging, water infrastructure, noise and vibration isolation, and high-performance special projects, the operational capability of our solutions are assured at the highest level. We have unrivalled global reach, with feet-on-the ground local presence, cross-industry expertise and in-house end-to-end solution capabilities, combining to improve integrity, sustainability and efficiency, and accelerate performance across projects.

Trelleborg Marine and Infrastructure's industry-leading solutions for offshore wind foundation seals are built on deep expertise and design knowledge to help you calculate the right specifications with accuracy and precision. Whether you are developing your first designs or innovating on your previous successes, our experience of working alongside contractors and subcontractors ensures that we deliver product excellence and support within your timelines.

Trelleborg, when failure is not an option. We are proud to have been the trusted supplier for more than 3600 Foundation Seals in offshore wind over the last 15 years. Next to these seals we focus on providing solutions to the offshore renewable energy market with grout seals, airtight deck seals, MP/TP flange seals, Tower seals, compression seals, inflatable seals, self-activating seals, anti-vibration solutions, shock pads, fenders, flexible mooring systems, installation & inspection.

Marjon.Frederiks@trelleborg.com
www.trelleborg.com

FibreMax

In the realm of offshore wind solutions, FibreMax emerges as a true game-changer. This Dutch company has set itself apart by introducing an innovation that is revolutionizing the industry; parallel endless wound fiber cables.
What makes this product truly exceptional is not just its uniqueness, but its wide-ranging applications.

FibreMax's patented cables have found their way into a multitude of sectors, from (offshore) cranes to tidal energy projects, yacht rigging, and the mooring of floating wind turbines, XXL Monopiles. Their versatility knows no bounds.

One of FibreMax's key strengths lies in its highly automated production process. This not only ensures precision but also enables them to scale up effortlessly, even on a global scale, to meet local content requirements which will de-risk projects significantly.

However, it's not just about automation and versatility. FibreMax's cables are engineered with impeccable precision, require no maintenance, are impervious to corrosion, are a remarkable >80% lighter than conventional steel cables and can be made from circular fibers.

These attributes make FibreMax cables the go-to choice for the most demanding on-and-offshore applications, where durability and performance are non-negotiable.

FIBRE Max
World's *strongest* cable...

info@fibremax.nl
https://fibremax.nl/

Delmar Systems

Delmar Systems is the trusted partners to most offshore energy industry's leaders, delivering innovative and customer-focused anchoring and mooring solutions.
We are committed to the highest standards of safety, integrity, and respect to the environment. We are proud of our legacy and impeccable track record over our combined 100 years, always delivering value in everything we do.

DELMAR

www.delmarsystems.com
sales@delmarsystems.com

9.4 Substations, subsea cables

Component supply, engineering support

24shore

24shore offers a comprehensive cable storage and management solution, addressing both offshore and onshore requirements. The company supplies a range of cable storage equipment, including the Modular Cable System (MCS), Offshore and Onshore Turntables, and Baskets. Operating under the umbrella of the XELLZ Group, 24shore specializes in project logistics management, ensuring transparent control throughout the entire project lifecycle.

Their cable solutions encompass rental, storage, handling, transport, transshipment, and engineering services. Notably, 24shore has introduced an innovative solution called ReelFrame™ for cable loading and transport. This patented innovation allows for longer cable lengths on a single drum for transportation and eliminates the need for mobile cranes during loading and offloading, resulting in a remarkable 45%+ reduction in CO_2 emissions in the logistics aspect of projects.

In addition to their transport solutions, 24shore boasts the Project Logistics Control Centre (PLCC), a central hub for managing complex projects, handling communication, documentation, tracking, contracts, and more.

24shore places a strong emphasis on the value-driven nature of logistics in projects, aiming to reduce costs and environmental impact significantly. Their experienced team, combined with a robust IT platform, ensures the successful closure of projects with efficiency and innovation at the forefront.

peter.bouwhuis@xellz.com
www.xellz.com

Gouda Holland BV

Gouda Holland is manufacturer and suplier of cable ladders, cable trays and supporting material. Also installation of our own materials is optional.

b.erdtsieck@goudaholland.nl
www.goudaholland.nl

Blueoffshore

The company

Blue Offshore is a Dutch subsea installation contractor founded in early 2010. Our company provides world-wide solutions for subsea cable installation to international clients. We provide support from the conceptual design stage to engineering, construction, installation and commissioning for offshore subsea cables, flexibles and umbilicals. We stand for highly qualified individuals with proven track records, modular and flexible equipment, strategic and operational best-in-class partners.

Our services

Our team assists customers with world-class innovative standalone solutions to suit their particular project needs. This service includes:

- Design and engineering
- Project management
- Installation equipment
- Offshore construction

Modular Basket Carousel

Our team has developed the world's largest Lloyds Register-certified subsea product installation equipment. The equipment consists, among other, of a modular Basket Carousel and has variable product carrying capacities to suit project requirements up to 5000 metric tonnes. The flexibility and modularity of the system will reduce costs and risks through:

- Flexible product installation schedules
- Product storage and transportation
- Shorter mobilisation and demobilisation schedules
- Increased choice in fit-for-purpose floating platform types to suit best project requirements rather than generic solutions.

www.blueoffshore.com/
info@blueoffshore.com

HSM Offshore

During more than 60 years HSM Offshore Energy has successfully completed well over 150 turnkey projects such as platforms, modules, and jackets for the offshore upstream energy sector.

SM is an integrated solution provider of Engineering, Procurement, Construction, Installation and Commissioning of Offshore High Voltage Substations and Offshore green Hydrogen production platforms and steel substructures.

Having delivered the World's very first OHVS in 2002, our track record features 3,5 GW commissioned offshore grid connections with a further 2,3 GW under construction with capacities up to 1.060 MW and topside weights of 5.300 MT.

The Quality Management System is certified to ISO 9001:2015. The health and safety management system is SCC** 2017/6.0 certified and we have been certified for Safety Culture Ladder level 3 . Our ISO 14001:2015 certification is testament to our environmental commitment, as is our CO_2 awareness level 3 certificate.

The covered production facilities in Schiedam and Krimpen aan den Ijssel allow full indoor completion with optimum control of quality and planning. The yards – 200,000 square metres – feature deep water open North Sea access, heavy duty load-out quays, a 270 metres jetty and own blasting and painting facilities.

HSM offshore energy

sales@hsm.nl
www.hsm.nl

Heinen & Hopman engineering

Heinen & Hopman was founded in 1965 in the Netherlands as a family business by Melis Heinen and Cees Hopman. Heinen & Hopman has become a leading specialist in the maritime sector. With a global network of 50 subsidiaries, we are able to offer the highest quality of service and products to our clients at all times in all places. HVAC is very important to assure continuous operation of the offshore wind park. Herein we focus in Offshore High Voltage Stations as well as Windfarm Installation vessels to maintain the right indoor climate, temperature and humidity level.

HVAC for offshore substations

HVAC is very important to assure continuous operation of the offshore wind park. Every down time due to technical failure means a decrease in the supply of electrical energy, and thus revenue. By using HVAC equipment of the highest standard, we provide durable and reliable installations. We understand that service visits should be kept to a minimum as visiting an offshore wind farm is slightly more costly than paying a visit to a docked ship. Therefore, we make sure our HVAC systems are low-maintenance. Therefore we use high quality materials – like stainless steel and titanium – to avoid corrosion and guarantee the lifetime of the platform. Harsh environments also require specialized preventive maintenance to minimize the risk of early failures. Our MRO department is specialized in preventive maintenance work and offers customized HVAC maintenance contracts. The offshore wind industry knows 'prevention is better than cure' and to ensure optimal operations of the OHVS regular maintenance on the HVAC cooling system is to be carried out.

HEINEN & HOPMAN

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Primo Marine

Since more than 2 decades we advise our clients on major subsea power cable projects, contributing to the greenification of the world's energy supplies. We offer a unique combination of academic knowledge and a long history of field experience to provide smart solutions.

As trustful advisors we provide confidence from boardroom to backdeck level in new or existing subsea infrastructure projects, ensuring your interests are protected by balancing cost, risks and technology over the lifetime of the assets.

We are passionately guiding our clients on technical, contractual & commercial matters related to interconnectors, export systems, offshore wind farms, new technologies like hydrogen, CO_2 pipelines, floating wind, offshore solar and other smart developments beyond the horizon.

primo marine

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www.primo-marine.com

Interdam

As an early entrant to the offshore wind market, InterDam developed a range of weight-saving products that comply with the DNV-ST-0145 standard for offshore substations. InterDam's G21 light-weight sandwich panels provide the most cost-effective solution for internal and external walls of offshore wind substations. As well as reducing topside weight, InterDam's panels are easy to transport and are easy to install.

InterDam also used its extensive offshore experience to develop a range of fit-for-purpose fire doors that maximize lifespan and minimize maintenance in harsh offshore conditions. Our weather-tight, durable fire doors can be applied both in substations and in the Transition Pieces of the wind turbines.

We have supplied our products to over 70 number of OSS and HVDC platforms worldwide for major operators as Ørsted, TenneT, EnBW, Iberdrola, EDF, Vattenfall, RWE and Parkwind.

Design, engineering, fabrication, supply and installation of architectural products for the Offshore SubStations or HVDC platforms.

