

OFFSHORE MAGAZINE • 2018

ENERGY INSIGHT YEARBOOK

Cost Reduction

Through innovation and new technologies

Digitalisation

Will disrupt the wind energy industry

Oil Price

Will be affected by new sources of energy

Tyra Field Redevelopment

A huge jigsaw puzzle

New DTU Programme

To lower operational costs and extend lifespan of mature oil & gas fields

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INDEX
ENERGY INSIGHT

FOREWORD

2017 proved to be another exciting year for the offshore sector. The dramatic price drops on offshore wind power continued while the outlook for hydrocarbon production from the North Sea gained ground with a stabilization of the oil price after the 2016 dip and firm political engagement in ensuring long term production capacity on the Danish Shelf.

Tender prices for offshore wind hit the zero-subsidy mark in 2017 as Dong (now Ørsted) and later Vattenfall placed zero-bids on offshore wind projects in Germany and the Netherlands. The continued rapid price drops removed all remaining doubt about the competitiveness of offshore wind and there are good reasons for green optimism for the offshore sector.

As the coming Danish offshore wind parks at Horns Rev III and Kriegers Flak is being build we in the government are preparing the proposal for a new energy paradigm for the coming decade. The proposal will point to offshore wind as one of the main areas for reaching the government's target of at least 50 pct. renewable energy in 2030. It is our clear ambition that Denmark remains a global leader in development, production and exports in offshore wind power and technology.

2017 also proved to be an important year for the oil and gas sector. In March a political agreement secured the reconstruction of the Tyra field facilities and safeguarded the central hub for natural gas from the Danish part of the North Sea for many years to come. As a consequence of the agreement the Danish Subsoil Act and the Pipeline Act were amended with the purpose of making it easier for the rights holders to use other parties' facilities for extraction, transportation and treatment (third-party access) and securing more expedient incentives for users to reserve capacity and for the owner to make new investments.

In July the Oil and Gas Strategy for the North Sea was published. It was based on a fruitful collaboration between the Danish government and the oil and gas industry. The strategy lays out a useful framework for the future development of the sector by addressing issues across a wide range of topics including employment, research and development and technology deployment.

2017 was a year of changes in the sector. Apart from the important political agreements we saw changes in ownerships proving continued interest in oil and gas production on the Danish Shelf. I look forward to see great interest and activity - not least from new players in the Danish North Sea - as the 8th licensing round will be initiated in 2018.

I hope that the new perspectives brought in by new players such as Total and INEOS combined with the framework laid out in the new Oil and Gas Strategy will prove fruitful and I am looking forward to follow the continued recovery of resources from the North Sea to the benefit of the Danish society.



BY ANETTE JORSAL

Green energy and shale oil will affect oil price

The oil market is volatile and prices will continue to fluctuate in the next few years. The price will be affected by new sources of energy, plans to mitigate pollution, shale oil in the US and a weaker OPEC.



When will aircraft fly on biodiesel?

When will most cars run on energy sources other than petrol and diesel?

Large countries, like China and India, are plagued by pollution and plan to encourage more widespread use of green sources of energy. What difference will these plans make?

No one knows. We do know, however, that all three questions will affect oil prices in coming years. As the price of oil rose steeply until 2014, many oil-importing countries adopted a greener approach to energy. Oil was just too costly. After oil prices plummeted in 2014, there were still many good reasons to find alternatives to fossil fuels, not least in the transport sector, which accounts for 55 percent of world oil consumption.

- "We expect to see radical changes in transportation in the coming years. Initially, we will see many more electric cars on our roads. We can then expect to see the road haulage and ultimately even air transport and shipping sectors looking at eco-friendly solutions," says Thina Saltvedt, energy analyst at Nordea in Norway. Bloomberg has recognised Thina as one of the sharpest energy sector analysts they know.

- "The real issue is 'when will the new sources of energy make a breakthrough?' They are already making headway – fast. I hear that in the US the first biodiesel-driven aircraft is already in the air.

- Within the next two or three years, we will see changes in transport sector demand for oil, especially because large countries, including China and India, have focus on pollution. For many years, standards of living in China improved rapidly but China's growing economy has had a negative impact on the quality of its rivers and air. The Chinese now have to clean up. China is therefore setting its sights on a greener economy, in which economic growth will no longer be achieved at environmental cost but in harmony with the environment.

- In India, there is widespread concern about urban pollution. The government is considering a ban on cars that run on oil or diesel."

Thina Saltvedt believes that the petrochemical industry that uses oil to produce e.g. plastics and drugs will also change.

- "There has never been anything to rival oil in the petrochemical industry. However, the discovery of huge islands of plastic in oceans across the globe and microplastics in fish has prompted this sector to take action. The petrochemical

industry now has to find convincing alternatives. In early March, the LEGO Group announced that it was ready to produce the first LEGO bricks made of sugar cane. Manufacturing industries are looking at ways to minimise oil consumption and find alternatives," says Thina. Early this year, she predicted that oil prices would simmer at around USD 65 throughout 2018.

Shale oil and OPEC

The global oil market used to be much simpler. In the past, if they decided they wanted a higher price, the OPEC countries reduced oil output, and vice versa. Today, OPEC's role is less important, primarily because USA is becoming increasingly efficient at mining shale oil.

- "The Americans are adept at extracting shale oil from the underground and the balance of power has changed. OPEC was once the dominant player in the oil market but US influence is growing all the time, partly because oil prices have risen and partly because shale oil extraction technologies have improved,"

says Kim Blindbæk, a macroanalyst at Sydbank, who keeps an eye on the oil market. He continues:

- "OPEC can only sit back and watch a US oil production boom while OPEC members continue to lose market share."

The OPEC countries have currently reined in production. This has helped to boost the price of oil but those who benefit most are the Americans.

- "It costs more to extract shale oil in the States than to pump oil up in the Middle East so the higher OPEC succeeds in raising prices, the more incentive the Americans have to increase production.

- People are asking for how large a shortfall in Middle East oil production the US can actually compensate. The signs are that the US shale oil barons are able to send more oil onto the market in the short term but opportunities to do so in the long term are more limited.

- If we look at prospects for the next couple of years, I believe oil prices will increase but only slightly. There will be no drastic price jumps," says Kim Blindbæk.





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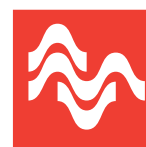
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BY KARIN JENSEN
PHOTO DWIA

APQP4Wind successfully celebrates first year with 1,500 distributed manuals

The APQP4Wind project has just celebrated its first year with approximately 1,500 manuals distributed throughout the value chain. The next step will be finetuning the manual and making the industry quality planning standard a global tool.



The APQP4Wind manual was officially launched on 25. January 2017 and now, one year on, approximately 1,500 manuals have been distributed throughout the entire value chain and more than 450 people have attended training courses worldwide.

“The concept is spreading like a wildfire and we’re getting inquiries from the USA, China and many other places,” said Kim Nedergaard Jacobsen, Senior Project Manager at The Danish Wind Industry Association.

Training courses are held by the two training providers, DNV GL and Bureau Veritas, which are approved by APQP4Wind. Courses are primarily held in Denmark, but also in China and USA. The courses are held in English, but because many Danish manufacturers have local employees in China, some courses are held in Chinese while the material is in English.

“In China, many people read English but often don’t understand English when spoken,” said Kim Nedergaard Jacobsen.

China is the world’s largest wind energy market and therefore a crucial market to

have on board in the deployment of the APQP4Wind framework. Not only is it beneficial for those companies already working with the APQP4Wind standards but it also underlines and supports Denmark’s role as a major influencer and trailblazer in the further development and maturing of the global wind sector, according to the APQP4Wind website.

Courses in Germany and Serbia are currently being planned while other locations such as Spain, Turkey, South America and India are on the drawing board a bit further ahead.

“The aim is for the APQP4Wind concept to be global,” said Nedergaard Jacobsen.

Spreading the training courses to numerous locations is part of the next step, which will also see a finetuning of the manual.

“We’re still in the start-up phase and there are still some things that need to be adjusted. Now when the manual is being tested in real life, we detect errors, or we get feedback from people. It’s a never-ending story and obviously we need to improve all the time,” said Kim Nedergaard Jacobsen.

The APQP4Wind project started as a cooperation between manufacturers, utilities and sub-suppliers in the wind industry. The steering committee consists of Vestas Wind Systems, Siemens Gamesa Renewable Energy, KK Wind Solutions and LM Wind Power while the Danish Wind Industry Association is project facilitator with the help from a newly appointed network coordinator.

The Danish Industry Foundation has provided funding for the project, which has been invaluable, said Nedergaard Jacobsen and added in the summer 2018, the Industry Foundation’s funding will come to an end.

“We still have some funds left but once the funding from the Danish Industry Foundation comes to an end, we’ll have to find out how to run the project going forward.”

“The idea is that the APQP4Wind project will be an independent organisation in future. The Danish Wind Industry Association will function as service provider for the future APQP4Wind organisation,” Kim Nedergaard Jacobsen said.





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DANOIL EXPLORATION A/S



BY ANETTE JORSAL

PHOTOS AND ILLUSTRATIONS: COURTESY OF MAERSK OIL AND SEMCO MARITIME

TYRA MEANS PLENTY OF WORK – in Denmark and abroad

Many Tyra redevelopment contracts signed. Platforms will be produced in the Far East and Italy. Local engineering companies have already spent about 200,000 man-hours preparing for the Tyra redevelopment.

It is not true to say that everything on Tyra is destined for the scrapheap. Parts of the Tyra facilities will be modified in line with this important project's overarching design principle that includes an intention to re-use many of the existing structures.

For example, Maersk Oil asked local engineering companies in Esbjerg to calculate the cost of extending platform jackets. They replied that the jackets on six platforms are suitable for modification.

According to Morten Hesselager, Head of Tyra Future Development at Maersk Oil, local engineering companies have already worked 200,000 hours in preparation for redevelopment work.

Will shift 100,000 tons of steel

At a cost of DKK 21 billion, the Tyra Field redevelopment is the biggest investment ever made in the Danish North Sea. Before production on Tyra recommences in 2022, millions of man-hours will have been spent on the redevelopment in Denmark and abroad. About 100,000 tons of steel – the weight of 14 Eiffel Towers – will be lifted in connection with platform disposal and reinstatement.

The first major contracts were put out to tender in Q1 2017.

–“The massive Tyra redevelopment project will affect the EU energy infrastructure so we are subject to the usual restrictions and regulations regarding our choice of suppliers. We have conducted comprehensive studies to ascertain which companies have the capacity, competences and experience needed to perform specific assignments,” explains Morten Hesselager,

Head of the Tyra Future redevelopment project.

The largest contracts, including those regarding the production of new platforms, were signed at the end of 2017 and early in 2018. McDermott will build seven of the eight new platforms. While engineering work will be done in Kuala Lumpur and physical production in Indonesia, Rosetti will produce the accommodation platform in Northern Italy.

The task of removing existing platforms has also gone to foreign specialists. Heerema Marine Contractors (HMC), based in the Netherlands, will remove the wellhead and riser platform topsides. AllSeas will remove the two existing processing platforms.

–“HMC and AllSeas both use huge construction vessels with multiple crane beams. The vessels lift the platform topside onto a barge for transportation into port. They reduce the amount of offshore work by moving this work to shore where working conditions are much safer,” says Morten Hesselager.

The redevelopment contracts stipulate that ship-breaking processes must be sustainable and that Maersk shall approve the shipyard proposed by the two companies.

Morten Hesselager expects that construction and redevelopment of the new Tyra Field will add up to about 1.5 million hours of work, i.e. the project will create about 500 jobs, primarily for skilled workers, most of whom will be employed by local companies.

There will be many O&M jobs on Tyra.



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-“When she is up and running again, Tyra will be a huge operation to the value of DKK 0.5 billion a year. Tyra will inevitably generate turnover and boost employment in the local area,” says Morten Hesselager.

Satisfaction at Semco Maritime

Semco Maritime welcomes the prospect of more work in connection with the Tyra Future Development project. By dint of a framework agreement with Maersk, Semco Maritime already supplies some of the workforce that operates the Tyra Field. Semco Maritime can now look forward to supplying more workers in connection with not only the shutdown but also reconstruction (e.g. welders and electricians).

Semco Maritime will bid for many other tasks related to the new platforms that will be built by multinational corporations in Italy and Indonesia.

-“We hope to sell technological solutions similar to those we have delivered to Maersk on previous occasions. We offer solutions within communication technology, ranging from telephony through sea-to-land communications, and TV and cinema on the platform to firefighting systems. We have sold

solutions to Asian shipyards in the past. We will not know if we have won the Tyra contracts until the end of this year but we do know we are competing in a strong, international field,” says Steen Brødbæk, CEO at Semco Maritime, who is also aware of opportunities for his company to win steel construction contracts at its shipyard facilities in Esbjerg, Denmark.

According to Steen Brødbæk, Semco Maritime is “very confident” that it will win some of the Tyra Field contracts. On a more general note, he is pleased that, in 2017, the parties involved in oil & gas activities in the North Sea – Maersk Oil, DUC and the Danish state – decided that activities would continue.

-“For a company like ours, it is important that activities in the Danish North Sea continue because if we were not strong on our domestic market, we would find it harder to make our presence felt internationally. Make no mistake: Denmark is our home market. Without Tyra, all hope of convincing the government and the Danish Parliament of the need to develop other fields would have been lost. Tyra is important for the oil & gas industry. The Tyra agreement will also prolong the lifetimes of other fields and create jobs in the future,” says Steen Brødbæk.



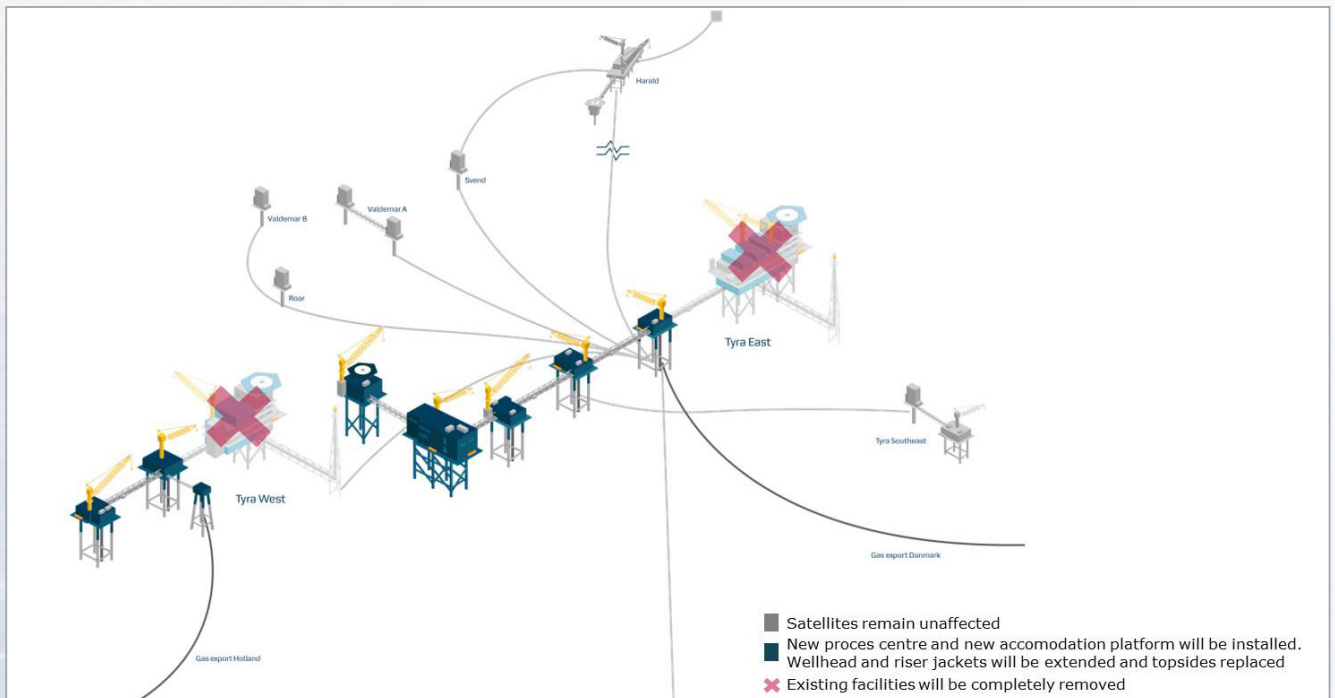
Redevelopment of the Tyra Field is a huge jigsaw puzzle that has three main pieces:

Firstly, the platforms, bridge links, pipes, etc. that cannot be re-used will be removed and decommissioned.