- External wall panels
- Internal wall panels
- External double sealed doors
- Internal doors
- External windows
- TP/MP Doors

InterDam
Your shield in the field.

info@interdam.com
www.interdam.com

SoluForce

There are many initiatives to help our society towards a carbon-free economy. However, there are still quite a few challenges to overcome. Our solution: providing a safe, sustainable, cost-efficient and, above all, quickly deployable infrastructure for local hydrogen distribution. SoluForce is the originator and technological leader in long length high pressure Reinforced Thermoplastic Pipe systems (RTP, also known as Flexible Composite Pipes or FCP). They are used for many applications, such as hydrocarbons, hydrogen, water, offshore and mining. It is completely flexible, fully corrosion-free, does not suffer from hydrogen embrittlement and is quick and simple to install.

Based on proven technologies, it can be the perfect accelerator to achieve local green hydrogen distribution in a fast, flexible and cost-efficient manner. Moreover, the CO_2 footprint of producing the SoluForce pipe is only a fraction of that of a traditional steel pipe, which is an important aspect in an ambition towards a CO_2 neutral industry.

The SoluForce RTP system has been certified for hydrogen applications up to 42 bar of operating pressure. Unique in the world of hydrogen transport and a global first. This significant milestone has a major impact on the feasibility of hydrogen projects, and is a new step towards a sustainable energy mix.

SoluForce®

info@soluforce.com
www.soluforce.com

Seekable

Seekable is an Amsterdam-based startup specializing in advanced technology solutions for the submarine cable industry. We are developing a tracking solution for the detection of submarine power cables, coupled with the simultaneous accurate estimation of their burial depth.

Our innovative tracker, powered by sensors, data analytics and AI, provides real-time and accurate tracking capabilities to optimize cable monitoring. The survey instrumentation uses magnetic data in conjunction with a model that encapsulates the marine environment to determine the relative position of the cable. Seamless integration with all standard offshore survey software is possible.

Regular monitoring of cable position and burial depth can reduce the potential for physical cable damage, which can result in costly downtime. Our team of skilled engineers, researchers and industry experts have worked together to develop an innovative submarine power cable tracker. We are driven by the belief that our solutions will not only improve operational efficiency by reducing cable downtime, but also contribute to the sustainable development of the renewable energy sector.

seekable

info@seekable.nl
www.seekable.nl

Reynard Solutions

We perform a wide range of offshore high voltage activities for the connection and maintenance of offshore wind assets, covering array, export or interconnecting cables. Our track record covers a multitude of wind farms and substations. We employ the largest team of HV specialists in the industry. All our staff receive proper and project-specific in-house training and certification prior to every new project.

As a result, our professionals deliver the highest quality of work in shortest amount of time, with an outstanding safety record.

Reynard recently became part of the WTS Energy Group, thereby enlarging its global presence creating the ideal combination of a contractor's mind-set with the flexibility of a large global workforce. Early involvement with our clients is therefore the key to joint success. As experts in our field, we jointly work towards reducing offshore downtime and risks. These time-saving measures are engineered during preparation phases where team optimization and smart solutions are scrutinized to reduce offshore operation time. For the benefits of both our clients and ourselves.

We are aiming to combine three goals – helping our clients become successful while improving the environment at the same time and create a well- trained local workforce. Our aim is simply to become the best jointing company in the world.

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Vos Prodect Innovations (VPI)

With over 60 years of experience in the offshore business, Vos Prodect Innovations (VPI) can be seen as one of the pioneers in the field of subsea cable protection systems, cable hang-off systems and many other associated solutions for subsea cable manufacturers and installers. Within the industry, VPI has gained a reputation of quality and has been trusted with numerous projects worldwide.

VPI offers a complete system, which includes the cable protection system and the hang-off systems, as a universal package, that has been tested extensively. As the cable protection system serves to protect and stabilize subsea power cables, the hang off-system secures the electricity cable during the installation on a wind turbine and securely locks the cable after final installation. VPI contributes to a greener world by investing in a sustainable future. Offshore wind farms have become incredibly important and can be seen as a crucial factor in the process of sustainability. We at VPI are ready to support in this.

VPI is your preferred partner in the renewable energy market, providing tailor-made subsea solutions for cable manufacturers and installers. VPI offers preliminary installation support as well as opportunities to attend 'training days', to experience first-hand the ease of assembly and installation for our product range.

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9.5 Transport and Installation

Balance of Plant contractors

Boskalis

As a leading global dredging contractor and marine services provider, Boskalis offers a unique combination of experts, vessels and services. Maintaining the highest safety and sustainability standards, we deliver innovative and competitive all-round solutions to our clients.

For the international offshore energy and renewables sectors we offer an unparalleled range of specialist services as either a service provider or a lump sum contractor for the execution of offshore energy projects.

Within the offshore wind industry Boskalis has a successful track record in providing services throughout every phase of a project. We perform geophysical and geotechnical surveys of the seabed. We take care of transport and installation of the offshore wind turbine foundations such as (XXL) monopiles and jackets for both floating and fixed offshore wind farms. We install and bury export and array cables, and install rock to protect cables and prevent scour damage to offshore foundations. Once the wind farm is operational, we offer long-term subsea inspection, repair and maintenance services (IRM). With our knowledge and experience in the removal of offshore structures we are well positioned to remove offshore wind turbines and cables after their useful life.

Boskalis

offshore.energy@boskalis.com
www.boskalis.com/offshore

Mammoet

Mammoet offers solutions for any heavy lifting or transport challenge, helping the world to grow safely and efficiently, moving towards a sustainable future.

We are the world's largest engineered heavy lifting and transport company, with around 140 branches worldwide and around 6,000 colleagues.

To deliver lower-cost offshore wind energy, we manage complex global supply chains, throughout all land-based scopes.

We help move fabricated components from production to storage, then storage to vessel, as quickly as possible, clearing space for the next batch to be manufactured.

By managing the entire seaborne transport and storage scope, including load-in and load-out, sea fastening, shipping agents and port marshaling, we reduce project interfaces and risk.

The world's largest cranes help us to assemble turbines close to the quay, where the process is most efficient – funded by operational budgets. We also launch smaller floating foundations this way, with larger types driven onto semi-submersible vessels.

MAMMOET
SMARTER, SAFER, STRONGER

david.leon.shaw@mammoet.com
www.mammoet.com

Van den Herik

Van den Herik is a family business of hydraulic engineers in heart and soul. The passion for working with water originated in 1946. The company has now grown into a multi-disciplinary enterprise with over 200 employees, that is strong in both hydraulic engineering projects and the detection of conventional ordnance. Van den Herik is versatile, sustainable ánd innovative.

With our seagoing fleet (like Trailing Suction Hopper Dredgers, Backhoe Dredgers, self-propelled Grab Dredger, Pontoons, self-propelled Hopper Barges) we have a unique position in the market. Our vessels are, like our company, big enough to make impact, and small enough to be highly maneuverable and flexible. We can take care of offshore and nearshore works like dredging, trenching, backfilling, protection of cables and installations with scour protection of every type. Our design department can assist in calculating and designing the right and most effective scour protection solutions. Recently one of our self-propelled hopper barges has been equipped with a new operating system for the bottom doors to enable precise and dosed rock dumping. With our own survey vessels we are always capable to work with real time data of the working area.

VAN DEN HERIK
SLIEDRECHT

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www.herik.nl/en

Seafox

Seafox strives to be world's first choice offshore support jack-up company in the energy industry, meeting and exceeding customers' expectations by offering safe offshore services through global expertise and local knowledge.

For over 30 years we have been managing our offshore support jack-up units around the world providing accommodation, catering, and housekeeping services to the offshore energy sector . Our versatile fleet is able to support both oil & gas and wind related operations such as platform and Offshore Substation hook-up and commissioning services, maintenance activities, well testing and workover operations, transport and installation, plug and abandonment, and decommissioning.

We are determined to providing innovative, safe, and reliable solutions for all our clients active in the offshore energy sector through operational excellence. Therefore, the Seafox units come with a professional crew who has a strong operational philosophy and heritage. Seafox is a dedicated and professional organization with a strong focus on quality and safety on all levels. Our shore-based staff as well as our own marine crew consist of highly-qualified, fully-trained, and quality & safety-conscious professionals that together with our clients endeavour to provide a steady, reliable, and more and more environmental friendly energy spectrum.

Seafox is certified by DNV Register Quality Assurance for:

- ISO 9001 Quality Management Systems
- ISO 14001 Environmental Management Systems
- OHSAS 18001 Occupational Health and Safety Management Systems for the Operations and Management of a fleet of jack-up offshore support units

SEAFOX

Info@seafox.com
www.seafox.com

Van Oord

We are a Dutch family-owned company with over 150 years of experience as an international marine contractor. Our dedication to marine ingenuity drives our commitment to creating a better world for future generations.

Working closely and safely with our clients and stakeholders, we specialise in developing innovative and sustainable solutions. The growing world population demands more space, enhanced maritime transport infrastructure, and better coastal protection due to climate change challenges. Meeting the rising energy demand while reducing global CO_2 emissions necessitates a transition to renewable energy sources, and offshore wind is a key contributor to achieving climate targets worldwide.