Secondly, new platforms will be produced and new facilities constructed, including a new process structure and a new accommodation platform.

Thirdly, comprehensive refurbishments will ensure that parts of the facilities that can be extended, i.e. the jackets on six wellhead and riser platforms, will be modified to fit the new units. The existing jackets will be extended by more than ten metres to raise the platform and allow for further sinking into the seabed. New platform topsides will be mounted on top. This alone will take 1.5 million man-hours.

- “This is a huge jigsaw puzzle and our job is to make the pieces fit. We’re in for a lot of planning and logistics,” says Morten Hesselager, who is Head of the Tyra Future Development project.



Facts

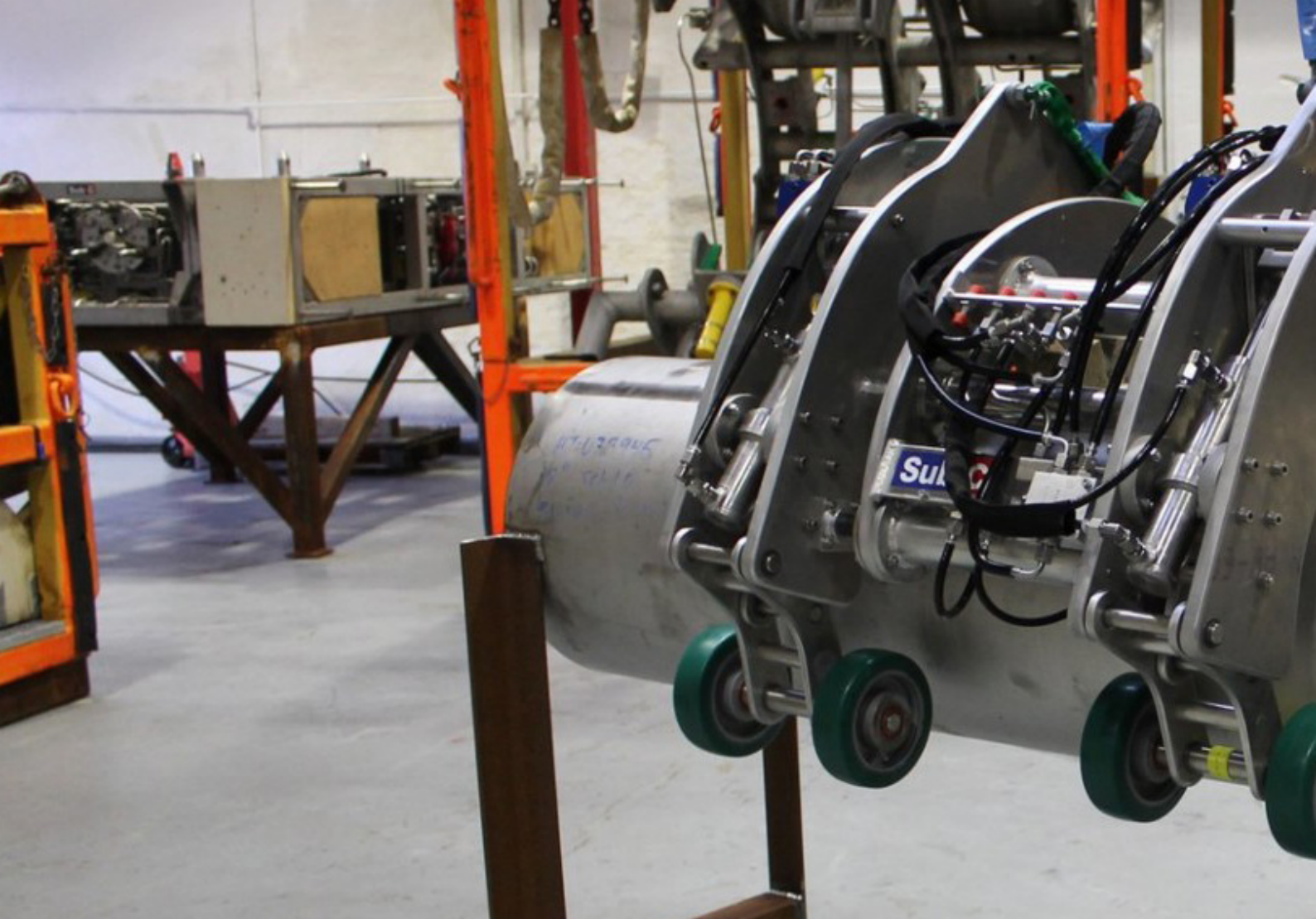
The Tyra Gas Field, situated 225 kilometres off the Danish North Sea coast, comprises two integrated process and accommodation platforms – Tyra East and Tyra West. There are also five unmanned satellites. New process platforms will

replace Tyra East and Tyra West, and a new accommodation platform will be built.

The Tyra Field will be shut down from 2019 until 2022.

Semco Maritime hopes to recruit many new employees. CEO Steen Brødbæk says that most will be hired via other companies, which have surplus capacity.





BY ANETTE JORSAL
PHOTO SUBC PARTNER

JACKET CRAWLER INSPECTIONS IN THE SPLASH ZONE

The Tyra Field shutdown and redevelopment present unique challenges. Difficult tasks require inventive solutions. SubC Partner in Esbjerg has invented a new tool to inspect Tyra's spider decks at the splash zone.

What do you do when it is not safe to use divers or rope access in connection with a redevelopment task on the Tyra Field? The work in question has to be carried out in the splash zone. An innovative new solution was required that would prevent personnel having to slosh around in the waves with all the risks involved in such an endeavour.

On Tyra, the spider decks are located between the platforms jackets. This deck was originally about six metres above sea level. However, as the platforms have been settling on the seabeds for years, the spider decks are now at water level. Inspecting the pipes to check their condition and ascertain whether they can be re-used in Tyra Field redevelopment work is therefore very difficult.



Difficult task in the splash zone

Esbjerg-based SubC Partner has been assigned the task of inspecting the spider decks. From the outset, Tonny Klein, CEO at SubC Partner, knew that neither divers nor rope access technicians could resolve this task.

- “It is too hazardous for personnel to work in the splash zone. While divers work underwater, rope access work takes place above the water line – and combining diving and rope access is not a workable option.

- Fortunately, The Tyra Future organisation at Maersk have some innovative guys that gave us the possibility to design, build and operate a system that we could lower from the topside. The system can secure itself on the spiderdeck structure and crawl around on the structure. We call it the Jacket Crawler.

- The Jacket Crawler was initially sent down to remove marine fouling (biofouling, e.g. mussels) using 500 bar high-pressure water jetting. The Crawler tool then measured pipe thicknesses using an ultrasonic gauge. Thirty-six measurements were taken around each pipe at 50 cm intervals. We made several thousand measurements in all,” says Tonny Klein.

SubC Partner completed measurement work on the spider deck of the first platform in March.

- “The operation was an unmitigated success. Not only did we get the Maersk the measurements they need. The solution also saved Maersk a very large sum of money. If Maersk had had to charter a diving vessel, the cost of mobilising the vessel itself would have run to several millions of Danish Kroner. Moreover, divers would have been asked to tackle extremely risky work due to the ocean waves.

- Although a complicated set-up, the Crawler requires only a few specialists to operate it. Our invention is a very low cost solution,” says Tonny Klein.

Potential for the new system

SubC Partner expects much of the remote-controlled system that it has developed, tested and now used in the field. The Crawler tool can be modified to perform many different tasks, including welding inspection work and high-pressure water jetting of jackets and pipes to remove marine fouling, i.e. work that costs many millions of Danish Kroner each year in the North Sea.

SubC Partner hopes to win more projects in connection with the Tyra Future redevelopment project. At the beginning of March, another important order ticked in; to cut pipes on the spider deck. The new version of the Crawler tool will have a diamond wire cutter attachment.



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The background of the page is a dark blue, slightly textured surface. In the upper left corner, there are two faint, stylized silhouettes of offshore wind turbines. The rest of the background is a solid dark blue.

BY KARIN JENSEN
PHOTO OFFSHOREENERGY.DK

The offshore wind industry looking to cut costs through innovation and new technology

Gone are the days when the offshore wind industry reduced the Cost of Energy by cutting costs in the value chain. Now, focus has turned to cost reduction through innovation and new technologies.

The offshore wind industry has been very successful in reducing costs in recent years to make the industry more competitive with other energy forms. What has changed recently is the shift away from cost cuts at sub-supplier level to innovation and new technologies.

“It’s getting more difficult to achieve cost-out gains at the supplier level only and there is a growing understanding in the industry that the way forward is reducing costs through innovation and new technologies, new solutions that are not in the market today,” said Glenda Napier, CEO at Offshoreenergy.dk.

Offshoreenergy.dk is the Danish cluster organisation for the offshore industry and it has developed a new concept, CRIF, or Cost Reduction & Innovation Forum, through which it facilitates the development of new solutions.

“CRIF is a systemised process where we run a number of projects with the aim to contribute to cost reductions. But it needs to be new solutions or new processes, or even new common standards,” said Napier.

The CRIF projects always have a problem owner and a group of problem solvers. The problem owner must be a large company that can take ownership of specific challenges and thus implement a possible new solution. The problem owner then posts its problem, or challenge, and Offshoreenergy.dk tries to match the company with a group of problem solvers, typically smaller companies.

“CRIF must lead to concrete new solutions that actually reduce costs of energy. As concrete as possible and solutions that can be implemented within a relatively short period of time. The process shouldn’t take more than two years,” said Glenda Napier.

New inspection method of blades

The latest CRIF project is the development of a new common technology for warranty inspection of wind turbine blades, which will help prolong the lifespan for the blades while at the same time lowering costs considerably.

The problem owners here are Vattenfall, E.ON and HOFOR, which together with 31 other wind turbine owners in an EUDP-funded network, The Blade Group Network, are looking for a new concept for the final inspection of blades prior to the expiration of the warranty period.

“The project will seek to find new solutions to improve the inspection of blades and to determine the conditions of the blades.”

“Previously, the inspection was looking at cracks on the surface of the blade. This new method will do the inspection from the inside of the blade and will be much more precise,” said Glenda Napier.

The new method being developed will be using NDT-methods such as thermography and ultrasound.

A new wind partnership, which was launched in October 2017, aims to unite the industry on common standards. Backed by Vestas Wind Systems, MHI Vestas and Siemens Gamesa Renewable Energy, and with Offshoreenergy.dk as the facilitating platform, the partnership will cooperate on innovation across the value chain.

“The three problem owners are keen to meet with sub-suppliers and discuss common standards and new common

solutions. The industry has developed rapidly, but standards have not followed, so establishing common standards will reduce costs because you don’t have to start from scratch every time,” said Glenda Napier.

The challenge today is that wind turbine producers have set different requirements for their sub-suppliers, and the risk is that it will end up being much more expensive to solve the tasks the serves the same purpose.

“The partnership consists of nearly 30 sub-suppliers working on developing common standards in different areas,” said Napier.

Accelerator

Wind industry companies cannot do all the innovation themselves and it is essential that start-ups and new companies enter the offshore industry. Therefore, Offshoreenergy.dk has established a scale-up accelerator project with Syd Energi SE and Business Development Esbjerg.

“It’s not enough that existing companies in the industry innovate. We need start-ups and new companies in the industry too,” said Glenda Napier.

Typically, it is companies and start-ups from other industries, for example companies involved in big data, drone and robotics technology, that take their innovation to the offshore wind industry and seek new solutions.

An example of companies from outside the offshore industry involved in innovative solutions, is a drone monitoring project. Semco Maritime cooperates with LIC Engineering, Drone Solutions, Svendborg Measurement Service and Dansk Fundamental Metrologi to develop the new solution, which will make it easier to inspect and monitor corrosion with the use of drones.

“Expectations for this project are rather high. The technology is ready and will be tested in a couple of months and then, hopefully, it will be in use within a year,” said Glenda Napier.



Glenda Napier, CEO at Offshoreenergy.dk



BY KARIN JENSEN
PHOTO ENVISION ENERGY

Envision Energy testing new EcoSwing superconductor with large cost reduction potential

Envision is currently developing a superconductor, EcoSwing, which has the potential to reduce CoE significantly. Series production is expected in four years.

Chinese-owned Envision Energy is more than a wind turbine producer. It is a smart energy solution provider. Innovation and advanced technology play a key role in keeping the company at the forefront of the renewable energy industry while at the same time helping to bring down the Cost of Energy (CoE).

The latest addition to the Envision family of innovation is a High Temperature Superconductor (HTS), the EcoSwing, which is about to be tested in Bremerhaven, Germany.

“The HTS generators for wind turbines offer great perspectives. When talking mass production, savings are approximately 30% compared with wind turbines using Permanent Magnet, Direct Drive technology, which is the norm today in offshore wind,” said Anders Rebsdorf, director at Envision Global Innovation Centre in Denmark.

Further to that, it will be possible to cut costs slightly on the floating foundation because the weight here will be reduced by 5-10%, said Rebsdorf.

Superconductors can conduct electricity without resistance, making them highly complementary to energy efficient technologies as a substitute to copper. Compared with copper, superconductors carry 100x the current density, making electrical machinery compact and lightweight. Vastly reduced

material usage contributes to making the technology highly competitive to conventional machinery.

“The advantage of the HTS is that it weighs less and takes up less space than generators used in commercial wind turbines today. The smaller generator weight means reduced costs on the bearing steel structures in the nacelle. And with a less heavy nacelle, the costs of the tower and floating foundation will fall too,” said Anders Rebsdorf, adding floating foundations will be the next big thing in offshore wind.

Envision's EcoSwing superconductor has been constructed in France and will soon be transported to Bremerhaven in Germany, where it will be tested at the test bed of the Fraunhofer Institute.

“It's the first full-scale superconductor generator for a wind turbine and once the prototype has been through the test period at the test bed, it will continue its journey to Thyboron in Denmark, where it will be demonstrated at the Envision 128-3.6MW turbine,” said Anders Rebsdorf.

Envision expects to have the optimised design ready within 18 months and a 0-series in roughly three years.

“This means we can look forward to series production in four years and proper volume in six years from now.

It's a relatively fast development when talking ground-breaking innovation,” the Envision director said.

Large rotor for low wind speed areas

Envision has a strong presence in China, but with low average wind speed in this market, it is not the bigger wind turbines being in demand here. Envision's wind turbines for the Chinese market are often below 5MW but with large rotor.

“The latest official rotor size we used was 148 metres, but we also work with even larger rotors. Over the past year we have begun designing and specifying our own blades,” said Anders Rebsdorf.

With a lower average wind speed in China compared with the North Sea, the rated power will be reached only for a limited number of hours per year if using a large generator. Thus, the combination of a large rotor and “medium sized” generator is so well suited for the Chinese market, according to Anders Rebsdorf.

“A turbine with a rated generator power of eight, nine or even ten megawatt and rotor size of, say, 164 metres would not be suitable for the Chinese market due to the low average wind speeds. Relatively small generator power and a rotor getting close to the size used in the North Sea, that's relevant for our Chinese customers,” he said.



Anders Rebsdorf, director at Envision Global Innovation Centre in Denmark



From Nysted to Nissum

– Aarsleff celebrates 15 years of Danish offshore wind

Aarsleff has installed 247 foundations for offshore wind projects in Danish waters over the past 15 years. The latest installation work was four newly developed hybrid jacket foundations for the Nissum Bredning project, a pilot project testing new technology for future offshore wind projects.

It started in 2003 with the installation of foundations for the 72 nos. 2.3 MW offshore turbines at Nysted Offshore Wind Farm. Now, 15 years later, Aarsleff has just completed its work with the Nissum Bredning project, which is a completely different game altogether. Not only have the turbines more than tripled in size, the Nissum Bredning project is also testing new technology for turbines, foundations and cables to be used at future offshore wind farms, which are located at much deeper water depths.

“The innovative gravity jacket concept has been developed by Siemens as an alternative to the traditional jacket foundations, which is the technology used when water depths are too deep for monopiles. The gravity jacket is a hybrid, using a combination of traditional steel jackets and concrete transition pieces,” said Esben Linnet, Chief Divisional Engineer at Aarsleff Construction.