With over 20 years of proven experience and an impressive track record in constructing offshore wind projects, Van Oord is leading the way in the energy transition. As an offshore wind contractor, we focus on the entire lifecycle of offshore wind farm development, including designing and engineering wind farm infrastructure, the installation of subsea foundations, electrical infrastructure and offshore wind turbines, as well as heavy maintenance and repair. Our commitment to safety, innovative solutions, the expertise of our employees, and specialised offshore wind equipment significantly contribute to the further build-out of offshore wind energy.

Van Oord
Marine ingenuity

area.ow@vanoord.com
www.vanoord.com

Installation equipment supply

CAPE Holland

We are passionate about piling; we continuously improve the performance of pile installation and removal: faster, easier, smoother and more sustainable. We love to make impact and contribute to good vibrations. Our customers' offshore oil, gas and wind projects are of the greatest significance. These mighty constructions require solid foundation, and we are there to support them with the smartest piling equipment and all our knowledge, skill and craftmanship. At CAPE Holland we proudly build on six generations of piling experience. We get the job done!

Above all, we are solution providers. We think in possibilities. Whether we need to be creative in sourcing the proper equipment for you, or the situation requires an 'out-of-the-box' approach. We are the pioneers in offshore vibro driving. Our work includes research, design, and engineering.

Since its first commercial project in 2015, the CAPE VLT (Vibro Lifting Tool) has accumulated an extensive track record with highly efficient upending, positioning installation and extraction of offshore and nearshore piles. Using various CAPE VLT configurations and pile clamping systems a large range mono-, pin-, jacket-, and anchor piles have been installed. The CAPE VLT has also been used for removal of piles during test and decommissioning projects.

communications@capeholland.com
www.capeholland.com

Dieseko Group

Vibro Monopile Installation Equipment

Dieseko Group, based in the Netherlands, is the world leader OEM in vibrohammer technology. We have designed, built and used these hammers and related auxiliaries for the past 50 years. The products are sold, serviced and rented worldwide from the head office in the Netherlands, branch offices in Australia, China, Poland and USA and through an extensive dealer and agent network. Dieseko also offers this technology for offshore installation & decommissioning projects.

Dieseko recently developed and built the GIANT 2000, a vibrohammer capable of upending and installing XXL monopiles. It has been built according to Dieseko's philosophy and experience that we build-up in the past 50 years and will be deployed in its first commercial OWF project in 2024. Patented details in the design such as variable damping elements and the modular built elements allow the hammer to be modified exactly to your job.

DIESEKO GROUP
INNOVATIVE FOUNDATION EQUIPMENT

www.diesekogroup.com/markets/offshore/
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Dutch Drilling Consultants

Dutch Drilling Consultants (DDC) is specialized in large diameter drilling. DDC owns a large fleet of pile top drilling rigs to execute the drilling works.

DDC is active in different markets varying from onshore, near shore to offshore and renewables. DDC drills foundations for offshore wind farms, bridges, jetties, oil/gas platforms and ventilation shafts for tunnels.

Drilling is our core business, also we can act as a consultant. We have our own in-house engineering department for the best integration of our services for your foundation drilling projects. Furthermore we supply skilled drilling personnel.

Our office is in Waddinxveen, the Netherlands and our yard is in Ridderkerk, near the Rotterdam harbour. At the yard we assemble the constructions and prepare the equipment for transport to projects all over the world.

DDC

info@ddcbv.com
www.ddcbv.com

Enersea

Enersea and its sister company H2SEA offer consultancy, project management and engineering services for the offshore Renewable Energy (Wind & Hydrogen) and Hydrocarbon market. We combine excellent client insight with high quality engineering (management), enabling us to increase the value of our client's investment. Clients vary from innovative start-ups to developers, owners and suppliers of installation vessels and equipment. Our effective and adequate design decisions result in on time delivery with feasible and practical solutions.

Email
www.enersea.nl
www.h2sea.nl

GustoMSC

The pioneers of offshore engineering

NOV is a leading provider of technology and equipment to the global energy industry. GustoMSC, part of the NOV Marine and Construction business, is recognized for providing advanced design & engineering consultancy for mobile offshore units such as Wind Turbine Installation Vessels, Blade Installation Vessels, Feeder Vessels, and Floating Offshore Wind Foundations. The company also specializes in reliable equipment like jacking systems and heavy lift cranes. In close cooperation with our clients, we translate experience, science, and technical knowledge into realistic & innovative ideas.

The performance of new and existing jack-ups, vessels and semi-submersibles is further optimized by our operational support and engineering consultancy. In this way, GustoMSC enables and supports safe and efficient operations at sea, contributing to a sustainable future.

Based on its expertise and track record GustoMSC is well positioned to support clients in conceiving and realizing dedicated and integrated solutions to meet today's challenging requirements of the floating and fixed offshore wind markets.

info.gustomsc@nov.com
www.nov.com/gustomsc

Eager One

Eager.one, based in Utrecht (NL), is active in the field of heavy mechanical engineering and fabrication services with specific know-how in systems for (offshore) heavy lifting and special transport.

Since its establishment in 1979, Eager.one has specialized in the engineering of lifting, handling and installation equipment and methods. Nowadays, Eager.one also supports its clients in the engineering of complex lifts and designs and constructs custom-made mission equipment, enabling efficient and safe operations, particularly in the offshore wind industry.

Our engineering experts provide bespoke lifting and handling tools to contractors worldwide for the mobilization, transport, and installation of offshore wind farms. Projects are completely taken care of, from concept study, engineering, and fabrication, to testing, commissioning and aftersales support.

sales@eager.one
www.eager.one

GBM Works

GBM Works develops and commercialises a silent installation method for offshore wind farm foundations, the Vibrojet®. Using a combination of vibrations and GBM's patented technology, the Vibrojet® reduces the friction between the soil and the inner walls of the monopile, reducing resistance against installation and the energy required. By fluidizing the soil, this innovative method enhances the performance of the Vibrohammer resulting in deeper refusal depths (mitigating the risk of not reaching target depth) and increasing piling speeds. More importantly, this installation technology induces less noise emissions, reducing the need for expensive noise mitigation measures.

The Vibrojet® is feasible for a variety of projects, in particular those with XXL foundations. As the monopiles get bigger and bigger, the value of the Vibrojet® in comparison to conventional installation method increases, making it a more suitable solution.

info@gbmworks.com
www.gbmworks.com

FibreMax

In the realm of offshore wind solutions, FibreMax emerges as a true game-changer. This Dutch company has set itself apart by introducing an innovation that is revolutionizing the industry; parallel endless wound fiber cables.
What makes this product truly exceptional is not just its uniqueness, but its wide-ranging applications.

FibreMax's patented cables have found their way into a multitude of sectors, from (offshore) cranes to tidal energy projects, yacht rigging, and the mooring of floating wind turbines, XXL Monopiles. Their versatility knows no bounds.

One of FibreMax's key strengths lies in its highly automated production process. This not only ensures precision but also enables them to scale up effortlessly, even on a global scale, to meet local content requirements which will de-risk projects significantly.

However, it's not just about automation and versatility. FibreMax's cables are engineered with impeccable precision, require no maintenance, are impervious to corrosion, are a remarkable >80% lighter than conventional steel cables and can be made from circular fibers.

These attributes make FibreMax cables the go-to choice for the most demanding on-and-offshore applications, where durability and performance are non-negotiable.

FIBREMax
World's *strongest* cable...

info@fibremax.nl
https://fibremax.nl/

Holmatro Industrial Equipment

Founded in 1967, Holmatro Industrial Equipment is worth over +55 years of experience with high pressure hydraulic tools & systems. We are proud that after all this time we are still a MADE in The Netherlands company with inhouse research & development, engineering and production. We aim to provide you with the most safe, reliable, durable and ergonomic solution for your application, delivering high-quality products, excellent service and great customer care.

Offshore Winds Systems & Services
Over the last decades, Holmatro Industrial equipment has built a proven track record providing various solutions for the Offshore Wind Industry. In our way of work, partnership is key. Most projects were developed & executed in close cooperation with the developer, engineering companies and installation contractors Besides hydraulic solutions to level and fixate wind turbine foundations, such as transition pieces and jackets, we have supplied various systems in the field of cutting, sea fastening, deck handling and skidding solutions.

Your reliable choice in demanding circumstances;
- Transport
- Installation
- Maintenance
- (Onsite) service
- Decommissioning.

holmatro
mastering power

industry@holmatro.com
www.holmatro.com

Huisman

Huisman is a worldwide supplier of step changing technical solutions to the world's leading companies in the energy sector. Our products range from large capacity cranes up to highly engineered installation tools, to optimise every stage of installation and operation of offshore wind farms.

Huisman
Equipped for impact

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www.huismanequipment.com

Enerpac

Enerpac Tool Group is a premier industrial tools and services company serving a broad and diverse set of customers in more than 25 countries.

The Company's businesses are global leaders in high pressure hydraulic tools, controlled force products and solutions for precise positioning of heavy loads that help customers safely and reliably tackle some of the most challenging jobs around the world.

The Company was founded in 1910 and is headquartered in Menomonee Falls, Wisconsin. Enerpac Tool Group trades on the NYSE under the symbol "EPAC".

ENERPAC

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www.enerpac.com

Hycom

HYCOM, part of the HYDAC Group, specializes in Hydraulic (sub)systems and components for seamless operations of offshore- and offshore wind applications.
With decades of experience since 1973, we have perfected our expertise, ensuring our systems are tailored to meet our client's needs, unmatched performance, and reliability of applications in the harshest marine environments.

We deliver custum made drive- & control systems for Monopile handling tools, Cable handling tools, piling/drilling templates, offshore access systems, subsea equipment and offshore mooring systems.

Innovation
In the field of Jones act compliant owf solutions we design and produce systems for motion compensation systems, seafastening systems and Offshore mooringsystems for feeder barges.

This last one is an 6 or 8-line mooring setup to enable offshore mooring of a feeder barge to a jack-up vessel. The mooring spread consist out of several spring lines and breast lines connected to winches. The breast lines are foreseen with an in-line heave compensation system consisting out of a hydraulic cylinder and sheaving to compensate for barge motion. The hydraulic system uses nitrogen gas as pretension spring and hydraulic throttle valves to provide additional damping.

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Hydrauvision

Hydrauvision operates worldwide as a versatile total supplier of hydraulic, electrical and hybrid drive technology. With over 50 years of knowledge and experience, we design, manufacture, maintain, overhaul and rent hydraulic and electrical drive and control systems for numerous companies in which drive technology plays a role. These companies find in Hydrauvision the partner for whom no challenge is too great.

Hydrauvision develops and realizes a wide range of (complex) systems: power packs, winches, charging systems, skidding systems, jack-up systems, offshore access systems, refrigeration units, manifolds, spooling devices and safety platforms.

These systems find their way worldwide in many sectors; from the dredging sector to the food industry and from the offshore wind industry to the steel industry.

Share your challenge.

Hydrauvision
Driven by technology

info@hydrauvision.com
www.hydrauvision.com/

Muns Techniek BV

Muns Techniek is a system integrator for hydraulic systems and electrical controls. With over 30 years of experience we offer integrated solutions for projects in the Offshore and (Maritime) Industry.

From stand-alone applications like hydraulic winches to complete turn-key projects such as jack-up systems (for WTIV), Muns Techniek is your ambitious partner to integrate ever increasing technical demands into reality. Working close with our customers is the key-factor for our daily business.

Always trying to be innovative, and never losing track of the Total Cost of Ownership. Muns Techniek combines the best components available in the market to simplify your system and the integrated controls. It is one of our strengths. With state-of-the-art solutions like our in-house developed Human Machine Interface we keep serving our customers at the highest level. Muns Techniek invests continuously in research and development and in the training and ongoing education of its employees.

Muns Techniek has proven to be able to contribute from the initial concept to the final commissioning and operation of a project. Muns Techniek aims to develop solutions which are not only durable, but which also contribute in making processes economical, flexible and fully automated.

Muns Techniek BV

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KenzFigee

KenzFigee is a well-established lifting and service specialist of high-end equipment for the marine, offshore and wind energy industry.
Established in 1836, KenzFigee has designed and built more than 4,500 cranes, lifting and handling solutions that fit the specific needs of its clients in the most demanding conditions. Based on our decades of experience, focus on innovation and client requirements, KenzFigee has become a leading supplier and service provider of reliable and durable high-end lifting solutions for the worldwide marine, offshore and wind energy industry.

As part of the energy transition, KenzFigee delivers a temporary and modular nacelle-mounted up-tower crane solution for safe, smart and efficient on- and offshore win turbine component exchanges & repairs. The use of this innovative up-tower crane technology lowers O&M costs, reduces ground preparation requirements, and increases the working window.

The experienced professionals provide design, engineering expertise and a variety of services, to support clients increasing operational efficiency and to minimize downtime of equipment. At KenzFigee we take care of clients during the whole life cycle of the equipment: from creation to disposal.

KenzFigee is headquartered in Zaandam, the Netherlands and has a branch office in Aberdeen, United Kingdom.

info@kenzfigee.com
www.kenzfigee.com

Polarttech

Polarttech has been a recognized manufacturer in the international polyurethane processing industry for over 20 years. We are specialised in the development and production of sustainable polyurethane products for industries such as the offshore wind.

All our products are developed and produced in the Netherlands and then used worldwide in industries such as the agriculture, concrete industry, food industry, infrastructure, machinery and machine tools, offshore & energy and transport.

Specialised in sustainable polyurethane solutions
Our sustainable polyurethane products are very widely applicable in the offshore & energy market and can therefore be found in all industries within this sector. From bearing, dampening and support pads that are essential for the transportation and installation of offshore wind farm components (such as monopiles and wind blades) to tensioner track pads that are used in cable and pipe laying projects.

All over the world our products are being used in a tough offshore environment, wherein the materials are successfully exposed to the changing conditions on a daily basis.

sales@polarttech.nl
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Tetrahedron

Tetrahedron launched a novel crane for the installation of the next-generation of offshore wind turbines. This novel crane is developed specifically for the offshore wind industry. A new motion principle exchanges unused extensive reach for useful height.

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Technical Maritime Services

TMS is a developer and manufacturer of mechanical installations. Our practical and innovative know-how results in unique products that excel in terms of efficiency, flexibility and reliability. Our clients are mainly renowned international contractors in the offshore field.

TMS translates, by concept designs, client requirements into the complete engineering package and delivers turnkey solutions including installation and commissioning. We have our own production facility with waterfront access, where assembly and/or testing activities can be executed.

info@tms.nl
www.tms.nl

Solidd Steel Structures

Solidd Steel Structures is specialized in mechanical turnkey projects. Solidd employs a wide range of specialists for the design, engineering, execution and management of turnkey projects, such as bridges, lock gates, cranes and offshore applications.

Having all steel construction facilities under one roof, creates maximum flexibility and added value for our clients. From cutting and welding up to machining. The majority of our projects are finalized on site, our service squad is ready to perform all types of support including onsite machining.

The climate change affects everyone in the world, therefore we feel responsible in contributing to a better and greener future. The company roots go back to the mid-fifties. Our experience in shipbuilding, infrastructure and offshore projects provides a solid base to accomplish tomorrows challenges.
Today's offshore machinery require a high level of standards and certifications. We maintain and expand this knowledge through continuous education and training of our highly qualified specialists.

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Sinus Jevi Electric Heating & Load banks BV

With fabrication locations in the Netherlands and Denmark Sinus Jevi Electric Heating BV is your go to specialist for Industrial Heating systems and Load Banks. Founded in the 1920's we rely on a century of experience. We have a thorough understanding of the offshore industry and its demands turning every project into high quality solutions for your challenges.

- Standardized Heating equipment such as Water-, Fan-, Space- and Winterizing Heating are the basis of our product lines. For process Heating we offer Gas- and Liquid- Heaters such as Natural Gas Super Heaters (LNG), Nitrogen Heaters and Glycol Re-boilers.
- Our Load Banks are applied to Offshore Cranes, Winches, Cable- and Pipe-Lay equipment and numerous other applications. We offer both Air- Cooled as well a Water Cooled- Load Banks.
- We produce both Anti- as well as De-Icing Heaters for Windmill Blades.
- Duct heaters for HVAC and High Temperature application complete the portfolio.
- Our scope of supply includes Control Panels specific for Heating applications.
- Apart from ATEX- and IEC-Ex- certified equipment we produce equipment compliant to the regulations of recognized bodies such as DNV-GL, BV and Lloyds.
- We design to ASME and EN13445 standards.
- Sinus Jevi is ISO-9001 and ISO-14001 Certified.

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www.SinusJevi.com

TWD

TWD is an engineering company specialized in method engineering and equipment design. By continuously developing our expertise, we strive to help contractors safely build their projects on time and within budget. Problem-solving, dedication, and teamwork are in our DNA, through which we deliver the fit-for-purpose engineering solutions for transport, installation, and construction projects.

Thanks to our multidisciplinary engineering teams, we are experts in tackling market-specific challenges and deliver state-of-the-art solutions. This has strongly positioned us in the markets of Offshore Wind, Heavy Lift and Transportation, Heavy Civils, and Vessel Outfitting.

TWD's services include Method Engineering, Structural and Mechanical Design, Geotechnical Engineering, Marine Engineering, Drive and Control Engineering, Project and Fabrication Management, Measurement and Testing, and Soft Engineering. Our creative, flexible, and cost-effective approach makes us the perfect partner for your next engineering project.

address: sales@twd.nl
https://twd.nl/

Installation/CTV/SOV vessel design, supply

Damen Shipyards Group

Damen Shipyards Group has been designing, building and repairing ships for all sectors of the maritime industry for nearly a century. We support the offshore sector in all its forms with a range of products designed in response to client and market feedback. Today, our offshore portfolio covers the entire range of small to medium sized vessels for the full spectrum of offshore activities.

With first-class, strategically located facilities, including the Damen yard in Galati in Romania, partner yards in the Far East or building locally to Damen design and under Damen supervision, Damen delivers vessels both from its proven, standardised series, tailored to individual client requirements via modular options, and fully customised, engineered-to-order projects, including complex, specialised vessels, offshore construction and fabrication works.

Damen's stated aim of being the world's most sustainable shipbuilder means it is committed to ever-increasing levels of sustainability in its products and operations. Its investment in diverse R&D programmes, often working in collaboration with other industry partners, has led to the development of numerous innovations that improve efficiency and lower fuel consumption and emissions during both the construction and operation of our products, thus minimising their environmental impact.

info@damen.com
www.damen.com

IHC Offshore Energy

Connecting the future of energy. IHC Offshore Energy has the knowledge and experience to rise to the global challenges facing the offshore industry by providing reliable and advanced vessels, equipment and services. With our extensive knowledge and experience, and through our passionate colleagues, we provide a competitive edge to our customers.