Steel jacket foundations are expensive and with an industry constantly looking to lower the cost of energy, an alternative concept was in need. The solution was the hybrid steel jacket and concrete transition piece.

As a sub-contractor to Siemens, Aarsleff has been part of the development phase and worked closely with the wind turbine producer, providing input for the new gravity jacket concept.



“Nissum Bredning has been very different. We basically had to reinvent the installation process and come up with new solutions to new types of challenges. For example, the 70 meters inclined piles. Inclined piling has never been done before on an offshore project and it was a real challenge, which required specially developed equipment,” Esben Linnet said.

Nissum Bredning consists of four Siemens SWT-7.0-15 turbines and is located on the windy West coast of Jutland. In 2015, the Danish Energy Agency (DEA) issued an invitation to apply for test arrangements for new offshore technology and later that year, Siemens Wind Power and the two owners, Nissum Bredning Vindmøllelaug and Jysk Energi, forwarded their application. In February 2016, DEA announced the 28MW “Nissum Bredning – Testbed for new technology and integrated design” project as winner of the competition.

Aarsleff was subsequently awarded a contract for the installation of the foundations as well as production, transport and installation of the transition pieces, each weighing approximately 1,100 tons.

The project has been a showcase of collaboration between the different departments of Aarsleff, including Mechanical Design, Design & Engineering and Aarsleff Biz, all working as “One Company” together with the Offshore Wind and Special Marine Projects department.

“Throughout the process we’ve had an excellent cooperation with Siemens’ project team and the appointed Marine Warranty Surveyor. All the installation methods we developed and used needed to be certified for both safety and insurance purposes. It’s



a standard thing, but fantastic to see such a close and pro-active cooperation between so many different partners,” Esben Linnet said.

Installation of the foundations was completed in December 2017 and in January this year, Siemens installed the last turbine. Power production is expected to commence early this spring and will provide electricity for approximately 20,000 households.



Focus on Danish offshore

Aarsleff has been part of Danish offshore wind since the beginning and plans to continue being part of Danish offshore wind in future.

“There’s quite a gap between the large offshore projects in Denmark, but our goal is to be part of as much as possible in Denmark and we’re bidding for all the contracts,” said Esben Linnet.

Before Nissum Bredning, the most recent offshore farm in Denmark was the 400MW Anholt project, which was inaugurated in September 2013.

“The next project could be the Vesterhavs project, which is located South West of Thyboron just a few miles from Nissum Bredning. The Vesterhavs project is being tendered right now while the planning stages will commence in 2019. Installation will take place in 2020,” said Esben Linnet.

Another project Aarsleff is tendering for is the 604.8MW Kriegers Flak in the Baltic Sea, the largest offshore project in Denmark to date. Foundations at Kriegers Flak will be installed in 2020, before the offshore farm will be fully operational in 2021.

“Aarsleff is the only larger Danish offshore wind contractor left. That’s something we’re very conscious about and that’s why we remain fully committed to Danish offshore wind.

“And Aarsleff is so much more than wind so it’s not a problem that there may be some years between the large offshore projects here,” said Esben Linnet.

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THYBORON
PORT

BY KARIN JENSEN

IT'S ELECTRIFYING

How digitalisation will disrupt the wind energy industry in future

Digitalisation is the new buzz word in wind energy and will change the industry dramatically in coming years. Better utilisation of data will help optimise operations and maintenance work but will also see the emergence of new business models and constellations of cooperation, while new players will enter the scene.



Digitalisation and big data offer new ways of utilising data better, benefiting the entire process in wind energy production. From optimisation of production and administrative processes, to site design, better equipment performance and operational performance. And in an industry constantly looking at ways to lower costs, digitalisation will play a key role in coming years.

"The wind energy sector is represented by companies of all sizes, some manufacturing very heavy components, others offering small, simple service jobs, so digitalisation in this industry can be a number of different things. Big and small," said Jan Hylleberg, CEO at the Danish Wind Energy Association.

Hylleberg said logistics and distribution, processes and relations with partners and sharing data and knowledge are all areas where new digital solutions are being sought.

"Something I believe we'll see in coming years is new constellations of cooperation. The knowledge you have in your databank will suddenly have great value because others can use it in their business to create extra value through an improved competitive situation," said Hylleberg.

Jan Hylleberg, CEO at the Danish Wind Energy

Even though digitalisation and gathering data has been a top priority for years, it is a process still at its early stages.

“We have only just begun scratching the surface, but in coming years things will go really fast,” said Preben Birr-Pedersen, Cluster Manager at House of Energy, the Danish cluster for sustainable energy technologies and production.

Birr-Pedersen said it is not because artificial intelligence (AI) has changed that much. The algorithms and mathematics behind AI are not new. What has changed is the access to giant amount of data and a computer power that can process these data.

“When we get quantum computers we will see a giant leap, probably within the next five years. It will be a giant leap for society but also very much for the energy and wind sector,” said Birr-Pedersen.

Birr-Pedersen said focus in the wind industry has for years been on reducing the Cost of Energy (CoE), a process helped along by data. The next big step forward will be to increase the value of the energy produced and here digitalisation will be, if not more important, then at least as important, he said.

“We need to find out when to produce energy by having excellent insight into wind forecasts and at the same time have a strong insight into the energy market. If it’s very windy at a time when energy consumption is low, then perhaps it’s better to produce biogas for an hour, or heat or store in a battery. This requires digitalisation and huge amount of data as well as someone who’s good at digesting these data,” said Birr-Pedersen.

One thing is to extract value from the data, another is data mining, or the art of discovering patterns and structures in large data sets.

“IT engineers need to cooperate with traditional wind engineers. It’s this cross-fertilization, which will seriously create radical innovation and move things forward. That’s when we’ll see digitalisation gain real altitude,” said Preben Birr-Pedersen.

One example is the area of energy storage and system integration where big data will help find out when to store energy and when to move it to another energy form, couple gas, electricity and heat by making data from all three sectors available for the national grid operator. This will optimize the energy system tremendously.

At the beginning of February 2018, Vestas announced acquiring Utopus Insights Inc., an energy analytics provider with 15 years of experience in solutions development, a suite of innovative digital products, over 30 patents, and a highly experienced team with data science expertise in analytics, power engineering, energy software development, and meteorology.

Vestas said in a statement that it is looking to offer customers digital solutions to deliver greater predictability, increased renewable energy production, more efficient operations, and better integration with energy grids. This transformation means energy systems and power plant owners must improve forecasting accuracy for renewable production, optimise output from each individual generation asset and orchestrate a portfolio of resources across multiple sites and equipment types. They must also do so in a cost-effective manner that ensures grid stability as renewable energy sources gradually replace conventional, fossil-fuel generated power plants, said Vestas.

Preben Birr-Pedersen, Cluster Manager at House of Energy, the Danish cluster for sustainable energy technologies and production





And with more and more fluctuating renewable energy in the grid, this becomes even more evident in future.

“The first 50% renewable energy in the grid was difficult, the next 50% will be even more difficult and requires use of data as well as system integration,” said Birr-Pedersen.

Birr-Pedersen said when the discussion turns to storage of energy then it is important to distinguish between the time one needs to store and the amounts that need to be stored.

“You can store very large amounts of energy in the gas system for a long time without any real losses. In the heat system, you can store large amounts but for a shorter time. In electricity, or batteries, you can store even less time and not as large amounts,” said Birr Pedersen, adding all elements are important.

Site design

Another area where digitalisation is being used is in virtual site design. The possibility to create several scenarios and find out, which site layout is the most optimal before starting to invest in the actual construction and machinery.^{1/2}

“With digitalisation, you gain access to roads, wind conditions, electricity grid, all the different factors that go into a wind project. You can create the optimal site layout way before you would normally begin to install the turbines,” said Anders Rebsdorf, Director at Envision Global Innovation Centre. He said that once the turbines are installed, roads are constructed, and cables laid, your decisions are locked.

Envision Energy has even turned this into a new business and has developed a tool which makes it possible to plan more thoroughly at the very early stages of site design. Together with the owner of the land, or the energy company controlling the site, the most optimal decisions can be made.

“It’s a very effective way for the customer to make decisions. Knowing more about weather conditions also eliminates the risks. Once you know where the turbine will be placed, you can match the technology with the weather conditions, or challenges, facing the turbine,” said Anders Rebsdorf.

Anders Rebsdorf, Director at Envision Global Innovation Centre

Worldwide maintenance of wind turbine blades



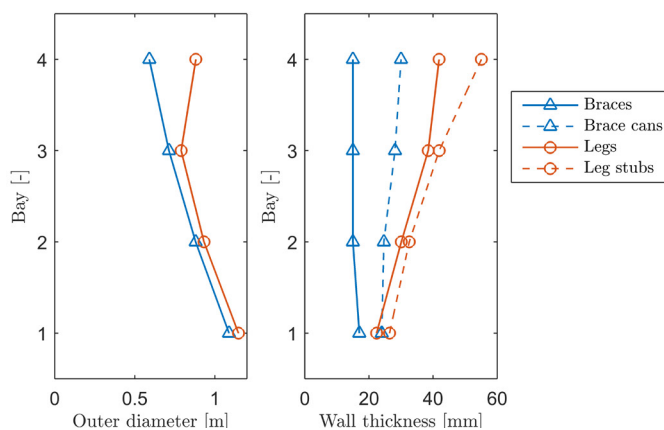
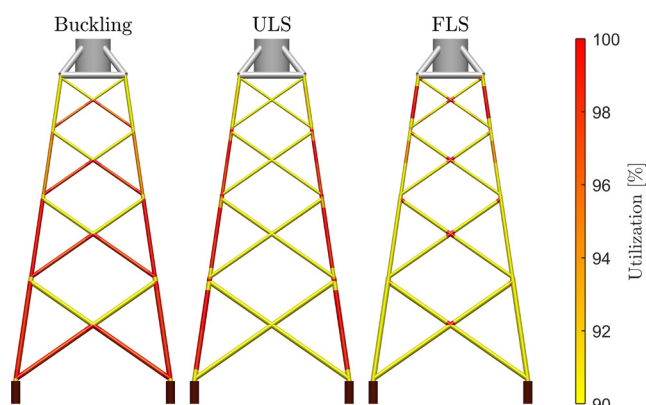
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DTU Wind Energy
Department of Wind Energy

BY KARIN JENSEN

ALL CHANGE IN THE DANISH NORTH SEA, BUT FUTURE LOOKS BRIGHT FOR THE DANISH OIL & GAS INDUSTRY

Over the past year, the two largest Danish oil & gas companies have sold their operations to foreign oil groups. Although it signals an end to an era, there is no need to feel sad. The new owners, Total and Ineos, will ensure Danish North Sea production for many years to come and may be a strong asset for society.

In 2017, both AP Møller-Mærsk and DONG Energy (now Ørsted) decided to divest their oil & gas businesses, selling their E&P operations to France's Total and UK-based Ineos, respectively. The timing of the divestments may seem planned, but nothing could be further from the truth.

"For both the companies, the decisions to divest the oil & gas operations, were based on new strategic directions and the ambitions each had for the future," said Morten Imsgaard, Senior Analyst at Sydbank.

For AP Møller-Mærsk it was a break with its conglomerate structure and a decision to focus on transport and logistics in future, that meant a farewell to oil & gas production. Ørsted, meanwhile, will focus on creating an energy company rooted in renewable energy, which meant that the oil & gas unit no longer fitted its profile.

"It was entirely by chance that both decided to leave oil almost simultaneously, but the reason was the same, that new strategic decisions had been made," said Imsgaard.

At Oil Gas Denmark, the trade organisation for the oil and gas sector in Denmark, Managing Director, Martin Næsby, agreed that the timing to divest the oil & gas operations was a coincident.

"What is unusual is that it has been so static for so many years in Denmark. That both AP Møller and Ørsted decide to divest their oil operations at the same time, is a coincidence," said Martin Næsby.

Næsby noted that the US oil giant Hess Corp has also announced it plans to sell Hess Denmark and focus on America and offshore Guyana.

"It's three different companies pursuing three different strategies. Timing is the same but that's down to coincidence," said Martin Næsby.

The new owners in the Danish section of the North Sea, Total and Ineos, both have oil & gas production as their core business and both are strongly committed to oil & gas, and this may prove to be a decisive factor.

"Oil & gas production requires massive long-term investments and you need to have oil & gas as a core business to be able to lift this. The oil & gas businesses fit much better with Total and Ineos."



Martin Næsby, Managing Director at Oil Gas Denmark

“Total and Ineos both seem keen to invest whatever it takes to develop and maintain the Danish section of the North Sea, so from a societal perspective, you could not have found better buyers than these two,” said Morten Imsgaard.

Another long-term benefit is the commitment of both Total and Ineos, which will be an advantage for Denmark.

“For example, when we look at decommissioning. We have two solid companies, which both take their social responsibility seriously. I see no risks anywhere,” said Morten Imsgaard.

Denmark new regional anchor

When completing the acquisition of AP Møller-Mærsk’s oil assets on March 8, Total announced that Denmark will become a new regional anchor point for Total with strong Copenhagen and Esbjerg bases, supervising all of Total’s operations in Denmark, Norway and the Netherlands. Moreover, the Copenhagen office will host the Senior Vice President of Total’s North Sea and Russia Business Unit while a new Technical centre will be established in Copenhagen, supplementing Total’s existing centres in Paris and Pau.

“We think this holds very exciting perspectives. It will create jobs in Denmark and provide for very exciting challenges for young people, who are interested in working with the task of ensuring the energy supply in Denmark. But also for the employees of Maersk Oil, who have the opportunity to seek new challenges globally,” said Martin Næsby.

Næsby said he hoped this will benefit and create new opportunities for the Danish supply chain too.

“Obviously we’ll do what we can to contribute so that all parts of the supply chain benefits from producing oil & gas in Denmark, to help ensure that production happens under safe conditions, both for employees and for the environment. It’s a great advantage for Denmark, and a position of strength we should hold on to for as long as possible,” he said.

Furthermore, it is important that Denmark, in its transition to a CO2 neutral society, can ensure Danish oil & gas production and that the oil & gas we need, is produced in Denmark.

“I see Total and Ineos as key players in this context. Ineos has a background in downstream and within chemicals but is focusing more and more on oil & gas production. It’s incredibly exciting that it’s now coming to Denmark and is committed to ensuring Danish oil & gas production.”

“The same with Total. It’s the world’s fourth largest oil group but also the world’s largest on PV. That makes for some exciting perspectives,” said Næsby.

Danish knowhow

With the acquisitions of Maersk Oil and DONG Energy E&P, Total and Ineos have also acquired Danish know-how and core competencies.

“No doubt that both the Danish companies have competences which are attractive for a foreign oil group. Maersk Oil, for example, with its vertical drilling technique. It’s unique know-how that you acquire,” said Morten Imsgaard.

The new owners have obviously also estimated that the fields being acquired contain values and possibilities for further development if willing to invest, said the Sydbank-analyst.

“The know-how, and core competences you get, may prove to be more and more relevant going forward as oil drillings become more complex,” he said.

Having worked in the oil & gas industry for a lifetime, Martin Næsby said it is with some sadness he sees Danish oil companies sell their businesses to foreign oil groups. However, now is a time to look to the future, and the future looks bright for Danish oil & gas.

“It’s highly reassuring, what we see now, and we welcome the way both Total and Ineos execute decisions. Now we’ll see what happens with Hess Denmark.”

Næsby said there are also plenty of things to be excited about in the supply-chain.

“Increasingly we see oil service companies refer to themselves as energy companies while other sub-suppliers have operations in both wind and oil. Maintaining a Danish position as self-sufficient with oil and gas supply – as the only EU country – and at the same time focus on the transaction to renewable energy, then new opportunities will arise,” said Martin Næsby.

“It’s all very exciting and there are plenty of perspective in it, both for Denmark, but also for employees,” he said.

Morten Imsgaard, Senior Analyst at Sydbank.



BY KARIN JENSEN
PHOTOS FALCK SAFETY

“WE TRAIN PEOPLE IN SOMETHING WE HOPE WILL NEVER BECOME RELEVANT”

– Falck Safety

Falck Safety provides safety training for offshore staff. Preventing accidents from happening in the first place is a top priority, but it is equally important to know how to handle an incident when it happens.