IHC Offshore Energy is fully equipped to provide offshore industries such as Renewables and Telecoms with superior solutions based on our market-leading expertise. With a proven track record in delivering sustainable offshore systems, including pipe and cable lay equipment, subsea vehicles and a wide range of integrated vessels, we can provide standard or tailored solutions to improve operational efficiency and allow for a more sustainable performance.

With our experts working on a global basis, we guarantee a local presence and industry-leading support on every continent. In addition, our responsive spares and services team has a wealth of operational experience to support maximising the productivity of vessels and equipment.

IHC Offshore Energy is part of Royal IHC. As we navigate new waters, our aim remains unchanged: to discover the smartest and safest way forward for both our customers and our people.

Together, we create the maritime future.

offshoreenergysales@royalihc.com
www.royalihc.com/offshore-energy

Ulstein Design & Solutions B.v.

We are a leading ship designer with proven track record in the offshore wind industry. We design game changing ships for the offshore energy market. Sometimes brilliantly simple, sometimes sufficiently complex.

ULSTEIN provides best-in-class solutions, combining a pragmatic design approach with extensive naval architectural skills and market knowledge.

Working together as a team, we push for sustainable solutions, developing state-of-the-art and fit-for-purpose ship designs that are cost-effective, safe, comfortable and providing an efficient working place for the crew.

For over 100 years, the family owned ULSTEIN Group has been associated with innovation and quality in design and delivery, meeting the demanding marine challenges by embracing change and identifying opportunities.

udsbv.info@ulstein.com
www.ulstein.com

Vuyk Engineering Rotterdam B.V.

A synergy of three maritime engineering specialisms is represented at Vuyk Engineering Rotterdam.

Vessel Design and Conversion
Our department Vessel Design and Conversion focuses on (concept, basic and detail) design and conversion of work vessels.

Equipment Design and Upgrades
Our department Equipment Design and Upgrades specialises in developing advanced mission equipment. We find solutions for complex issues or upgrades to facilitate high performance operations.

Operational Engineering
The department Operational Engineering focuses on optimizing efficiency and safety of maritime operations with development of methods, design of temporary steel structures, sea fastenings, hydrodynamic analysis and workability studies.

Solving your maritime challenges
Our three disciplines are working together as one team, enabling us to provide our customers complete design packages. Vuyk Engineering Rotterdam has all the in-house expertise to support innovative projects in various maritime markets: dredging, subsea, offshore wind, renewables and the heavy lift market.

VUYK ENGINEERING

vuyk@vuykrotterdam.com
www.vuykrotterdam.com

CTV/SOV deck equipment supply

Ampelmann

Ampelmann is the leading offshore access provider that delivers safe and efficient access solutions to the global offshore energy sector. Its innovative approach to offshore access has propelled the company forwards as a key global player with strong local presences in Europe, Africa, the Middle East, Asia Pacific and the Americas. Ampelmann's diverse portfolio of modular and energy efficient gangways is tailored to meet every local and global demand, providing reliable and consistent access to offshore installations in a variety of sea states and weather conditions.

The company's growing fleet of gangway systems includes solutions for crew change, cargo and decommissioning operations in the offshore oil and gas, wind and floating wind markets. The company operates on a full-service business model and provides its renting and buying clients with trained operators, the possibility to train client operators, 24/7 operational support and digital management tools to improve uptime and ensure maximum efficiency during offshore operations.

AMPELMANN

sales@ampelmann.nl
www.ampelmann.nl

Safeway

Safeway designs and fabricates motion compensated gangway bridges and with its Safeway Seagull-type sets a new standard for motion compensated systems.

With year-round workability at 20+ meter above sea level, Safeway redefines the state of affairs in offshore access solutions.

Extensively tested and based on proven technology, the application of an additional roll compensation actuator provides a spectacular reduction of overall gangway motions.

SAFEWAY
MOTION COMPENSATED GANGWAYS

wva@vanaalstgroup.com
www.safewaygangway.com

Breman Machinery B.V.

Extreme Precision

Breman Machinery B.V. has the experience to make your wishes become reality. Our team of 130 well-experienced employees has the knowledge to create workpieces of extreme sizes with maximum precision. We have a good record of projects for Oil and Gas companies, Mechanical Engineers, Aerospace companies and Industrial firms. We do not turn down any challenge.

Capacity

The welders of high-quality steel, like S460-S690, Duplex etc., are qualified by Lloyd's Register or DNV for all welding positions. With 30 milling, boring and turning machines we have the possibility to offer unique services. Our largest boring machine has a range of X=26.500, Y=10.000 and Z=2.500 and the largest turning machine can handle a length of 16.000 mm. Our preservation department can protect your projects with different painting systems. The workshops in Genemuiden have a surface of 21.000 meters with a height of 25 meters. The crane capacity is up to 320T. Our location is beside open water, which means we have a direct connection to the international ports.

Quality

High quality is one of our most important standards. We work according ISO9001, ISO3834-2, EN1090-1 and VCA**.

info@breman-machinery.nll
www.breman-machinery.nl

Barge Master

Barge Master is dedicated to improving offshore workability. We provide motion compensation systems that help our clients to avoid weather downtime and remain in charge of their operations and schedules. We see motion compensation as the perfect technology to keep the load still, the equipment stable and the people safe. Our systems eliminate the need for bigger ships and provide a cost-effective solution for offshore operations. With motion compensation, working at sea becomes almost as easy as working on land.

Our Platform can be installed on any large vessel to serve as a working base for any kind of equipment. By eliminating the motions of your vessel, the platform effectively turns your deck space into a perfectly stable working area. As a result the operations can continue even in adverse weather, enabling you to stay on top of the execution and timeframe.

Our Gangway provides continuous access to any offshore structure. This motion compensated gangway ensures safe and efficient transfer of crew irrespective of weather conditions. Making the system truly unique are its distinctive safety features, such as triple redundancy and the anti-tip-slip.

The Barge Master Crane enables controlled lifting operations in high sea states, making it possible to work at sea almost year-round.

info@barge-master.com
www.barge-master.com

SMST

SMST is an internationally oriented company that designs and builds systems for the offshore market, with a strong focus on the renewable sector (Offshore Wind). The company supplies turnkey systems for safe transfer of personnel and cargo for worldwide offshore operations.

Through the unique combination of the inhouse design and engineering expertise, production facilities, testing capacity, worldwide installation and service, SMST is able to deliver high quality engineering and product solutions that are distinctive in the offshore market.

Besides delivering safe and efficient operations, the modularity of the SMST products offer maximum flexibility to the international partners from various industries. For the offshore wind sector, SMST has developed a complete system package including a range of gangways adjustable for various heights and modular offshore cranes which can be equipped with various knuckle booms and active heave- and (3D) motion compensation.

SMST is continuously improving its products and services for the purpose of aligning them to the latest industry standards and is always looking for innovative, green solutions which may bring the industry to its next level of success.

info@smst.nl
www.smstequipment.com

Eagle-Access

The EAGLE-ACCESS system is a revolutionary new Offshore Access system, capable to transfer People and Cargo at the same challenging conditions.

The revolutionary new concept is the answer to the market requirements of access to all platforms without the need for modifications. With our new developed EAGLE-ACCESS system, recently successfully tested during sea trials, we can work from almost any DP2 vessel. This opens the market for vessel owners interested in the offshore wind industry to work with a state-of-the-art fully electric system. We can work from smaller vessels and due to positioning on the aft there will still be sufficient deck space for cargo, TLQ's etcetera.

Main characteristics

- Flexibility in height 0 – 24 meter
- Cargo transfer up to 1 ton that can be remotely released to improve safety and efficiency.
- The horizontal reach is 27 meter where the system can be installed on the aft of the vessel allowing for a 270 degrees vessel heading freedom.
- The system is fully electric and requires a max. 75 KW from the vessel.
- EAGLE can be operated by your own on board qualified crane operator, additionally trained on the EAGLE-ACCESS Academy.
- All this is possible from a smaller vessel, hence lower investment cost, while improving safety, workability and comfort.

EAGLE-ACCESS

m.klitsie@eagle-access.nl
www.eagle-access.nl

Z-Bridge

Z-Bridge has developed an innovative Bring-to-Work system. It enables the offshore industry to significantly reduce costs whilst increasing operational flexibility. The Bring-to-Work system operates with a telescopic arm mounted on a pedestal which is fully motion-compensated. It accommodates flexible landing heights, ranging from 8 up to 21 meters above the deck with out the need for any heavy and costly pedestals. It transfers up to 6 people or 1000 KG cargo in a trolley driven over the telescopic arm. For heavier and larger objects, the system even has an integrated crane capable of lifting loads up to 3000 kg. Because of its Limited size, the system is extremely suitable for deployment on smaller vessels, opening the offshore access market for a new type of vessel at a totally different price point. Or it can optimize the deck use on large vessels, The system can be rented or purchased for full integration on vessel. The system design allows swift mobilization by truck to any harbor optimizing the mobilization planning of any vessel.

If your organization would like to save costs in it its offshore access operations, whilst working with a company with a proven track record, please check out our website.

Z-Bridge
Bring-to-Work system

info@zbridge.nl
www.zbridge.nl

9.6 Operations & Maintenance

Services Operations

Acta Marine Profile

Established in 1970, Acta Marine works in a broad scope of maritime sectors. Our background is in shallow water projects, but in these four decades we have developed our skills to include a variety of tailor-made services for clients working throughout the maritime sector.

We operate globally; supporting clients in three main areas. Coastal Infrastructure, which comprises dredging, coastal defence, port and marine construction and aquaculture. Offshore Wind industries, emerging renewable energy markets, and the Oil & Gas industry.

Our focus is on building long-lasting relationships with our clients and maintaining the long-term continuity of our services. This includes continuous investment in the welfare and training of our personnel as well as in upgrading and maintaining our fleet.

Our fleet includes DP Multicats, Walk-to-work vessels, Tugs, Crew Transfer Vessels, Multipurpose & Survey Vessels, and barges. We own over forty vessels, which help our clients achieve their goals of safe and effective operations, in addition to long-term sustainability and productivity.

At the core of the company is a team of approximately 250 committed and reliable professionals. It is their dedication and expertise that has built our reputation. And it is their passion that makes Acta Marine a company with clear goals for the future.

Acta Marine

info@actamarine.com
www.actamarine.com

AE Wavehexapod

Company was founded in 2021 by three experienced entrepreneurs. Johan Paulides, Frank van Bodegraven and Lucas Nijman. They have developed a wave generator.

Wave energy converter
The Wavehexapod is a hexapod with 3 buoys and 6 generators. The generators hang from a fixed suspension mechanism to a larger submersible that can hold up to 9 hexapods. With the hexapod we can follow the waves as best as possible to extract energy from them. Both in the up and down movement and the horizontal movement. During a storm, the hexapod is pulled out of the water to prevent storm damage.

The Wavehexapod is suitable for offshore wind infrastructure (both greenfield and brownfield), but also as an electrifier for oil and gas platforms. The wave hexapod uses robots as generators that they have made offshore proof, making the wave hexapod a product that can be easily scaled up. All parts within the Wavehexapod are standard products. This latest robot expertise can also be used to apply robots offshore in other offshore applications, such as wind turbines and offshore ships. The Wavehexapod has also developed a special cable connection for floating solar and oil platforms.

AE WAVE HEXAPOD

info@wavehexapod.com
www.wavehexapod.com/

Brady Corporation

Speeding up maintenance in a safe and efficient way to maximise power generation and supply, Brady Corporation offers a wide range of reliable identification and safety tools to support highly efficient maintenance professionals complete fast machine interventions in a safe way.

Our solutions include full service Lockout/Tagout, inspection management software and tools, reliable, on-site printable safety signs and floor marking, and cable and component identification labels that stay attached and remain legible.

BRADY

salesbenelux@bradycorp.com
www.brady.nl

Amphibious Energy

Amphibious Energy is an pioneering Dutch company based in Delft, which are dedicated to delivering sustainable energy solutions to the offshore and maritime industries. Established on the principles of innovation and environmental responsibility, we are at the forefront of the energy transition, revolutionizing the way remote and offshore operations are powered.

Innovation at the Core: The EnergyPod

Our flagship innovation, the EnergyPod, embodies our commitment to greener, more efficient offshore energy. This modular system integrates solar panels, wind turbines, and energy storage to provide a consistent and eco-friendly power supply. From offshore oil and gas platforms to remote aquaculture facilities and offshore wind farms, the EnergyPod reduces environmental impact and operational costs while bolstering reliability.

Digital Transformation for Efficiency

Amphibious Energy leads the way in digital transformation within the off-grid energy sector. We seamlessly blend IoT connectivity and data analytics into our solutions, enabling real-time monitoring and optimal energy management. Our technology empowers you to make data-driven decisions and reduce downtime.

Your Sustainable Energy Partner

Amphibious Energy is more than a solutions provider; we're your partner in sustainability. We're dedicated to minimizing carbon footprints, enhancing cost-effectiveness, and ensuring the resilience of your offshore and maritime operations.

amphibious energy

info@amphibiousenergy.com
www.amphibiousenergy.com

DUC Marine Group: Pioneering Offshore Innovations

DUC Marine Group epitomizes Dutch expertise and innovation in the offshore wind sector. As a Netherlands-based maritime service provider, we pride ourselves on a legacy of technical excellence and unwavering commitment to sustainability. With decades of experience, we have evolved as an indispensable partner for offshore wind ventures, spanning underwater services, salvage operations, and infrastructure development.

Our inventive approaches in engineering and subsea constructions empower us to provide cost-effective and efficient solutions, even amidst the most challenging maritime conditions. Moreover, our eco-conscious methodologies support the preservation of our seas while advancing the energy transition.

In the dynamic realm of offshore wind energy, we stand as your trusted ally. DUC Marine Group embodies Dutch ambition: marrying technological advancement with maritime tradition. Discover why we set the gold standard in the offshore wind sector.

DUC MARINE GROUP

info@ducmanrienrgoup.com
www.ducmarinegroup.com

Brand Energy & Infrastructure Services

With locations surrounding the North Sea, Brand develops access, insulation and coating plans around your specific offshore oil, gas and wind energy assets. Our solutions are based on a multidisciplinary approach to ensure that your operations continue safely, smoothly and with minimum downtime. The specially trained Brand operatives support the world's most renowned offshore clients.

With over 45 years offshore experience Brand support its clients by delivering tailored solutions, and providing method statements ensuring a safe, effective and timely execution of the work. Avoiding conflicting areas through integrated planning and execution using a ONE-team approach.

BRAND
ENERGY & INFRASTRUCTURE SERVICES

nl@beis.com
www.beis.com

DHSS

DHSS unburdens customers by being the clients' eyes and ears at all times, being our clients' representatives on the ground, acting in their best interests on every issue. 24 hours a day.

From our A1 located support bases in strategic related ports, full coverage is granted - coordinating berthing, stevedores, transport and warehousing, arranging customs and immigration formalities, organizing security, liaise with pilots and Port authorities. As well as collaborating with a wide variety of supply-chain. Attending to the needs of the client, vessel master and crew.

As one single point of contact with an extensive qualified network.

agencies@dhss.nl
www.dhss.nl

Intrepid Safety Products BV

Intrepid Safety Products BV (ISP) is the European distributor for self-closing safety gates, manufactured by Intrepid Industries Inc. TX, USA.

Since 1980, 600.000+ gates have been supplied to refineries, chemical plants, paper mills, automotive, offshore, and marine environments. These polyurethane gates have proven to be the most reliable solution to protect people against accidental falls through guardrail openings.

Beside self-closing gates ISP supplies a range of different safety related products. ISP always strives to make its products simple and effective at a fair price.

info@isp-products.com
www.isp-products.com

Peterson Energy Logistics

Our services:

- Port services / stevedoring
- Ship agency
- Procurement
- Warehousing and distribution
- Materials management
- Customs formalities
- Consultancy services
- Integrated logistics
- Freight forwarding
- Fourth party logistics
- Marine planning and assurance
- Onshore site establishment
- Supply chain control tower
- Storage of large components

Our global locations:

- USA
- Guyana
- Netherlands
- UK
- Trinidad & Tobaga
- Qatar
- Australia

info@onepeterson.com
energylogistics.onepeterson.com

DroneQ Robotics

DroneQ Robotics is a next-generation Unmanned Vehicle System Operator & Integrator, where operational processes and autonomy are important factors for operations in the air, on land, on water and underwater! Areas of activity include Unmanned Aerial Systems (Drones), Unmanned Surface Vessels (USV) and Remotely Operated Vehicles (ROVs).

DroneQ Robotics has more than 20 years of maritime experience and has roots in offshore, civilian sub- and surface construction and maritime Disaster & Incident Response. Tasks performed include drilling support, pipeline and cable laying support, construction and decommission activities and inspections of oil and gas production installations, pipelines, cables and surface and other subsea installations with UAVs and ROV's (Remotely Operated Vehicles) or underwater drones.

DroneQ Robotics is specialised in Offshore Energy services such as Long Distance Cargo Drone Logistic services, Incident & Disaster Response, drone and ROV Inspection and surveying of Offshore wind turbines, production platforms and other offshore installations.

info@droneq.nl
www.droneq.nl

H2M

Lightweight Offshore Accommodation Modules
H2M provides a wide range of lightweight offshore accommodation and workspace modules to the oil & gas, maritime and renewable energy industries. Our system is based on modular build, therefore we can provide almost any type of module. Our product range contains several designs of offshore lightweight accommodation modules. We manufacture all our modules to the highest industry standards; DNV 2.7-1, EN 12079 and ATEX, including compliance with IMO/SOLAS regulatory requirements for A60 fire protection.

Full Service provider
H2M can deliver a full service solution, what includes engineering, transport, installation, hook-up, commissioning and service during the period of use. We are able to provide everything that's required to ensure that the modules are ready for a comfortable stay. On several projects we have provided our clients with stairs and walkways, power-packs, water treatments systems, hook-up materials and several structural requirements.

H2M Specials
H2M is not only a rental company for accommodation modules, we are also able to manufacture all kind of custom build containers for rent and/or sale. Some examples of the various possibilities are: workshop containers, storage containers, satellite TV/internet containers, freshwater maker containers, sewage treatment containers and service containers.