Falck Safety, the world's largest supplier of safety training, offers a full palette of services and training for the offshore sector, both offshore wind and oil & gas. Providing offshore staff with the competences to handle any situation that may occur when out at sea, but also to enable a person to save himself and his partner.

Whether it is the offshore wind or the oil & gas industry, safety is a top priority and anyone working offshore needs to be fully up to speed and know exactly what to do if, or when, an accident happens.

“We train people in something we hope will never become relevant.”

“You have to be able to rescue

yourself and your co-workers, because in some situations, there won't be anyone else, or it may take a long time for help to arrive,” said Claus Nexø Hansen, managing director at Falck Safety.

Amongst the services and training sessions being offered by Falck Safety are fire extinguishing and first aid courses, both basic and advanced levels, altitude rescue, how to survive in cold water, contingency management and verification of competences. Medical examinations and health certificates for offshore staff are also provided by Falck Safety.

“Contingency plans, for example, are adamant. You need to know exactly what to do in case of an accident and how to react in the most appropriate way. We help our customers make the plan and we train their employees,





but also check the plan after a while to ensure that all information is up-to-date,” said Nexø Hansen.

Verification of competences is equally important as there may be several years between courses.

“When offshore, you are part of a team and if you’re under pressure, you might have forgotten what you learned three years ago,” said Nexø Hansen.

Onsite courses, where Falck Safety offers courses at the company’s own site, is becoming increasingly popular. Instead of sending 30 employees to Esbjerg for two weeks, Falck Safety sends two instructors to the company site and train with the employees.

“Basically, we believe that when you train people in their own environment, using their own equipment, you get the best results. And then it’s a way to cut costs too, not least travel expenses and accommodation,” Nexø Hansen said.

After the accident

Safety training is of course meant to prevent accidents from happening in the first place, or at least to minimise the chances of an accident happening and minimise the consequences of them. Because it is unavoidable that accidents happen at some point – and handling an accident is something that must be planned accordingly.

“How to handle the press after a major incident is vital and can be decisive for a company. The same goes for handling next of kin, for example have a team to receive them.”

“We help the companies set up a specific contingency plan for when an accident happens, for example what to do, how to handle different situations, who to call,” said Claus Nexø Hansen.

Offshore wind vs oil & gas

There are many similarities between offshore wind and oil & gas when it comes to safety, but also many differences.

“The main difference is, that when working in offshore wind, it’s typically just two people at a time and this ½ places greater demand on those working in offshore wind, for example in a rescue situation. An oil platform has an entire team, many even a paramedic onboard,” said Claus Nexø Hansen.

Offshore wind is still a reasonably young industry and for the first many years, it looked towards oil & gas for guidance on how to do safety procedures. But this is no longer the case, said Nexø Hansen.

“Today, the safety level in offshore wind is fully on par with oil & gas. Wind is not lagging in any way,” he said.

DANISH PORTS

The Port of Thyborøn

The port is fully geared for the disembarkation of equipment and the servicing of the offshore industry, with main focus on offshore wind turbines near the coast.

Thyborøn Port is a strategic port for Northsea projects.

Thyborøn is closest port to Nisum Bredning Testsite and Vesterhav North Windfarm.

The port has a heavy load Quay with 12 hectares' storage area. Perfectly suited as installation, manufacture and decommissioning port.

The Port of Hvide Sande

The harbour has been modernised and extended. The new west jetty is 210 metres long. The port has a 20,000 m² of ISPS-secured storage area, and areas of around 200,000 m² in its west and northern sectors. The approach is 100 m wide and dredged to a normal depth of 7 metres. The port has its own dredging equipment and can therefore guarantee stable approach conditions.

The wind industry already uses the port, and Hvide Sande is set to play a key role in the construction phase of the Horns Rev 3 wind farm, especially regarding the shipping of manpower, supplies and servicing vessels.

The services provided are also available to oil & gas customers, at this highly efficient and price-competitive port.

The port of Aabenraa

The port of Aabenraa has water depths of between four and 11 metres and is close to the European motorway network. It is a port of shipment and disembarkation for the entire Baltic area and offers all the facilities which hallmark an efficient industrial port.

The Port of Esbjerg

The Port of Esbjerg is the leading port for offshore wind power in Europe. A new multiterminal covering an area of 116,000 m² has opened in the east harbour. The new terminal will meet various industries' demands in terms of flexibility and efficiency just as the terminal is great news in terms of environmental concerns and traffic safety.

The Port of Esbjerg is ideal for the shipment of wind power due to its unique experience and location, modern facilities, flexible areas and supply chain, which includes several of the world's leading companies specialised in handling and servicing wind installations.

The Port of Rømø

The Port of Rømø is ideally located to function as a service base for the construction and service of German wind farms in the North Sea. Water depths alongside the new quay are seven meters (mean level) and five meters in the other basins.

Major investments have been made in new facilities, which make the Port of Rømø an attractive partner for offshore activities in the North Sea and for freight transport.

Port of Hirtshals

The Port of Hirtshals has the facilities to provide the right settings for service, repair and renovation of offshore units. Furthermore, the port is home to a wide range of service companies with experience in the offshore business.

The Ports of Fredericia, Nyborg and Middelfart

ADP, Associated Danish Ports, operates the industrial ports of Fredericia, Nyborg and Middelfart.

One of the core competencies of ADP is the cooperation with international companies for the assembly and shipping of offshore wind farms. The Port of Nyborg, for example, is favorably located for shipping wind turbines to offshore farms in the Baltic Sea and the Kattegat and in 2011 a new quay was built in Nyborg, designed for heavy project cargo, enabling the port to accommodate larger and heavier wind turbines.

The Port of Grenaa

Until October 2018, there will be quite a few long wind turbine transportations on the roads between Grenaa and Aalborg. The first 24 turbines have been upgraded at sea during 2016-2017, and the remaining 87 turbines from Anholt Offshore Wind Farm are now coming ashore for an upgrade. The procedure is that the blades are shipped to Grenaa, and will be transported to Aalborg afterwards for optimisation and repair work.

The port of Grenaa has large areas for pre-assembly directly at the quay as well as large capacity for disembarkation and services.

The port has easy access to the maritime A-route in Kattegat and good infrastructure to the main land and cities.

The Port of Aarhus

Denmark's largest container port is currently undergoing a major expansion, which will see the port expand to approximately 1,800,000 m² and with maximum water depth projected at 15.5 meters along the quays. A new Omni terminal will, among other things, be used for storage of windmill projects being prepared for shipment.

The Port of Odense and Lindø Industrial Park

Lindø Port of Odense is expanding. The port expansion will be designed as a flexible port terminal for heavy special projects, such as wind turbines, maritime projects, decommissioning (scrapping) and infrastructure projects, and a major area will be allocated to bulk goods and other traditional port operations.

The Port of Odense and Lindø Industrial Park offer production and warehouse facilities for large-scale infrastructure/construction projects and projects in the offshore and wind turbine industries. Lindø has a central location in relation to the North Sea and the Baltic, huge production halls, quays and dry docks.

(Sources: respectable websites)



The Port of Hvide Sande welcomes oil & gas customers



The port has been expanded and now has a flotilla of 40 companies ready to deliver a versatile range of services 24/7/365. The wind industry has homed in the Port of Hvide Sande, which is now hoping to attract the oil & gas industry.

In recent years, Hvide Sande has made ready for a fresh start. The harbour has been modernised and extended, and is now equipped to receive offshore customers of all kinds. The wind industry already uses the port that lies between the North Sea and Ringkøbing Fjord. When construction of the Horns Rev 3 wind farm gets under way, Hvide Sande is set to play a key role in the construction phase, especially for shipping manpower, supplies and servicing vessels.

The services provided at the port to the wind industry are, of course, also available to oil & gas customers so the Port of Hvide Sande is doing its utmost to make its presence felt, drawing the oil & gas industry's attention to the wide range of opportunities on offer at this highly efficient and price-competitive port.

The harbour and jetties have been expanded and modernised to the tune of DKK 250 million. The new west jetty is 210 metres

Investments at the port have boosted the level of activity in a number of business areas. The former fishing harbour has expanded and the Port of Hvide Sande is now also an important service and cargo port.



long. The port has a 20,000 m² of ISPS-secured storage area, and areas of around 200,000 m² in its west and northern sectors.

The approach is now 100 m wide and dredged to a normal depth of 7 metres. The port has its own dredging equipment and can therefore guarantee stable approach conditions.

The facilities are one thing. Vessel services and systems are quite another. The Hvide Sande Service Group, comprising 40 companies, is dedicated to delivering on-demand services, day and night, all year round.

- Hvide Sande is a highly efficient little port that provides exceptionally high levels of service. In many areas, Hvide Sande offers competitive prices, compared, for example, with Esbjerg.

- "The group offers all kinds of services, ranging from a state-of-the-art shipyard to a wide selection of rented accommodation for shift workers," says Bent Haumann, Senior Business Development Manager, the Port of Hvide Sande.

The Hvide Sande Shipyard has built several CTVs and if your CTV needs a pit stop for service, it can be laid up over the weekend. The shipyard is open at weekends and ensures that the vessel is ready to sail on Monday morning.

- "We know that this kind of service is a must. Companies have obligations and, as vessels have to sail more or less 24/7, things have to run like clockwork. Here in Hvide Sande, we make sure that they do," says Bent Haumann.

The port is ideal for supply vessels, CTVs, and inspection and monitoring vessels. Vessels of all sizes can make Hvide Sande their port of call. Several large installation vessels have already called in here.

The logistics between port and town via the main road are also good. There is a road connection to the motorway system near Herning. Every effort is being made to ensure that the road to Herning is soon upgraded to a 2+1 road.

BY ANETTE JORSAL
PHOTO STOCK

MORE WIND TURBINES OFFSHORE



Taiwan and USA are among many nations currently nursing ambitious plans for offshore wind expansion. In Europe, there are many more wind farms on the drawing board. The UK and Germany lead the pack.

The wind turbine industry still has the wind in its sails. In 2017, many new wind turbines were erected across the globe. There are no signs of a lull. Ambitions remain high when it comes to building offshore wind farms. New countries have joined the scramble and countries that already have established offshore wind farms are planning to build more.

In 2017, 3,148 MW of new wind energy capacity was installed in Europe alone – even more than in 2015 and twice as much as in 2016. In 2017, 560 new offshore wind turbines were built in 17 wind farms. European capacity is now just under 16 GW. There are 4,149 offshore wind turbines off the coasts of 11 European countries.

Counting all the plans and projects known currently to be on the drawing board, European offshore wind is expected to reach 25 GW of capacity by 2020. Sixty-seven percent of European offshore wind energy comes from the North Sea, 15 percent from the Irish Sea and 13 percent from the Baltic.

Offshore wind farms are mushrooming across the globe. There is focus on offshore wind in the US, and Taiwan has announced ambitious goals for wind energy by 2030. Status and prognoses for selected countries are presented below.

Great expectations in the East

In 2016, Offshoreenergy.dk organised a study tour for executives interested in offshore wind in Taiwan. The island state has launched ambitious renewable energy plans. In a few short years, Taiwan will invest more than DKK 18 billion in offshore wind, building 800 wind turbines by 2030. The Danish businesspeople could tell the public authorities and private players at the Port of Taichung what they needed to create facilities for shipping and construction of offshore wind turbines. The Danish delegation returned home certain in the knowledge that there is great potential for Danish companies in Taiwan. NIRAS has already set up shop in Taiwan. More Danish players are expected to join them.

China accounts for more than half of the world's wind power market. This gigantic economy in the East continues to foster plans for impressive wind power growth. China focuses primarily on onshore wind power. As yet, only a very small proportion of Chinese wind energy is generated offshore.

Continued expansion in the UK

When it comes to offshore wind, the UK is a very important player. In 2017, UK offshore wind farms



produced just over half of all offshore wind energy in Europe. There is no sign of a British change of heart. In the past, the British invested in many onshore wind farms. In recent years, their focus has shifted to offshore wind.

From 2018-2020, UK market capacity will increase by 3.3 GW. There are plans for more new wind farms and therefore still clear potential for Danish companies. The Hywind Scotland Pilot Park was built to test offshore wind turbines with floating foundations. Progress reports from Hywind are being followed closely.

Focus on Germany

Germany is another important player in wind energy. As Germany is Denmark's much larger neighbour to the south, the German wind power market is a natural focal point for Danish companies. The Germans have many onshore wind turbines but recently the market has focused on Veja Mate and Wikinger, two of the largest German offshore wind farms. Both were fully commissioned and plugged into the grid in 2017.

Germany expects to install a further 2.3 GW of offshore wind turbine capacity between 2018 and 2020.

The US looks to the sea

While it is true that the US President has withdrawn US support for the Paris Accord, other things have not changed at all. The US still has major and ambitious plans to build offshore wind turbines. Why? Because when it comes to energy policy, the state administrations have the last word and many states have expressed a desire to build wind turbines at sea.

Offshoreenergy.dk has joined forces with the Danish Export Council in North America, which will act as a bridgehead to the offshore wind industry in the US. During 2018, the parties are organising a trip to the States where Danish offshore companies will visit relevant American enterprises and states that have expressed an interest in offshore wind.

Brazil stakes on dry land

Brazil also has strong focus on wind energy. It plans to add two gigawatts of capacity each year – onshore. As there is plenty of space inland to locate wind turbines, offshore wind is not a hot topic on the Brazilian market. No problem: onshore wind offers just as much work for Danish companies.



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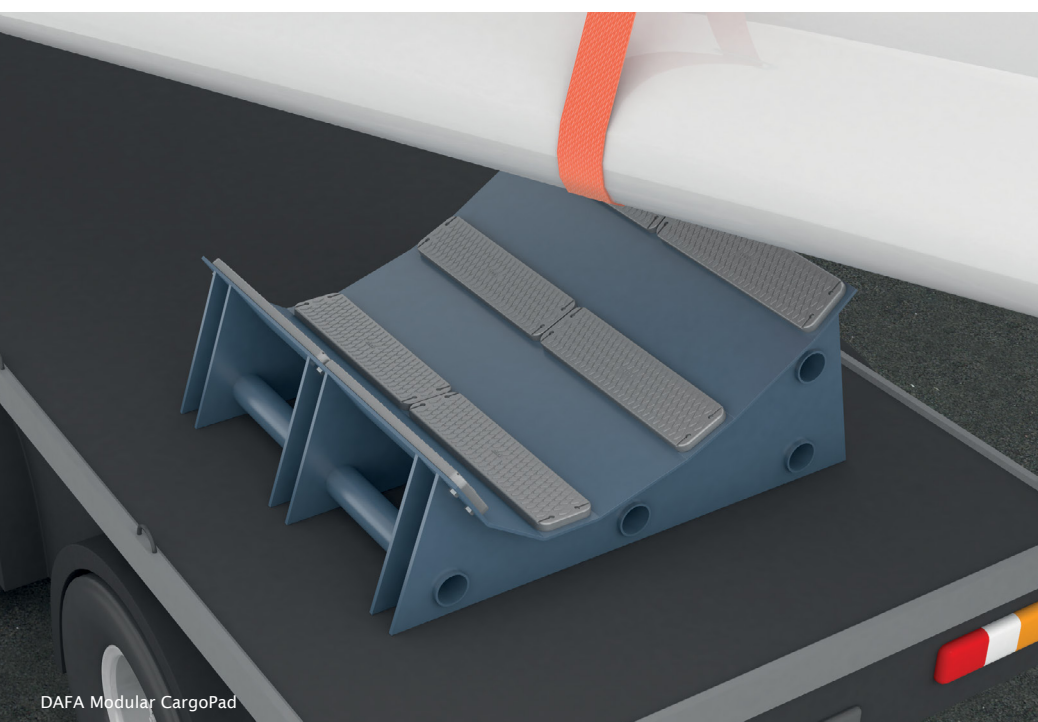


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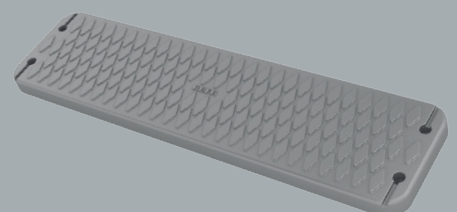


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OCEAN TEAM DEVELOPS NEW SOLUTIONS FOR THE OIL & GAS INDUSTRY

Ocean Team Group has received EU funding to develop new solutions for the oil & gas industry. Cost savings and safety are key words and among the new projects is a potential cash cow.

Ocean Team Group has received EU funding to develop new solutions to challenges faced by the oil & gas industry. It started with a major Danish oil company posting a list of challenges and now Ocean Team has defined ideas for the solutions.

“The project is still in the start-up phase. We have presented six ideas and the next step will be looking at costs and then we can go into more details,” said Espen Kähler Amundsen, Managing Director at Ocean Team.

Ocean Team will start up with a smaller project. The challenge is big, but the solution will be easier than the more complex challenges coming up later.

“The challenge occurs when bunkering diesel on a satellite platform. Satellite platforms are unmanned so you need a person to go there when filling diesel but quite often it’s not possible because of the weather. As a result, the platform runs out of diesel and the well shuts down,” Kähler Amundsen said.

Production shut-downs are costly, and it’s risky to send a person to a satellite platform. Ocean Team’s idea for a solution can help save costs and lower risks.

“We are developing a telescopic solution, an “arm” connected to the satellite platform that will be completely still even if the ship moves. We reckon our solution can fill diesel in 90% of all weather conditions,” said the managing director.

This project contains numerous small challenges

that Ocean Team will find solutions for, using its patented technologies from the Ocean Team Windcare department as well as from the Subsea industry.

Once this project is complete, Ocean Team will commence a much bigger challenge, which relates to the umbilical, the long, thin pipeline, that is often used to connect the satellite platform with the main platform. Amongst the challenges is how to clean the umbilical, which can get blocked by dirt, or just send dirt to the valve that will then operate slow or even fail. Conventional flushing is currently used in the umbilical but because of the length of the umbilical, often 20-30 km long, very high flow is required.

“Ordinary water won’t do. Ocean Team is already working on a proven technology where we use supercritical & liquid CO₂. We’re the first in the world to use this,” said Kähler Amundsen.

Ocean Team has cooperated with a Dutch company testing this technology offshore. It tested the method in the Netherlands and managed to clean a 38 km long umbilical pipe between an offshore satellite platform and the main platform.

“The test results showed that we can reduce the NAS1638 contamination level to three, the best-ever seen, from 12, which is the worst on the scale.”

“We hold the global patent to the liquid CO₂ technology and believe this could be a future cash cow,” said Kähler Amundsen.





Ocean Team is talking to several large oil companies, which are interested in using the technology. In future, wells will be at much deeper waters and further from shore, which makes it even more important with an efficient cleansing technology.

“In Norway, for example, there are umbilicals that are 120 km long. We are also talking with a company in Australia, which has 130 km long umbilicals,” Kähler Amundsen said, adding the market for this is global.

Long umbilicals have been in use for many years and now begin to see contamination with blocked lines.

“80% of all failures of components and valves that break in fluid transfer systems, such as hydraulic or chemical injection, is due to contamination in the fluid itself, not because of a mechanical fault,” said Kähler Amundsen.

The environmental-friendly supercritical CO₂ method has the potential to reduce costs significantly by increasing the

lifetime of the system, longer time between oil changes, and reduce shutdown of the subsea clusters or satellite platforms drastically by having a reliable system and no blockages. Furthermore, it will make the subsea systems safer and more environmentally friendly.

Ocean Team cooperates with Offshoreenergy.dk on the EU-funded projects together with DIS, Holtech Automation and Force Technology.

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BY KARIN JENSEN
PHOTOS: DTU

NEW DTU PROGRAMME TO LOWER OPERATIONAL COSTS AND EXTEND LIFESPAN OF MATURE OIL & GAS FIELDS

A new research programme at the Danish Hydrocarbon Research and Technology Centre (DHRTC) will seek to find ways to reduce operational expenditures related to oil production in the North Sea. The mature Gorm Field is the pilot field in the project. Scale and corrosion are among the areas being looked at.

Named after the legendary Viking King, Gorm the Old, the Gorm Field in the Danish section of the North Sea is increasingly living up to his namesake. Signs of old age are becoming visible and unless something is being done, the Gorm Field will be heading for retirement soon.

A new research project at DHRTC, which is part of the Danish Technical University (DTU), is looking into ways of bringing down operational expenditures and find new ways to improve the production facilities at the field.

“The Gorm Field has been chosen for the project because it’s the field in the Danish section facing closure in near future unless we can do something about the operational expenditures and thereby prolong its lifespan by some years,” said Kitt Ravnkilde, Principal Programme Manager at DHRTC.



Karen Feilberg, Senior Researcher at DTU

The DHRTC's research programme is using the best practise of the manufacturing industry, e.g. modularisation, which helps reduce the complexity of a process or operation by splitting it into smaller units, or modules.

"We try to find the best of breed. We look at different maintenance operations and see if we can identify ways to reduce the time spend on the individual operations," said Kitt Ravnkilde.

The better you can predict when you need to do maintenance work, the better you can plan. Something as seemingly simple as available beds on the platform can be a big problem.

"When changing a tubing, for example, you need beds for maintenance people for several days. If it's a sudden integrity problem in a well, that means production downtime, perhaps for a very long time, a new rig needs to be found, people are sent home and maintenance staff transported to the platform," said Kitt Ravnkilde.

Scale & Corrosion

The researchers are also looking to reduce costs by solving scale and corrosion challenges in wells in a collaboration with Aarhus University.

"We're looking at scale deposits and corrosion in the injection and production wells. It's cost-heavy to do maintenance activities in wells if there's corrosion but also to have scale deposits removed," said Kitt Ravnkilde.

Scale such as Calcium Carbonate (CaCO_3) and Barium Sulfate (BaSO_4) will deposit inside the tubing wall and over time build up and almost choke production.

" BaSO_4 deposits on the horizontal pipes and needs to be removed mechanically. It's an expensive operation, so if you can avoid BaSO_4 deposits to begin with, then that's an area where you can really cut expenses," said Karen Feilberg, Senior Researcher at DTU and in charge of the Scale project.

CaCO_3 is formed primarily in the upper, vertical part of the well and may also prevent the sub-surface safety valve from closing properly if an incident should happen.

The focus of the research programme is to understand the mechanisms and kinetics of scale formation and predict the operating conditions that cause the various types of scales to be formed and where in the well the scales are located.

"This will help to predict and carefully plan appropriate treatments, which would mitigate scale formation or remove scale deposits. Subsequently, it will result in reduced operating expenditures as well as increased oil recovery and extended lifetime of the wells, facilities and pipelines," said Kitt Ravnkilde.

Another common integrity problem in the oil and gas industry is corrosion, which reduces the lifetime of oilfield equipment.

"It affects production because you need to replace the production tubing, or part of a pipeline. This is a costly operation, also the production downtime, so obviously you want to be better at predicting the corrosion rate to plan maintenance operations better," said Kitt Ravnkilde.

To predict scale and corrosion requires the right tools and one such tool is a new software programme developed by its partner, Aalborg University.

"We're hoping to develop a risk-based well intervention planning tool, a software programme, which takes all risks and uncertainties into consideration," said Kitt Ravnkilde.

Kitt Ravnkilde, Principal Programme Manager at DHRTC.



BY ANETTE JORSAL
PHOTOS: DTU

LOWERING THE COST OF WIND ENERGY

20 MW wind turbines are feasible. Blade erosion is preventable. These facts result from two research projects spearheaded by DTU. The goal is to drive down the cost of wind turbines and optimise energy production.

Manufacturers, service industries and research scientists are currently driven by a common desire to reduce the cost of erecting and operating offshore wind turbines.

DTU Wind Energy is actively involved in two research projects, both of which aim to lower costs. Twenty-seven European and one American partner are involved in INNWIND.EU, a five-year project to develop innovative turbine designs and parts, etc. for very large offshore wind turbines. Until 2020, DTU and

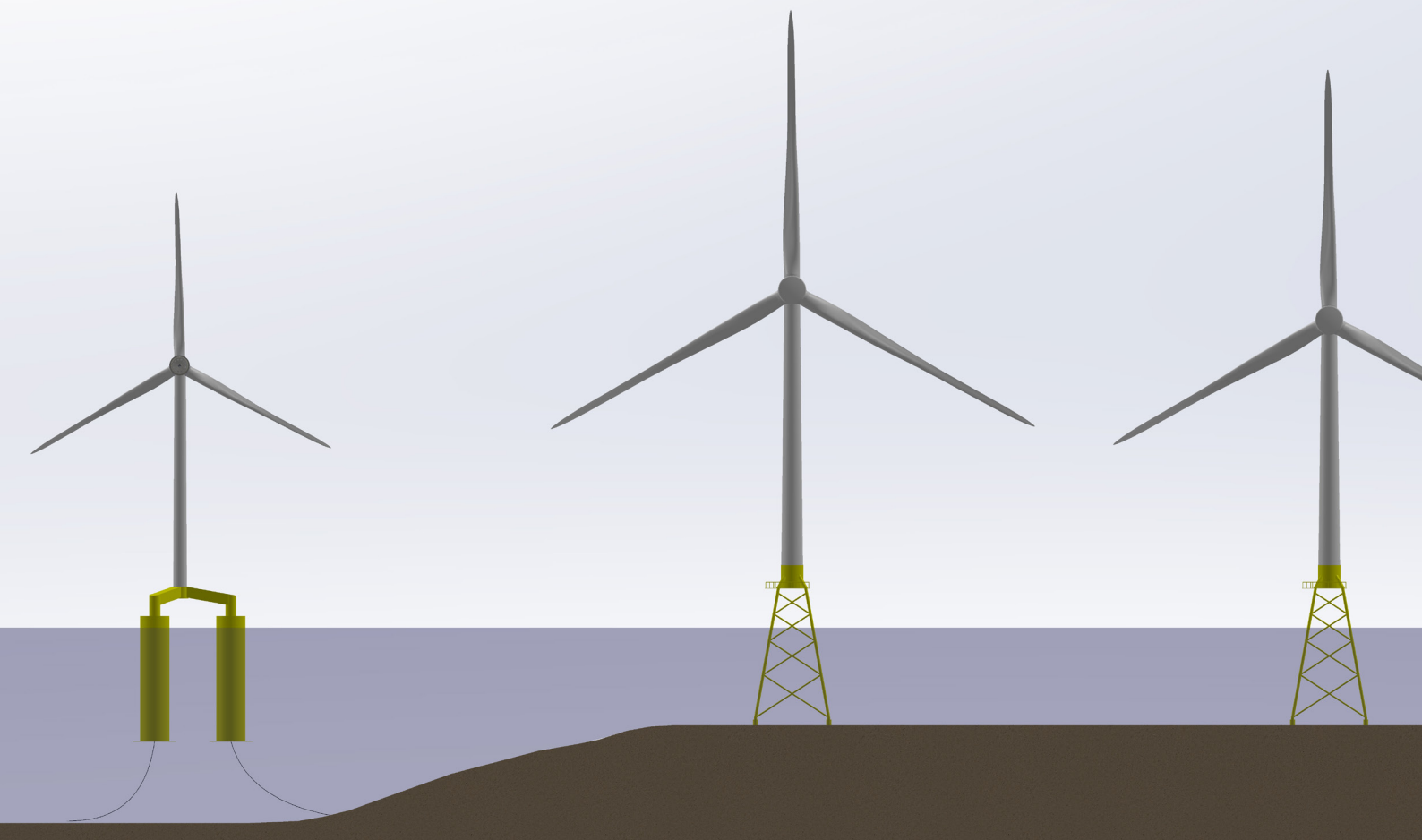
five partners are also working on the EROSION rain-erosion.dk project that is investigating ways to prevent wind turbine blade erosion.

The INNWIND.EU project has developed innovative concepts for enormous offshore wind turbines that can be erected at water depths of 50 metres. This aim of this project is to lower the cost of producing wind energy.

“When we embarked on this project in 2012, 6 MW offshore wind turbines were already in operation and 7 MW turbines

were under way. Back then, we dreamt of making 10 MW turbines. Today, we are erecting 9.5 MW turbines. Back in 2012, no-one even imagined that 20 MW turbines would one day become a reality,” says Anand Natarajan, Senior Scientist at DTU and project manager of the INNWIND.EU project. He continues:

“20 MW turbines can be erected farther from the coast at a water depth of 50 metres.. Our project has proven that 20 MW turbines are feasible and they could reach the market before 2030. With 20 MW turbines, we have succeeded in



reducing LCOE (Levelized Cost of Energy) by 30 percent compared with 5 MW offshore wind turbines.”

Appreciable cost reductions can be achieved through innovation. The scientists have developed new generator technologies and redesigned blades so that they can be made longer without increasing mechanical loads. Finally, the project team has designed a new substructure (foundation), onto which the wind turbine itself will be mounted.

“The most costly part of the design is the submerged substructure. The team has developed solutions that can reduce costs by 20 percent. Cost reductions are achieved by using new material technologies and better integrating the design of the substructure with that of the turbine.

This means that we can reduce the cost of the structure itself and enhance energy production efficiency,” says Anand Natarajan.

Preventing blade erosion

Rain hammering hard on a rotating wind turbine blade is a serious problem. The rain can beat hard enough to damage the blade’s leading edge. A damaged blade does not have as long a useful lifetime as wind turbine operators would like and they have to invest heavily in repair work.

DTU Wind Energy is therefore heading an innovation project that examines how blade erosion can be avoided. Working with five partners, some of whom are industrial players, the research team began work on the project in 2017.

“The aim of our study is to prolong blade lifetime,” says Charlotte Bay Hasager, Senior Scientist at DTU, who manages this research project.

Initial laboratory tests clearly showed that heavy rain does indeed damage the blade and the faster it rotates, the more severe is the damage. The next step is to examine whether the erosion caused is merely superficial or if rain damages the blade structure.

This then begs the question: What is best? Should we reduce blade rotation during heavy rainfall or is it better to calculate with downtime for repairs? Both cause power production to fall but by how much?

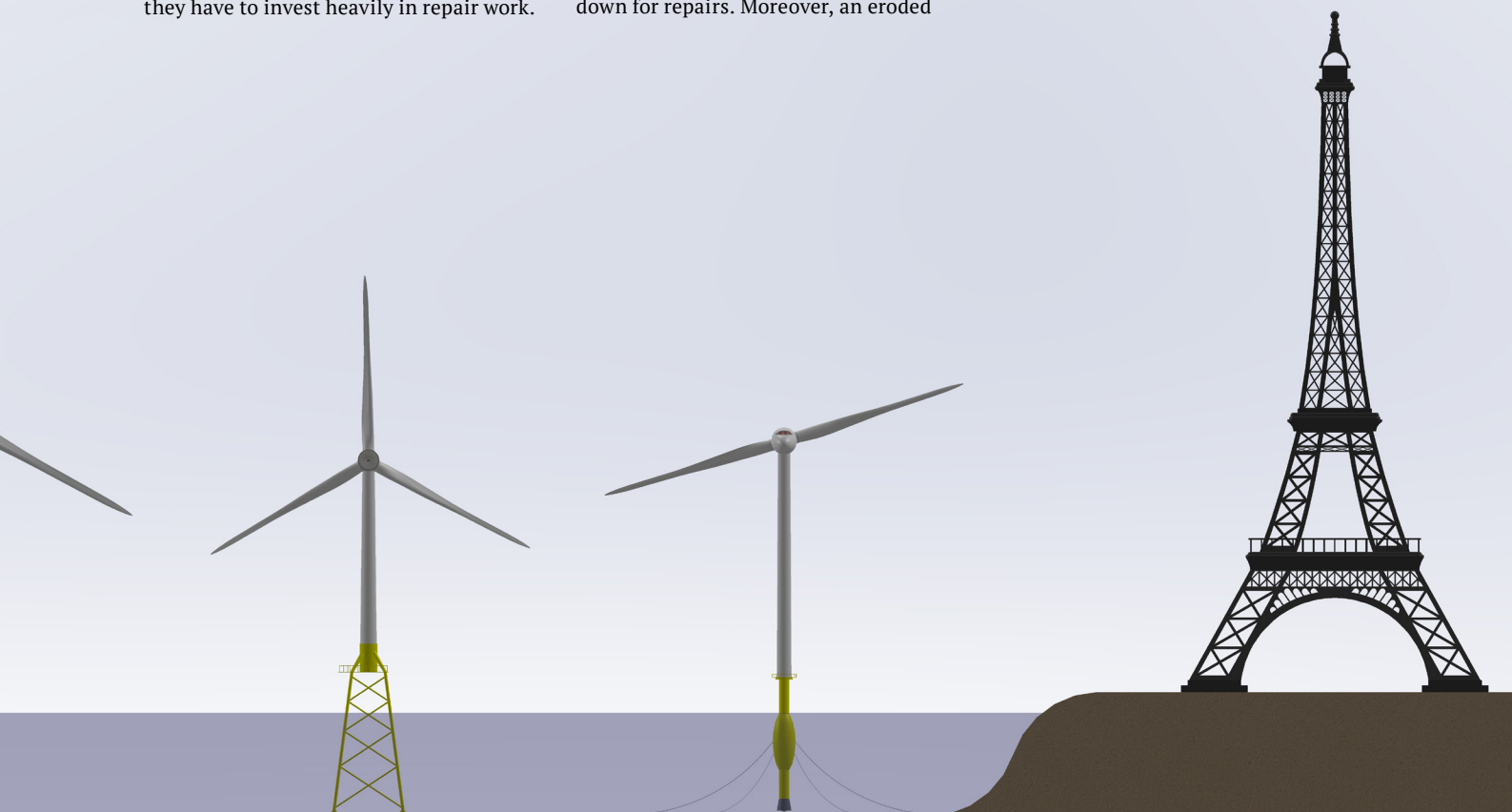
“Our calculations show that it is much more profitable to reduce rotor blade velocity in bad weather than to shut the turbine down for repair work. If the speed is reduced for 15-30 minutes whenever it rains, speed may be reduced for only five days in a 20-year period. On the other hand, the wind turbine has to be shut down for repairs. Moreover, an eroded



Charlotte Bay Hasager, Senior Scientist at DTU

blade is less aerodynamic and therefore less efficient, and after repairs, we cannot expect the blade to regain its original, optimal aerodynamics,” says Charlotte Bay Hasager.