H2M
OFFSHORE ACCOMMODATIONS

info@h-2m.com
www.h-2m.com

N-Sea

N-Sea is an integrated total subsea solutions provider in Survey, IRM & Construction, Subsea Cable Repair & Installation, and UXO ID & Disposal.

We deliver total solutions for subsea infrastructures and assets that meet the needs of our clients and the international oil, gas- and renewable industries, considering a safe environment.

We want to create a sustainable business and increase our profitability through solid project management and full client awareness.

To realise this ambition we develop our organisation to the level of best in class being fully synchronised with our ambition and strategy by contributing to the following key success factors constantly:

- Qualified and engaged people
- Long term client relationships
- Strategic partnerships
- Innovative solutions
- Safety and quality 100%
- Visible presence
- Full control over marine assets

SEA

sales@n-sea.com
info@n-sea.com
www.n-sea.com

Next Ocean

Next Ocean, spun-off from Delft University of Technology in 2016, provides next generation wave and vessel motion observation and prediction technology. Using radar images of the surrounding sea, Next Ocean's WavePredictor predicts waves and resulting vessel motions for the upcoming 1-3 minutes, enabling crew to avoid moments of high waves or motions for critical operations. Next Ocean's mission is to provide less risk, and more uptime this way for operations involved in Offshore Wind such as installation of transition pieces, templates, crew and cargo transfer from (C)SOV's, launch and recovery of UAV's, lifting off feeder barges and cable laying equipment etc.

Next Ocean's WaveAnalyzer provides a fully directional wave spectrum, optionally used for additional operational decision support tools such as optimal heading advice for Dynamic Positioning.
Contact Next Ocean for less risk and more uptime.

NEXT OCEAN

info@nextocean.nl
www.nextocean.nl

MEP

Voice Communication systems
MEP provides systems for Wind Farms which allows Voice communication from onshore and offshore control rooms with helicopters, ships and local staff.
This is essential to guarantee safety of staff, be able to warn ships which are sailing too close to the Windfarm or guide helicopters.

Maritime and Air Traffic solutions
MEP was founded in 1989 and has a long history in both Maritime and Air Traffic Voice communication solutions. We are proud to state that several major seaports, many Airports, Coastguards and offshore Wind farms are using our system.

One complete solution for an offshore Windfarm
Communication is often an afterthought when designing Offshore Wind farms. MEP has developed an easy to install solution which allows safe communication with all parties involved.

MEP
VOICE COMMUNICATION SYSTEMS

info@mep-info.com
www.mep-info.com

VTN Veiligheidstechniek Nederland

For 40 years VTN Veiligheidstechniek Nederland has been supplying and maintaining high quality personal protective equipment that increases the safety of people in dangerous work situations and environments. We can rightly call ourselves a leading total supplier for, among others, the fire department, police, defence and industry an offshore in the Netherlands.

VTN is also specialized in the production of breathing air systems for a broad range of applications in the chemical and petrochemical industries.

VTN
VEILIGHEIDSTECHNIEK NEDERLAND

info@vtn.nl
www.vtn.nl

SeaMar

SeaMar is a Dutch family business operating worldwide, carrying out activities for offshore projects. We provide shipping related services, ranging from vessel supply, agency & logistics, to vessel management. We are personal, switch quickly and are customer oriented with a “No-Nonsense” approach. Offshore energy and shipping is our field of activity for our integrated range of services.

Offshore support vessels
With a legacy built on expertise, state-of-the-art vessels and a forward-looking approach, we offer a comprehensive range of shipping services. Our fleet meets the demanding challenges of the offshore industry.

Vessel Management
As vessel owners we understand efficient management of vessels is crucial. With SeaMar at the helm of your vessel management, you can focus on growing your business.

Agency and logistics
Committed to efficiency, reliability and customer satisfaction, we offer services with local insights and support with a global perspective. Our team possesses knowledge of maritime operations, regulations and local practices. Our network spans key ports throughout the Netherlands.

Guard and chase vessels
Guard vessels play a crucial role in maintaining maritime security. We have an extensive track record in providing guard vessels for offshore wind, wreck & shipping lane protection, decommissioning and seismic support.

SeaMar
YOUR HEADING, OUR COMPASS

info@seamar.nl
www.seamar.nl

Whiffle

Whiffle is a leading provider in ultra-high-resolution weather data using Large Eddy Simulation (LES).

At Whiffle we are revolutionizing the Wind Energy sector with our state-of-the-art LES (Large Eddy Simulation) model. Our advanced technology seamlessly integrates comprehensive weather and environmental data, turbine specifications, and obstacle information to provide you with unparalleled insights into every aspect of your wind project such as Wind Resource and Yield Assessments including turbulence, wake, blockage and cluster effects. This is all available in a user-friendly web application or through our professional services.

For wind power forecasting (day ahead and intraday) our approach combines the power of our LES (Large Eddy Simulation) model with the latest advancements in artificial intelligence and machine learning to deliver unparalleled accuracy and precision in both day-ahead and intraday forecasting.

Our weather model runs on graphic processing units (GPUs), allowing large areas and high resolutions to capture local turbulence and underlying processes and conditions in the atmosphere. Our technology delivers benefits in many economic sectors, but our primary focus is on the renewable energy market (wind and solar energy), making sustainable energy production more predictable and reducing the costs of weather risks.

whiffle
precision weather forecasting

info@whiffle.nl
www.whiffle.nl

Maintenance

C-Cube

C-Cube International B.V. is a technology company that can prevent unplanned unavailability of assets by detecting corrosion at an early stage. This enables maintenance managers to plan preventive maintenance and determine the scope of work in a data-driven way.

Maintenance can be very invasive and costly. The aim is to reduce maintenance costs, extend service life and prevent traffic disruption. Ultimately, the solution we offer also leads to a reduction in CO_2 emissions through more efficient maintenance and life extension due to corrosion risk management.

Our Corrosion Monitoring System (CMS) technology is capable of accurately measuring corrosion degradation and corrosion rate with applications in sectors such as the offshore industry. The CMS is a permanent sensor that collects real-time data for lifetime modelling. Our technology is able to make predictions on when corrosion will start and generate the rate of visible corrosion over time. This results in extended asset life, effective risk management, cost-efficient inspections, cost savings, promotion of sustainability and data-driven decision-making.

If you would like more information about our technology, we warmly invite you to contact th@ccube.nl for a no-obligation introductory meeting.

C-Cube
International bv

jw@ccube.nl
www.c-cube-international.com

Digitaaleon specializes in AI based Smart Maintenance solutions

Smart maintenance solutions often send all data to the cloud. But let's face it: it's not always easy to set up and maintain a constant, stable internet connection. Now you don't have to. We work with a new generation of solutions that send as little data as possible to the cloud and develop these solutions in collaboration with you. Unlike other solutions on the market, we place microcomputers on your systems to do the analysis locally. That way, only necessary data is sent to the cloud, such as when an alarm indicates something needs to be replaced.

Digitaaleon offers you a complete package for AI-based smart maintenance: from identifying challenges in the maintenance process to rolling out a complete product. Contact me today and find out how we can optimise your maintenance process using AI and ML-based AI. Together, we will ensure a better and more efficient future for your business—you will be amazed by the possibilities.

Digitaaleon

sander@digitaaleon.com
www.digitaaleon.com

GranEnergia (STRATUS Energy BV)

Founded in 2011, GranEnergia is an integrated offshore energy services company, headquartered in Brazil. GranEnergia operates DP3 Semi-submersible Safety and Maintenance Vessels (UMS). These vessels have been operating in Dynamic Positioning since 2014 in Brazil and West Africa, with excellent performance.

Besides Offshore Accommodation Units, the GranEnergia group of companies has an extended Oil & Gas services portfolio to support its client Offshore and Onshore operations.

With approximately 1,000 offshore staff, well-equipped support bases and significant fabrication and storage capacity, the GranEnergia Group delivers innovative and integrated life cycle solutions in the fields of offshore maintenance and repair, logistical services and infrastructure facilities to both local and international clients in the offshore energy sector.

GranEnergia

maarten.verjaal@granenergia.com
www.granenergia.com

Corrosion & Water control BV

CORROSION has been in the business of protecting offshore wind farms, vessels and onshore applications since 1993. From our humble beginnings in the small town of Moerkapelle in the Netherlands, we've grown into an internationally recognized leader in creative, sustainable, state-of-the-art solutions in corrosion and cathodic protection.

CORROSION is market leader in protecting wind turbine foundations in an environmentally friendly way by using ICCP Our highly sophisticated ICCP and ICAF systems are utilized by companies large and small around the world, protecting their valuable assets and equipment in even the toughest and most demanding conditions. We're proud of the quality of the products we offer and the level of service we provide.

Excellence is born of experience and expertise, and our unique research laboratory at our global headquarters in Moerkapelle is the beating heart of our company. It's where we test and develop new products and services, enabling us to lead the way in creating innovative anti-fouling and corrosion solutions. Over the last three decades, we've expanded not just in terms of what we do, becoming a major global player in anti-fouling and maritime protection, but also geographically, with successful subsidiaries everywhere from Germany and France, to China and Vietnam.