The research will also produce a new rain gauge that measures the type of rain hitting the wind turbine and sends data to the control mechanism that adjusts blade rotation speed accordingly.



IPS provides perfect wipes for wind turbine applications

The IPS-Group has a wealth of experience and still swears by one of its original values: To supply top-quality products at the right place at the right time in the right volume. The IPS-Group now also develops new solutions for the wind energy industry.

Lint on a freshly painted surface is just plain irritating. You have to sand down and retouch – and that sucks!

In the wind energy industry, dirt and lint are not merely irritating. Impurities can have costly consequences if they cause cracks and holes to form on wind turbine surfaces.

Wind turbine blades must be cleaned with great care prior to painting. You should never choose cloths and wipes at random.

At the IPS-Group, we are proud to have many years' experience of working with industrial cloths and wipes, including non-woven speciality wipes that are used to clean and prepare surfaces in the wind energy industry. We offer dry wipes and saturated wipes all hydro-entangled without any chemical binders. High-speed water jets entangle cellulose and polyester layers to form a strong absorbent web. Hydro-entangled cloths are smooth and lint-free with excellent absorbency capacity and speed.

The IPS-Group supplies special wipes to major players in the wind turbine industry across the globe. We supply dry cloths and wipes saturated with e.g. ethanol, isopropyl alcohol or solvents such as the PF® Solvent, an industrial degreaser used in the wind turbine industry to clean power cables.

The IPS-Group is a family-owned company. In the early 2000s, founder Claus Hjorth Madsen decided to focus on saturated wipes for specific industries. He was not slow to pinpoint the needs of the rapidly

expanding wind energy industry. Before long, he was delivering speciality wipes to large players such as Vestas and Bonus Energy. The IPS motto was 'top-quality cloths and impregnated wipes at the right place at the right time in the right volume' and the company sought to provide eco-friendly solutions that were easy to work with.

- "When you saturate wipes, you use less chemicals and reduce evaporation," explains Claus Christian Hjorth-Madsen, who has now taken over at the company from his father.

The motto's 'at the right place at the right time in the right volume' turned out to be a future-proof policy. In the chemical industry, meticulous precision is imperative to documentation and certification.

The IPS-Group supplies high-quality industrial cloths and wipes at reasonable price levels. The company markets leading brands of dry cloths, including the Sontara® (former DuPont™) range of products, and produces its own saturated industrial wipes. The IPS-Group is consistently developing new customer-specific solutions.

- "In a current case, a major wind turbine manufacturer was exasperated by external service partners' using a range of approved and especially non-approved wipes and chemicals for wiping tasks, e.g. when connecting wind turbines to the power grid. "We are developing a service kit containing different types of wipes dry and impregnated for the service partners' use, which should ensure the manufacturer that the right

chemistry and wipes are being used during operations and maintenance. The end result would be among other things an extension of the guarantee towards the customer as the wind turbine has been treated correctly during maintenance with the right wipes and the approved chemistry," explains Claus Christian Hjorth-Madsen.



The IPS-Group

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FROM COMPETITOR TO PARTNER – A MUST IN THE QUEST FOR SURVIVAL AND SUCCESS

The market for energy has always been affected by climate, global policies and new technologies. According to Energy and Climate Academy, who works worldwide in further education for the energy and climate sector, there are changes ahead. The future parameter for success is not another invention, but the ability to be able to process the large amount of new information and the ability to cooperate with both knowledge centers, government agencies and other actors who should be considered as partners rather than competitors.

The strategic overview in the energy & climate sector has been reserved for a few experts in the sector. They analysed the energy system and then communicated with tech developers and the decision makers. The tech developers work from separate platforms such as companies or universities.

A wind turbine producer's closest competitor, at the moment, is other wind turbine producers and then come all the other energy sources such as solar, bio fuel and traditional fossil fuels. In the future, the closest competitor will be other renewable energy sources and not just the other wind turbine manufacturer.

Simply put, the way the development – or the work distribution – in the energy and climate sector today, both nationally and internationally, belongs to a dying paradigm, which is being replaced with a new one, where growth and development on a much larger scale, will happen through the sharing of knowledge, co-operation and communication. This is the goal of Torben Kirkegaard, CEO and founder of Energy and Climate Academy, who develop courses targeted

specifically at stakeholders in the energy and climate sector all over the world.

“At the Energy and Climate Academy we specialise in developing courses for companies in the energy and climate sector globally. With this in mind we have established an extensive contact network in knowledge and education institutions, companies and organisations, in a number of countries. It's during exchanges, with a long list of competent professionals, when we discover needs, when we develop both nationally and internationally, that I see the potential for more communication and sharing of knowledge in the energy and climate sector.” says Torben.

Torben Kierkegaard's observations in the energy and climate sector are supported by the general tendencies of global industries and knowledge societies, where new knowledge is generated faster than ever and the need for the appropriate skills is changing at a similar pace.

The Swiss Foundation “World economic forum”, which ran a discussion forum on the world's economic issues with

government heads, politicians and industry leaders, stated in January 2017 that approximately 35 percent of the skill sets considered vital today will change within just 5 years.

The foundation also listed the four most important skills, necessary to handle and adapt to the changes of the future, known as the 4 C's or the 21st century skillset:

- **Creativity** – to create and innovate, have ideas, be inventive, learn from experiences and be original.
- **Collaboration** – cooperation, participating equally in processes, be responsible and stay open.
- **Critical thinking** – relate to the real world, be problem solving, analyze, evaluate and ask investigative questions.
- **Communication** – listen, express ideas, use different platforms and use different expressions

“The statement from the world economic forum very accurately addresses the future needs in the energy and climate sector. This is relevant for all industries; the possession of knowledge is in itself





not the road to success when knowledge and information are developed at an increasing pace. The resources expended to find the correct knowledge, keeping it to yourself and utilising it to gain an advantage over the competition, without the knowledge being compromised is becoming increasingly difficult and is no longer profitable. This is because technology will have advanced before a marketable product is ready. Therefore the way forward is the sharing of knowledge and co-operation” explains Torben Kirkegaard

He is well aware that this approach is shaking the foundations of the traditional methods of corporations in the energy and climate sector, particularly their approach to business development and the idea that knowledge is to be considered a corporate secret. There is no doubt that this paradigm shift will have major bumps along the road and across all corporate levels.

The point is that there is no way around this. Disruption might be a severe expression to use in this case, but then again not. The approach to knowledge

is ever changing and the industries and organisations that fail to adapt could be facing a dark and difficult time. Organisations, in for example, the wind industry, could advantageously start using the sharing of knowledge. By doing this, they would take their development further in relations to other energy sources. Instead of what amounts to hindering each other and as a result, the entire industry’s development, by not sharing their knowledge.

The Green Tech Center in Vejle, Denmark is an example of a practical cooperation. Here are 25 companies with 200 employees, all working within energy and climate areas. Competitors who have become partners in specific projects, companies who can use their neighbors’ competencies and thus deliver a better product or service to their customers. They meet at lunchtime, in the same canteen and at the coffee machine during the day, which not only means that they share professional knowledge, but also create relationships which lead to trust and makes co-operation faster or more effective.

In terms of courses the tendency towards sharing knowledge is also showing. The Energy and Climate Academy has just opened enrolment for its first course on the Integrated Danish energy system. This is where employees from different organisations can improve their external sharing of knowledge. Here participants from the Danish Energy Agency will meet project managers from private companies, university lecturers and energy companies. This course is available in Denmark.

”This course underlines that we still have some steps to go before we can apply knowledge sharing across entire industries, when the potential is not yet fully understood internally in organisations. But it is an important first step in the right direction.” emphasizes Torben Kirkegaard.

“Therefore the way forward is the sharing of knowledge and co-operation.” ends Torben Kirkegaard.

www.energyandclimateacademy.com



THE SOUND OF OFFSHORE

From the very early days of wind energy it has been apparent that man's pursuit to harnessing wind, one of nature's inexhaustible resources, goes hand in hand with the concern of the impacts on local communities and the environment. As onshore turbines have grown larger in capacity and size, so have the concerns around the environmental impact implications. Where visual impacts can be partly or fully mitigated by moving from onshore location to an offshore environment, the impact of noise continues to raise concern. Local offshore inhabitants do not have the possibility to raise their concerns, and hence the responsibility falls on man to ensure that sensitive marine species such as harbor porpoises, dolphins and whales can live side by side with our ever evolving need to move energy production offshore. Technology holds the potential to practically eliminate underwater noise emissions during offshore construction works.

With more than 500 newly installed offshore wind turbines, bringing the total installed capacity in Europe close to 16GW at the end of 2017 out of some 19GW globally, Europe continues to dominate the global offshore wind market. Of the 4.000+ wind turbines installed in Europe, some 95% have been installed on piled foundations with the majority topping the industry darling, monopile. But increasing attention is directed towards the fact that the traditionally piled foundation has a major drawback; underwater noise and its impact on marine environments!

Harmonised regulations?

The main concern with respect to offshore construction work is the underwater noise generated and its impact on marine mammals. In Europe the primary focus is on harbor porpoise, as this marine mammal is classified as particularly sensitive to underwater noise and is under strict protection by the European Commission's Habitats Directive from 1992. Unmitigated pile driving noise has been shown to cause behavioural reactions in harbor porpoises at distances of tens of kilometres, and can

potentially cause hearing damage in animals closer to the foundation. To ensure that member states adhere to the Directive in a more effective manner, the Marine Strategy Framework Directive was adopted in 2008. This further sets out that member states should aim to achieve or maintain so-called Good Environmental Status by 2020 at the latest. For the introduction of energy, including underwater noise, the Directive requires anthropogenic underwater noise to be at levels that do not adversely affect the marine environment.



So, do the Directives automatically translate to an easily understandable and broadly accepted “Best Practice” on legislative matters? In reality, far from it! The major offshore markets in Europe, Germany, Denmark, the Netherlands, Belgium and the soon to be Brexited United Kingdom, each have adapted individual approaches to protect the marine environment from underwater noise emissions. Germany is recognised as having implemented the most restrictive regulations under which noise threshold level cannot exceed an unweighted sound exposure level (SEL) of 160db or 190db peak levels in 750meters distance from the pile location. The Netherlands operate under a SEL requirement of 160-172db. The neighbouring windfarms in Belgium have adapted a sound criterion of a so-called maximum zero to peak noise level of 185db re 1 uPA at 750 meters from the source. Both are enforcing seasonal restrictions, meaning that construction is forbidden some months of the year. And Denmark is currently operating on a “project to project” basis where Horn Rev 3 is

restricted by a 183db limit.

On top of the noise limits, since 2015, Germany has operated with maximum piling durations 180 minutes, which includes time for marine mammal deterrence. To complicate matters further requirements for noise monitoring varies, for example Belgian wind farms are subjected to ad hoc inspections by a government body versus continuous monitoring by the permit holder in the Dutch sector for the Borssele sites. And to make matters more challenging there are significant differences in regulations around seasonal restrictions and whether projects are subjected to marine mammal inspections prior to piling or not.

The developing offshore wind markets of Taiwan and the USA are looking to better understand the environmental impacts of offshore wind on marine mammals and how to potentially best adapt regulatory elements from Europe to benefit local regulations. In the US the Bureau of Ocean Energy Management is undergoing investigations to better understand

the population size of certain whale species, particularly the critically endangered right whales, but also humpbacks, fin and minke whales are of interest on the US West Coast. The Taiwanese focus is on the critically endangered white dolphin.

Investing in noise

On the back of the restrictions imposed on projects wind farm developers are investing millions of euros in the development of strategies to achieve cost-effective piling noise reduction. Further, projects are incurring significant costs to adhere to national regulations. For example the Baltic Sea project Wikinger earmarked a total of 40 million EURO for noise mitigation initiatives. The typical project spends 250,000 and up to 700,000 EUR per foundation on noise mitigating actions. Such initiatives prove to be a logistical challenge, as it normally involves multiple vessels and more than 50 people on and offshore during the piling duration. And as the typical pile requires some 3-6.000 high impact hammer blows the construction of offshore wind farms today is highly reliant on balancing an array of mitigating actions to

achieve compliance. Developers normally seek to implement soft starts, where the power of the pile hammer is reduced; use of active noise mitigation systems, like Big Bubble Curtains, shell-in-shell systems or hydro sound dampers; use of Marine Mammal Observers, where piling is delayed if mammals are spotted; acoustic deterrent devices, from which sound is emitted to scare away animals.

Change on the horizon

The benefit of today's noise mitigation systems is that they have a documented effect on sound reductions. But as monopiles grow larger in size, so does potentially the issue of noise. To meet the challenge of noise, industry is looking at either reducing the piling noise below the required national criteria or eliminating noise emissions altogether by introducing new installation methods.

Today's noise mitigations systems have a documented effect of 5-20db, but the company Fistuca is proposing to replace conventional hydraulic hammers with so-called Blue Piling Technology which could reduce noise emissions by up to 20db and reducing the need for standalone noise mitigation

systems. Pile driving using vibratory installation looks to achieve the same.

Others are looking to entirely eliminate the issue of noise emissions by adapting their foundation selection. Suction bucket technology enables this possibility. Utilities Ørsted and Vattenfall have pursued designs for suction bucket jackets, whereas the company Universal Foundation is combining the benefits of a monopile foundation with a single suction bucket, the Mono Bucket. Ørsted tested their first suction bucket jacket in Germany, and are in progress to deploy the foundation in higher volume, where Vattenfall is showcasing 11 suction bucket jackets for their Aberdeen Bay wind farm. Universal Foundation has deployed Mono Buckets for a wind turbine and for a number of met mast projects, and recently announced the company's engagement in deploying two foundations for 8.4MW wind turbines at the Deutsche Bucht project in the noise restrictive German sector. Suction buckets provide the added advantage that they can be 100% decommissioned after the operational lifetime, giving an extra eco-social advantage to project owners.

Noise remains a hot topic for the industry. Uncertainty remains with regards to both the level of underwater noise produced during piling, the method on how to measure sound as well as with the effectiveness of the noise mitigation measures being applied. Concern has been raised that deterrence effect of seal scarers is comparable to or even exceeds deterrence by pile driving itself, and hence this could entail that seal scarers merely replace one type of impact with another. Despite the vast investments in the effort to streamline projects and limit the cost of noise mitigation, in reality, no "best practice" exists. Site specific factors such as local geology, thickness of the pile wall, hydraulic hammer energy, background noise from surrounding marine activity or even from neighbouring wind farms currently under construction, does not make the challenge any easier. Developing offshore markets continue to implement their own standard and restrictions.

The industry continues in the pursuit of a "Best Practice" – or even a completely noise free future!





SOURCE SIHM HØJTRYK

VERSATILE HIGH PRESSURE UNIT CAN PUMP ALL MEDIA...

Sihm Højtryk A/S and Hammelmann GmbH have in cooperation with customer designed and produced an innovative diesel driven ATEX zone 1 high pressure unit that by its design can perform a myriad of tasks.

As the first in the world, the unit can easily be converted to perform with different performances depending on the conversion kit installed.

- 350 bar water pressure – 300 ltr / min
- 1000 bar water pressure - 100 ltr / min
- 3200 bar water pressure – 28 ltr / min

Furthermore, the conversion kits offer the opportunity to operate with fresh water, salt water or hydrochloride acid – which is very unique!

The unit is primarily design for offshore use and is therefore approved to following standards;

- ATEX Zone 1, Cat. 3G, Group 11B
- T3 Norsok Z015
- DNV 2.7.1

The unit is, as the first in the world, mounted in a 10" container, so that it can easily be transported to the job site. Furthermore, it has an additional 10" container, which is intended for personnel use and materials.

"At Sihm Højtryk A/S we seldom operate with standard solutions",

says owner Frank Sihm. "A job often begins with a customer approaching us, with a specific job in mind. Through dialogue with the customer and supplier, the unit is designed, so that it meets the customer's specifications 100%," he ends.



DANISH EIVA EXPANDS WITH A TEAM IN BRAZIL

The Danish software and hardware engineering company EIVA expands its activities in Latin America with a dedicated business development team located in São Paulo, Brazil.

With the Brazilian team, EIVA is able to accommodate the increasing interest in its hardware and software products for offshore and shallow water construction and surveying operations from specialist operating in Latin America. Moreover, the company is able to provide customers in the region with a local point of contact with strong ties to the Danish headquarters.

Point of contact with many years of experience and strong technical expertise

The new Brazilian team will be headed by Antonio Felipe Silva, who brings with him 13 years of experience in the offshore industry. He started his career as an ROV

support technician and quickly moved on to more sales- and management-focused positions, which also included collaboration with EIVA in more recent years.

“We have worked together with Antonio Felipe Silva as an EIVA representative for some years now. We have always been very satisfied with his level of commitment, drive and technical expertise. Consequently, when it became possible to combine our wish of establishing a dedicated business development team in Latin America with his wish of focusing solely on EIVA’s product portfolio, it was an obvious choice to make him head of the new team,” said EIVA CEO Jeppe Nielsen.

About EIVA

EIVA is an engineering company with 40 years’ experience in the offshore construction and survey industry.

EIVA provides software, equipment, integrated system solutions, rental services, 24/7 support and training to a wide range of segments, covering virtually any subsea task.

Consequently, EIVA’s customer base comprises organisations and companies from the international subsea industry specialising in oil and gas, renewable energy, construction, oceanography, defense and security, and hydrography.

Learn more at www.eiva.com





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AN OVERVIEW OF THE COMPANIES AND ROLES IN THE OFFSHORE INDUSTRY

ABB A/S

Meterbuen 33 - 2740 Skovlunde

+4544504450
abb.dk@dk.abb.com
www.abb.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Engineering; Installation; Manufacture or Supply

Profile: ABB is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact.

Acccoat A/S

Munkegårdsvej 16 - 3490 Kvistgård

+4549126800 / +4549126899
info@accoat.dk
www.accoat.com

Industry sector: Oil and Gas

Industry role: Manufacture or Supply

Profile: With over 40 years of business Acccoat is a leading European applicator of fluoropolymer coatings and serves wide and diverse industries including offshore, petrochemical and chemical.

ALL NRG GROUP A/S

Søndre Kajgade 7-9 - 8500 Grenaa

+45 87 58 28 10
contact@allnrg.com
www.allnrg.com



Industry sector: On- & Offshore Wind, Oil & Gas

Industry role: Design; Engineering; Installation; Service; HV Solutions

Profile: ALL NRG holds a group of prominent onshore and offshore energy-related companies. Working together, the companies are able to offer comprehensive services for both high voltage and mechanical installations and services. Jointly, the companies in ALL NRG Group hold a globally leading position as a full-service provider to the offshore energy industry. All companies in the group deliver highly qualified solutions to the onshore and offshore energy sector. To customers, the constellation means that they will benefit from more knowledge and better service.

Altra Industrial Motion

300 Granite Street, Suite 201 - Braintree, MA 02184

+1 781-917-0600
www.altrawind.com



Profile: THE LEADING BRAND NAMES OF ALTRA WIND TECHNOLOGY CAN OFFER EXPERTISE IN CUSTOM PRODUCT SOLUTIONS FOR A WIDE VARIETY OF WIND POWER APPLICATIONS. These leading brands include Ameridrives, Matrix, Stromag, Svendborg Brakes, Twiflex, Warner Electric and Warner Linear.

As a leading multinational designer, producer and marketer of a wide range of electromechanical power transmission products, Altra offers products utilized in wind turbine applications where reliability and accuracy are necessary to avoid costly downtime, assure safe operations and consistent reduction output. As the world's demand for wind power grows, the infrastructure and equipment necessary to produce and distribute it will come under increasing pressure to perform.

AMU-Vest

Spangsbjerg Møllevvej 304-306 - 6705 Esbjerg Ø

+45 79140322 / +45 79140300
inst@amu-vest.dk
www.amu-vest.dk



Industry sector: Oil and Gas; Offshore Wind

Industry role: Training and Education

Profile: AMU-Vest is the leading centre for adult education in service training in Western Jutland.

AN GROUP A/S

Mejeribakken 8 - 3540 Lyngø

+4548 25 10 00 / +4548 25 46 40
info@angroup.dk
www.angroup.dk

Industry sector: Oil and Gas

Industry role: Consultant; Design; Engineering; Manufacture or Supply; Service

Profile: The people of AN GROUP are specialists within production IT & Automation systems, SCADA & ESD, Instrument, Electrical and Project Management, Safety Management including Safety Instrument Systems.

Atcom ApS

Storstrømsvej 9 - 6715 Esbjerg N

+4576123200 / +4576123299
www.atcom.dk

Industry sector: Oil and Gas

Industry role: Consultant; Manufacture or Supply

Profile: ATCOM ApS is a vendor of products from leading suppliers of data transmission and network equipment - wireless as well as cable based.

Atkins Danmark A/S

Dokvej 3, Sektion 4 - 6700 Esbjerg

+4552519000 / +4552519799
oilgas-dk@atkinsglobal.com
www.atkins.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant

Industry classification: Fabrication and Construction; Feasibility or Front End Studies; Foundations and Piles; Installation and Commissioning; Instrumentation; Land and Premises; Maintenance, Modification and Operation; Networking and Events; Personnel; Pipes, Pipelines and Risers; Process Control; Project Management; Safety; Training

Atlas Copco Rental
Naverland 22 - 2600 Glostrup

+4543454611 / +4543632120
rental@dk.atlascopco.com
www.atlascopcorental.dk

Industry sector: Oil and Gas

Industry role: Consultant; Service; Certifications: 923 Certification;
iso-9001 Certification; ohsas-18001 Certification

Profile: World wide rental supply of compressors, nitrogen and power generators.

ATP Instone Marine & Corporate Travel
Havnegade 35 - 1058 København K

+45 33915915 / +45 33915916
marine.denmark@atpi.com
www.atpi.com

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Service

Profile: ATP Instone is a marine travel service provider..

AVEVA Denmark A/S
Sofiendalsvej 5A - 9200 Aalborg SV

+45 99301100
sales.nordic@aveva.com
www.aveva.com*

Industry sector: Oil and Gas; Offshore Wind

Industry role: Design; Engineering

Industry classification: Computing and Information Technology; Construction Vessels

Balslev Consulting Engineers A/S
Produktionsvej 2 - DK - 2600 Glostrup

+45 7217 7217
balslev@balslev.dk
www.balslev.com



Industry sector: Oil and Gas; Offshore Wind

Industry role: Engineering & Consulting

Profile: For offshore projects we design electrical systems and auxiliary systems for transformer platforms and electrical systems (transition pieces) in connection with cabling to wind farms. These services includes, among other things: Design of electrical systems - high to low voltage; Lighting and backup power supply; Lightning and transient overvoltage protection; Safety installations like video surveillance (CCTV). For wind turbines we provide: Design of machinery transformers with related protection equipment; Preparation of material for "Failure mode and effects analysis" (FMEA); Design verification and validation procedures; Definition of electrical and mechanical interfaces plus co-ordination of these.

Baltic Industries & Consulting A/S
Birk Centerpark 40 - 7400 Herning

+45 70 22 41 05 / +45 96 42 65 34
www.BIC-electric.com

Industry sector: Offshore Wind; Wave Energy

Industry role: Service

Bech-Bruun
Langelinie Allé 35 - 2100 København Ø

+45 7227 0000 / +457227 0027
info@bechbruun.com
www.bechbruun.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Service

Profile: Bech-Bruun is among the leading law firms in Denmark. From our offices in Copenhagen and Aarhus, we provide advice on all aspects of corporate and commercial law. Our clients include national and international enterprises, organisations and public authorities.

BIC Group
Springbankevej 14 - 7323 Give

+45 70 22 41 05
www.BIC-electric.com

Contact person:
Maj Winther Møller, Sales Manager, +45 50 43 61 98,
MWM@BIC-electric.com



Industry sector: Oil and Gas; Offshore Wind

Industry role: Service provider; Pre-assembly; Electrical; Maintenance; Installation

Profile: BIC Electric is a technical service provider in electrical and mechanical installation, maintenance and commissioning for Offshore Wind Power and Oil & Gas. We provide experienced, skilled, competent and hard-working technicians and engineers at competitive rates. Using our services, our partners can adjust their capacities to the current market demands quickly and smoothly and improve competitiveness.

Blue Company ApS
Boven 11 - 6700 Esbjerg

+45 20 83 83 53
info@blue-company.dk
www.blue-company.dk

Industry sector: Offshore Wind

Industry role: Service

Blue Water Shipping

Trafikhavnsvej 9 - 6701 Esbjerg

+45 7913 4144 / +45 7913 4677
bwsebj@bws.dk
www.bws.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Manufacture or Supply; Service; Certifications:
923 Certification; iso-14001 Certification; iso-9001 Certification; ohsas-18001 Certification

Profile: Blue Water Shipping is a global provider of all logistics services in modern supply chain management. We operate within seven business areas:

• Wind Logistics • Oil & Gas • Industrial Projects • Port Operations & Agency • General Cargo • Reefer Logistics • Cruise Logistics • North Atlantic.

Blue Water Shipping offers complete and customized solutions to any shipping requirements anywhere in the world.

Blaaholm A/S

Limfjordsvej 13 - 6715 Esbjerg N

+45 7519 5427 / +45 7519 5425
blaaaholm@blaaaholm.com
www.blaaholm.com

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Design; Engineering; Installation; Manufacture or Supply

Profile: Blaaholm A/S develops special equipment for production, lifting, transportation and installation. We offer turnkey solutions which includes concept development, engineering, production and installation. We have a high quality standard and are focused on delivery on time..

Bolt Specialisten Aps

Alpedalsvej 101 - 6000 Kolding

+45 7550 1575
info@boltspecialisten.dk
www.boltspecialisten.dk

Competences Industry sector: Oil and Gas

Profile: Supplier of: Linepipes, Offshore and Structural pipes, Foundation piles, Anchor piles. Flanges - ASTM/DIN and Bolts. Heads, closures and special pressings.

Brammer A/S

Cedervej 2 - 8462 Harlev J

+4576 40 87 00 / +45 7640 8701
dk@brammer.biz
www.brammer.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply; Service

Industry classification: Bearings; Bolting, Fixing or Fasteners; Brakes; Electrical Equipment, Materials and Services; Electronics; Gears and Gearboxes; Generators; Hydraulics and Pneumatics; Supply Chain Management; iso-9001 Certification; Member of Achilles.

Brüel & Kjær Vibro A/S

Skodsborgvej 307 B - 2850 Nærum

+45 7741 2500 / +45 4580 2937
bkvinfo@bkvibro.com
www.bkvibro.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply; Service

Profile: Brüel & Kjær Vibro A/S is the leading European vibration monitoring company, with more than 50 years of dedicated expertise in systems and services capable of doing protective and condition monitoring of rotating and reciprocating industrial machines.

Bureau Veritas Danmark

Vesterbrogade 149, byg. 4 - 1620 København V

+45 7731 1000
www.bureauveritas.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Service

Profile: Bureau Veritas Group is uniquely placed to support customers with services that generate high added value and are intended to guarantee the legality and conformity of their operations, reduce the risks they incur, and measure and improve the performance of their organisation. Visit our Energy and Process website at: <http://energyprocess.bureauveritas.com>.

Business Connect A/S

Helgolandsgade 22 - 6700 Esbjerg

+45 81409370
connect@business-connect.dk
www.business-connect.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Design; Installation; Manufacture or Supply; Service

Industry classification: Bearings; Business Development; Construction Vessels; Corrosion Protection; Forging and Casting; Foundations and Piles; Insulation; International Trade; Machine Shops; Market Research; Marketing; Metal Materials; Networking and Events; Project Management; Rotor Blades; Supply Chain Management; Surface Treatment; Towers; Wind Turbine

Bølgekraftforeningen (The Wave Energy Association)

Hamborgvej 40 - 7730 Hanstholm

+45 2463 2404
wave@waveenergy.dk
www.waveenergy.dk

Industry sector: Wave Energy

Industry role: Support Organisation

Profile: The Wave Energy Association - the Association for the promotion of wave energy is up to date with the development of wave energy in Denmark and abroad. The board holds virtually all Danish experts within wave energy and offers their knowledge to the members of the association.

Cabicon a/s

Emil Neckelmanns Vej 5 - 5220 Odense SØ

+45 7623 4400
Fax +45 7623 4401
sales@cabicon.com
www.cabicon.com

Contact: Søren Haslev, Electrical Engineer, sh@cabi-
con.com, +45 2924 6045



Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply

Profile: Cabicon a/s is a professional supplier of electrical products and equipment to the Danish and European market. Core business is: Electrical insulation, connectivity, fixation, cable glands, cable support systems, industrial marking, measurement instruments, tools, Cable handling systems and Megger.

Carl Backs A/S

Vesterhavsgade 153 - 6700 Esbjerg

+45 7515 1177 / +45 7515 1726
info@carlbacks.dk
www.carlbacks.dk



Industry sector: Oil and Gas

Industry role: Manufacture or Supply

Carl Backs was established in 1971, therefore we have many years of experience supplying the offshore oil and wind sectors, we have the experience and knowledge necessary to provide the best service and knowhow.

We are proud of our success in aligning our partners' requirements for Personal Protective Equipment to our easily accessible and bespoke webshops. Our aim is to add value and provide cost reduction for our partners.

Located in Esbjerg, we are already involved with the current and emerging offshore market.

Caverion, Fredericia

Vejlevej 123 - 7000 Fredericia

+45 7623 2323
www.caverion.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Service

Profile: Caverion supply integrated technical solutions and services for a wide range of applications. The company have more than 20 years of experience with work in the offshore industry.

Ce-Tec A/S

Kirkegade 9, 2. - DK-6700 Esbjerg

+45 7478 3564
cea@ce-tec.dk
www.ce-tec.dk



Industry sector: Oil and Gas; Offshore Wind

Industry role: Support Organisation

Profile: Ce-Tec A/S matches experienced and specialized engineers and other personnel with relevant assignments e.g. within the oil and gas industry. Ce-Tec also provides consultancy services e.g. within power and instrumentation installations, planning and commissioning, quality assurance of ATEX-installations and electrical safety courses.

CLEAN

Rådhuspladsen 59, 4. - 1550 København V

+45 2196 1000
info@cleancluster.dk
www.cleancluster.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Support Organisation

Profile: Promoting green growth and employment in Denmark. CLEAN is Denmark's leading green cluster organisation with members from the entire cleantech sector. CLEAN is a political-ly and technologically neutral platform that works across industry boundaries and the public and private sectors allowing domestic and foreign companies, knowledge institutions and public authorities to exchange knowledge and enter into new partnerships.

Clemco Danmark ApS

Niels Bohrs Vej 40 - 8660 Skanderborg

+45 7013 1030 / +45 8033 1030
info@clemco.dk
www.clemco.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Engineering; Manufacture or Supply; Training and Education

Profile: Clemco Denmark is a provider of equipment and tools for anti corrosion coatings such as sand blasting equipment, metallisation equipment and paint spraying pumps as well personal protection equipment.