CORROSION
STEEL GOING STRONG

info@corrosion.nl
www.corrosion.nl

Ridderflex & Plastics BV

Ridderflex develops and produces essential components of rubber, plastic and polyurethane, gaskets and sealing products for the offshore industry. Ridderflex believes in possibilities. A technical problem is a challenge for our team: what is the best way to help you? We will always find the best solution for your specific requirements, using all our knowledge and experience of materials, machining operations and applications. We look beyond standard materials and products.

Ridderflex products

Our rubber, plastic and polyurethane products are essential for the offshore industry. Ridderflex supplies amongst others: plastic sliding plates and strips, wear parts, rubber strips, dampening pads and even stinger rolls linings. Ridderflex excels in the production of customised products. Ridderflex: small enough to be flexible, big enough to solve your problem.

Polyurethane specialist

As a polyurethane specialist, Ridderflex's strength is producing polyurethane products. Our tensioner track pad linings, stinger roll linings and cross-overs are indispensable for the installation of pipelines, cables and umbilicals. We can adapt the material properties to the application of the product. There are no other materials in our product range, that are so flexible and versatile. Experience shows us that PU products can be the solution to numerous technical problems.

info@ridderflex.nl
www.ridderflex.nl

Rope Access Noord

Rope Access Noord (RAN) is a multidisciplinary Dutch company specialized in working at heights, depths and difficult to reach places. Our work consists of inspection, maintenance and repair on on- and offshore installations that can only or more easily be reached by our rope techniques and tools. Next to these activities we also create safe entrances, set up rescue plans, perform technical rescue, provide training on how to work safely on height and in confined spaces and we map the integrity (in co operation with our partners in drones and 3D scanners).

For our activities in the offshore wind market we created a sub division: Offshore Wind Solutions. From this division we offer experienced and internationally trained Offshore Wind technicians supported by our back office consisting of a Planner, Material Manager, QSA Manager and Technical Manager.

Our technicians maintain large components and/or small electronic parts on the entire wind turbine: foundation, rotor blades, transition pieces, substations and nacelle:

- Visual inspections: periodic physical or drone inspections (MPI, UT, VT, ET)
- Instrument inspections: periodic NDT (PCN level 2 & USM) and paint inspections
- Maintenance: rigging & lifting (rope access hoisting), bolting, welding, coating, painting, cleaning and mounting
- Training, advise & instruction to junior Offshore Wind Technicians

info@ropeaccessnoord.nl
www.offshorewindsolutions.eu

TrustLube

TrustLube designs, manufactures and installs automatic lubrication systems and monitoring systems for the maritime, dredging en food industry. TrustLube systems guarantee you will receive the exact dosage, at the correct location, at the desired time, using a precise quantity with the right product! This way you prevent downtime. And your business always moves smoothly.

Customized lubrication systems for builders of offshore wind farms

Jack-up rigs, crane ships and walk-to-work vessels that are used to build and maintain offshore wind farms all have their own unique characteristics. Thanks to our many years of worldwide experience in the maritime world, we know exactly which external influences your ships, installations and platforms are exposed to. Our AISI316 stainless steel systems defy seawater and other influences. As a result, maintenance is reduced and uptime improved drastically. And that is exactly what you need in a world where delay is not an option.

Xtreme Lubricants

TrustLube Xtreme Lubricants offer high-quality solutions for use under extreme conditions, such as maritime environments.
All lubricants are developed to improve the sustainability. There is a type of Xtreme Lubricant for every application.

info@trustlube.com
www.trustlube.com

Crew/ staffing services

Atlas Inexco

Atlas Inexco specialises in global recruitment and workforce solutions, with a focus on the energy and marine sectors. Our primary mission is to connect highly skilled professionals with companies operating within these industries.

With a significant international presence, we excel at sourcing skilled engineers, technicians, supervisors, project managers, and other experts, both for onshore and offshore projects. Our unwavering commitment to safety and industry compliance ensures that the professionals we place consistently meet the highest standards.

In addition to traditional recruitment, we offer comprehensive workforce solutions, including training and development programs. We take pride in our ability to match top talent with the specific needs of our diverse client base, which includes offshore energy firms, maritime organisations, and engineering companies.

At Atlas Inexco, we understand the unique challenges and demands of the energy and marine sectors. We work hard to provide tailored workforce solutions that drive success for both professionals and clients. Our dedication to safety, compliance, and excellence in talent acquisition has established us as a trusted partner in these dynamic industries.

office@atlasinexco.com
www.atlasinexco.com

Oceanwide

Oceanwide is an international provider of diversified through a network of offshore recruitment agencies spread throughout Europe and the USA. Our services as an agency mainly focus on recruitment for Maritime and Offshore/Energy industries. Our organization's main goal is to facilitate the perfect match between the talented new generation looking for their dream job and the values and skills employers are looking for. This is how our offshore recruitment agency thrives!

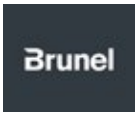
personnel@oceanwidecrew.com
www.oceanwidecrew.com

Brunel Energy Europe BV

Brunel is an international group, operating from our network of more than 100 branch offices in over 40 countries.

We currently work on many of the worlds largest projects in the following sectors: Renewable energy, Oil and gas, Mining, Infrastructure, Automotive and Life Sciences. Services provided include Perm Recruitment, Contracting & Secondment, Technical Training, Talent Acquisition, Staff Secondment, Offshore Recruitment, Career Industry Training,

Global Mobility services including New location start up, Project Management, HSE, Third Party Vendor Inspection, Commissioning.



j.zwaan@brunel.net
www.brunel.net

IPS Powerful People

iPS Powerful People has over 35 years of experience as a international recruitment and crewing agency, leveraging extensive expertise and a dedicated team to cater successfully to businesses in the Maritime, Energy, and Civil sectors.

Whether you're a client or a candidate, we share your passion for these industries, whether it's in Maritime, Energy, or Civil construction roles. iPS serves as your global partner in crewing, secondment, recruitment, and payroll solutions.

Are you prepared for what lies ahead? In a dynamic and ever-evolving market, staying one step ahead is essential. Through collaboration with both candidates and clients, we can collectively strive towards optimal solutions. Aligned with our core values, we aspire to be your preferred recruitment partner.

info@ipspowerfulpeople.com
www.ipspowerfulpeople.com

Atlas Professionals

Atlas Professionals is an international recruitment company specializing in Energy, Marine & Renewables industries. Operating globally, we strive to create a reliable, agile and sustainable business environment where our Professionals can secure the career they deserve and our Clients having means to access the best talents our industries have to offer. We do this by offering bespoke solutions – along with comprehensive recruitment planning that covers everything from work visas to payroll, and from compliance to safety inductions. Taking strength from our impressive track record and dedication for excellence, Atlas Professionals continues to be an influential recruitment company that does not shy away from innovating, refining, and progressing – evident by development of our landmark programmes such as the Zero Harm initiative and the Greenhand Programme. With more than four decades of experience under our belt, Atlas Professionals is dedicated to ensuring that we are always at the frontier of everything related to personnel recruitment and business solutions in Energy, Marine & Renewables industries.

info@atlasprofessionals.com
www.atlasprofessionals.com

TOS | Crewing & Ship Delivery

We are TOS, a loyal and authentic family business founded in 1992 in Rotterdam. Today, we are a trusted maritime service provider, connecting people from around the world, empowering and helping them find pleasure in their work. Our business is a people business. We proactively support clients in finding a flexible workforce and effective personnel solutions worldwide. We supply the very best people in the maritime, onshore, offshore & wind energy sector.

- Nautical Crew: Officers, Engineers, AB's and Catering staff
- Construction Crew: Foremen, Riggers, Gangway Operators, Electricians and Crane Operators
- Maintenance Crew: E&I Technicians, Turbine Technicians and Mechanics
- Supervisors: Lifting and Offshore construction
- Project Staffing
- Turnkey Ship Delivery

In recent years, we've specialised in building and maintaining teams for offshore wind installation and decommissioning projects in the North Sea, German Bight, America, and Asia. Our teams are used to working together and are trained to meet the highest industry standards. We take care of these teams' recruitment & selection, training, and planning in close cooperation with our clients. By entrusting TOS with these HR services, our clients gain flexible and cost-efficient solutions for their project teams.

info@tos.nl
www.tos.nl

ProPakt

Are you looking for additional Freelance Project Personnel (or work) as:

- Commercial Diving (Air, Saturation, Diver, Technicians, Supervisors)
- Remote Operated Vehicle (ROV) operators and technicians
- Hydrographic and Geotechnical Survey engineers and Party Chiefs
- Rope access technicians
- Offshore Construction managers and Client representatives
- Selected deck and offshore administrative personnel

ProPakt is the transparent self-service recruitment platform to efficiently and cost-effectively search and contract experienced, certified and verified, Freelance Professionals from the Global Offshore Energy & Maritime Industry. Either contract direct for personnel with entity or via a payrolled structure for personnel without entity. Search local to save costs and lower your carbon footprint. Download required verified certification once you are in agreement with each other and enjoy a flawless invoicing procedure which relieves the burden of bookkeeping. Register via our website.

Do you rather manage your own personnel, but still in Excel sheet status? Choose for ProPakt-Private, the customized personnel management software for a private company experience with dedicated, customized cloud-based infrastructure, including employee self-service to maintain their profile and certification.

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Colofon

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More information

Interested in offshore wind development in the Netherlands? Visit us at www.windandwaterworks.nl. If you are interested to become a Partner, contact us via windandwaterworks@nwea.nl.

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