**Comtec International
Workwear & Safety Equipment**

Vesterhavsgade 153 - 6700 Esbjerg

+45 7512 0930
comtec@comtecint.dk
www.comtecint.dk



Industry sector: Oil and Gas; Offshore Wind

Industry role: Work Wear; Safety

Profile: We have more than 15 years of experience supplying the offshore oil and wind sectors, we have the experience and knowledge necessary to provide the best service and knowhow. We are proud of our success in aligning our partners' requirements for Personal Protective Equipment to our easily accessible and bespoke webshops. Our aim is to add value and provide cost reduction for our partners. Located in Esbjerg and Hull, we are already involved with the current and emerging offshore market.

COPCO A/S

Vestkraftkaj 4 C - 6701 Esbjerg

7513 6011 / 7513 6027

fc@copco.dk

www.copco.dk

Industry sector: Oil and Gas

Industry role: Manufacture or Supply

Profile: COPCO serves the oil and gas industry with a wide range of chemicals and oil products. Our office and tank terminal is located right on the quay side at the Port of Esbjerg.

CS Accommodation A/S

Darumvej 145c - 6700 Esbjerg

+45 7512 0093

info@csaccommodation.com

www.csaccommodation.com



Industry sector: Oil and Gas; Offshore Wind

Profile: Around the world we are handling everything from the first survey reports, renovation and reconstruction projects offshore to implementing large accommodation upgrades during Yard Stays. This includes: All types of IMO approved floor constructions, IMO approved wall systems, IMO approved ceiling systems (prepared for lights, ventilation etc.), complete solutions from 3D layouts to delivering a fully equipped Galley, IMO approved furniture for all areas in living quarters, complete solutions from the first layouts to delivery of new bathrooms ready for use, Cold storage / Deep freeze rooms (renovate or deliver new storage areas), service and maintenance (from survey reports to operations and maintenance plans).

DAFA A/S

Holmstrupgaardvej 12 - DK-8220 Brabrand

+45 87 47 66 66

dafa@dafa.dk

www.dafa-as.com



Industry sector: Offshore Wind

Profile: New solutions, new methods, new technologies and new structures are constantly appearing. DAFA is contributing to development of the sector through its extensive insight into and experience with wind turbines.

This allows DAFA to serve as a trusted business partner offering foam, rubber and plastic solutions which improve turbine functioning – onshore and offshore.

DAHL Advokatfirma, Esbjerg

Dokken 10 - 6700 Esbjerg

+45 8891 9000

mail@dahlaw.dk

www.dahlaw.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Service

Industry classification: Legal

Danish Export Association

Glarimestervej 20 A - 8600 Silkeborg

+45 8681 3888 / +45 8681 3114

export@dk-export.dk

www.dk-export.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Service; Support Organisation; Training and Education

Profile: A membership of the Danish Export Association brings you know-how: Through the Danish Export Association you are included in a professional and powerful network. The Danish Export Association addresses suppliers of components, systems as well as services. The Danish Export Association is a strong partner for Danish companies wishing an international impact.

Danish Marine & Offshore Group

Nørremarksvej 27 - 9270 Klarup

+45 9831 7711 / +45 9831 7755

dmog@offshore-denmark.dk

www.offshore-denmark.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Support Organisation

Profile: Danish Marine & Offshore Group is a member-based supplier association of companies offering products, consultancy and services to the international offshore industry. The aims of the association is to organise conferences and networking events as well as to encourage cooperation between the members to the benefit of the customers.

Danish Standards (Dansk Standard)

Göteborg Plads 1 - DK-2150 Nordhavn

+45 39 96 61 01

fax +45 39 96 61 02

dansk.standard@ds.dk

www.ds.dk

Industry sector: Oil and Gas; On- & Offshore Wind

Industry role: Standardisation

Profile: Danish Standards is Denmark's national standardisation organisation. Through our Danish committees and strong professional networks, we provide knowledge about and influence on international standards to Danish enterprises, trade associations, consumer organisations, the authorities, researchers etc. We are members of the international standardisation organisations ISO and IEC as well as the European counterparts CEN, CENELEC and ETSI.

Danoil Exploration A/S

Åhave Parkvej 11 - 8260 Viby J

+45 8932 2211



DANOIL EXPLORATION A/S

Industry sector: Oil and Gas

Danske Bank

Strandbygade 2- 6700 Esbjerg

+45 4512 6500 / +45 4514 5502
www.danskebank.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Service

Profile: By providing proactive advice, we enable you to make the right financial decisions for your business. With our market-leading financial tools and expertise, we give you a realistic picture of the consequences of selecting specific strategies.

DBI - Danish Institute of Fire and Security Technology

Jernholmen 12 - 2650 Hvidovre

+45 3634 9000 / +45 3634 9001 //
dbi@dbi-net.dk
www.dbi-net.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Service

Industry role: Service

Deloitte Statsautoriseret Revisionspartnerselskab

Frodesgade 125 - 6700 Esbjerg

+45 7912 8444 / +45 7912 8455
esbjerg@deloitte.dk
www.deloitte.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Service

Profile: Deloitte works with a wide range of both private and public organisations. Deloitte offers a range of support services including: Auditing; Accounting; Tax; Relocation; Information technology; Environment; Management consultancy

DHI

Agern Allé 5 - 2970 Hørsholm

+45 4516 9200 / +45 4516 9292
info@dhigroup.com
www.dhigroup.com

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Consultant; Design; Installation; Research and Development; Service; Training and Education

Profile: DHI is an independent, international consulting and research organization with head-quarter in Denmark. Our objectives are to advance technological development and competence within the fields of water, environment and health. With respect to design optimization, environmental impact assessment, and environmental management of large-scale offshore projects (oil & gas as well as offshore renewables), DHI possesses a body of experience and an array of advanced problem solving tools, which are unsurpassed worldwide.

DI Energi

H.C. Andersens Boulevard 18 - 1787 København K

+45 3377 3377 / +45 3377 3300
hps@di.dk
www.energi.di.dk

Industry sector: Oil and Gas

Industry role: Support Organisation

Profile: The Confederation of Danish Industries (Dansk Industri - DI) is a private organisation funded, owned and managed entirely by currently 6,400 companies within the manufacturing and service industries.

DIS, Esbjerg

Spangsbjerg Møllevej 100 - 6705 Esbjerg Ø

+45 8738 7450
esb@d-i-s.dk
www.d-i-s.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Consultant; Design; Engineering; Manufacture or Supply Research and Development

Profile: DIS is a consulting engineering company, delivering product development, special machinery and consultants to the industry. As one of Denmark's leading engineering companies, DIS' engineers are experts in creating innovative solutions, with a focus on cost, robustness, quality, safety and implementation.

DJURS Wind Power

Færgevej 1, 1. sal - 8500 Grenaa

+45 5122 0222
dwp@djurswindpower.dk
www.djurswindpower.dk

Industry sector: Offshore Wind

Industry role: Support Organisation

DNV GL, Esbjerg

Dokken 10 - 6700 Esbjerg

+45 7912 8600 / +45 7912 8601
esbjerg@dnvgl.com
www.dnvgl.com

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

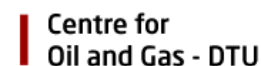
Industry role: Consultant; Design; Engineering; Installation; Research and Development; Service; Training and Education

Profile: DNV GL is driven by the purpose of safeguarding life, property and the environment. DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries.



DTU - Centre for Oil and Gas
Elektrovej - Bygning 375 - 2800 Kgs. Lyngby

+45 4525 7210
www.oilgas.dtu.dk



Industry sector: Oil and Gas

Profile: The Danish Hydrocarbon Research and Technology Centre at DTU is tasked with researching and developing new technologies with a view to improving utilization of the North Sea reserves of oil and gas. The centre is located at DTU and affiliated with research groups at the University of Copenhagen, Aarhus University, Aalborg University, and the Geological Survey of Greenland and Denmark (GEUS).

DTU Wind Energy

DTU Risø Campus - Frederiksborgvej 399 -
4000 Roskilde

+45 4677 5085
www.vindenergi.dtu.dk

DTU Wind Energy
Department of Wind Energy

Industry sector: Offshore Wind

DTU Wind Energy is a globally leading department for wind energy with scientific and engineering competences to the highest international standards.

East Metal A/S

Bavnehøjvej 6 - 6700 Esbjerg

+45 7525 1799 / +45 7525 1647
emt@eastmetal.dk
www.eastmetal.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Manufacture or Supply

Profile: East Metal is a Sub-supplier with specialty in heavy complex steel constructions and components. With certified quality and a large capacity we can serve our customers within offshore wind energy, oil & gas, transportation and lifting equipment and other industries.

EKU, E-Learning Kompetence Udvikling

Hegnet 28 - DK-6715 Esbjerg N

+45 41 40 67 00 / +45 75 170 500
www.eku.dk

Contact person:
Per Nørsten, Adm. Direktør, Pjn@eku.dk



Industry sector: On- & Offshore Wind, Oil & Gas

Industry role: Training; Safety

EKU offers the best E-Learning solutions!
Our electrical safety course "EN 50110 & L-AUS, Safety when working on or near electrical installations" is available at eku.dk in English and Danish. (European standard and Danish regulations)
Course based on German regulation (EUP) - in English and German - is available at ontra.de
Our courses are available 24/7/365 for enrollment and completion. Enrollment, payment, course completion and print of certificate - All online - whenever it suits you.
We offer the best competencies and service in the market.

Endress+Hauser A/S

Poppelgårdvej 10-12 - 2860 Søborg

+45 70 13 11 32 / +45 70 13 21 33
info@dk.endress.com
www.dk.endress.com

Contact person: Oline Westerdahl, Marketing Manager
Scandinavia, Oline.Westerdahl@dk.endress.com,
+4539558107 / +4523268107

Industry sector: Oil and Gas

Industry role: Consultant; Engineering; Installation; Manufacture or Supply; Service; Training and Education

Profile: Endress+Hauser is a leading supplier of measuring instruments and automation solutions for the industrial process engineering industry. Safety, efficiency and availability, whether upstream or downstream, we tackle your specific challenges with partnership and enthusiasm. Our goal is to support you in enhancing and improving overall plant safety, and in enjoying the confidence that comes from working with accurate, robust and reliable measurement instrumentation. Our factory-trained and knowledgeable people are available to support you globally throughout the entire life cycle of your plant.

Energinet.dk

Tonne Kjærsvvej 65 - 7000 Fredericia

+45 70102244
info@energinet.dk
www.energinet.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Service

Industry classification: Cables and Connectors; Grid Interface or Substations; Safety

Energistyrelsen

Amaliegade 44 - 1256 København K

+45 33926700 / +45 33114743
ens@ens.dk
www.ens.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Support Organisation

Profile: The Danish Energy Authority carries out tasks, nationally and internationally, in relation to the production, supply and consumption of energy. This means that the Authority is responsible for the whole chain of tasks linked to the production of energy and its transportation through pipelines to the stage where oil, natural gas, heat, electricity etc. are utilised for energy services by the consumer.

Energy and Climate Academy

Lysholt Allé 6 - DK 7100 Vejle

+45 3023 7636

tki@energyandclimateacademy.com

www.energyandclimateacademy.com



Industry sector: Offshore Wind

Industry role: Training and Education

Profile: Capacity building is one of the key factors for success in the off shore wind energy business.

We offer short, professional post-graduate courses for engineers, managers and others that want access to the newest knowledge and experience.

Our lecturers come from leading companies and universities, such as Ørsted and DTU Wind. Since 2004 more than 4.000 have participated in our courses.

We offer open courses as well as custom designed courses. During the years we have conducted courses all over the world.

Envision Energy, Denmark

Torvet 11, 2. - 8600 Silkeborg

+45 7244 4439 / +45 8685 9942

gic@envisioncn.com

www.envisioncn.com

Industry sector: Offshore Wind

Industry role: Design; Engineering; Manufacture or Supply

Profile: Envision Energy is the largest privately owned wind turbine manufacturer in China. Envision is based in China with the core business of developing and manufacturing WTG's which comprises research & development, manufacturing, sales and maintenance of advanced-technology wind turbine generators.

Erhvervsakademi Sydvest

Sp. Kirkevej 103 - 6700 Esbjerg

+4576133200 / +4576133201

www.easv.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Training and Education

Profile: The Business Academy SouthWest offers different higher educational programs up to bachelor-level with a specific focus on offshore and energy among other areas.

The Business Academy SouthWest is closely linked to the regional business and industry and all programs have a strong focus on the practical problems the students will meet in their professions.

Esbjerg Airport (Esbjerg Lufthavn)

John Tranums Vej 20 - 6705 Esbjerg Ø

+45 7612 1400

www.esbjerg-lufthavn.dk



Industry sector: Oil and Gas; Offshore Wind

Industry role: Airport

Profile: Esbjerg Airport is a vital nerve center for the offshore industry and the many passengers who each day pass through our facilities on their way to and from work. We are a hub for helicopter flights to the North Sea and daily scheduled flights to Aberdeen and Stavanger. Furthermore, we are fully equipped to handle heavy cargo such as containers, anchors, nacelles and other elements that need to be shipped to oil rigs or elsewhere in the world.

Esbjerg Business Development Centre

Niels Bohrs Vej 6 - 6700 Esbjerg

+4575123744 / +4536973501

info@eeu.dk

www.eeu.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Support Organisation

Profile: At Esbjerg Business Development Centre we will nourish your business. We offer you new approaches to your opportunities and challenges, regardless of the development stage and line of your business.

Esbjerg Ejendomme A/S

Kongensgade 104, 1. - DK - 6700 Esbjerg

+45 20 65 99 20

www.esbjergejendomme.dk

kontakt@esbjergejendomme.dk

Contact Person: Lone Madsen



Esbjerg Ejendomme A/S offers furnished apartments for rent. The apartments are located in the center of Esbjerg, very close to the harbor. Apartments from 2-8 persons. Modern and simple style, with all the necessary furniture and kitchenware. We offer apartments with 2-4 bed rooms with shared living, dining, bath room and kitchen. Included: Refrigerator, stove, microwave, ironing board, washing machine/dryer, cable TV, WI-FI, duvet, pillow, linens, towels and dish-towels etc. Extra services available at additional cost: washing of the bed linen, cleaning of the entire apartment etc.

Esbjerg Havn (Port of Esbjerg)

Hulvejen 1 - 6700 Esbjerg

+4575 12 4144

adm@portesbjerg.dk

www.portesbjerg.dk

Profile: The Port of Esbjerg is Denmark's western gateway.

Esbjerg Kommune

Rådhuset - 6700 Esbjerg

+45 76161616 / +4576161617

raadhuset@esbjergkommune.dk

www.esbjergkommune.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Support Organisation

Profile: The Municipality of Esbjerg is the fifth-largest in Denmark with approx. 115.000 inhabitants. It covers an area of 75,543 hectares or 755 square kilometers. Today the Municipality of Esbjerg is Denmark's center for energy technology based on a strong business cluster and a strong education and research environment. Go to www.energymetropolis.dk for more information.

Esbjerg Oiltool A/S

Håndværkervej 67 - 6710 Esbjerg V

+45 75156400 / +45 75156143
eot@estool.dk
www.estool.dk

Industry sector: Oil and Gas

Industry role: Manufacture or Supply

Profile: Stockholders of: Pipes and Tubulars in ASTM/API Qualities.

Esbjerg Shipyard A/S

Mølevvej 28-30 - 6700 Esbjerg

+4575 12 01 50
tlt@granly.dk
www.esy.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Engineering; Installation; Manufacture or Supply; Service; iso-9001 Certification; Member of Achilles; Other

Profile: Esbjerg Shipyard is part of the Granly Group – a family of highly specialized companies. Esbjerg Shipyard represents the maritime sector within the group and offers all kinds of shipbuilding, repair, maintenance, classification and inspection. Esbjerg Shipyard collaborates with a large number of service companies in Esbjerg Harbour and thus covers all the needs of ship owners.

ESVAGT A/S

Dokvej 4 - 6700 Esbjerg

+4578730730
www.esvagt.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Service

Profile: ESVAGT delivers safety and support at sea, and focus on quality and safety and provide a wide range of specialized services to the offshore oil, gas and wind industries: Standby, rescue and serviceduties, Oilspill response and surveillance, Offshore Wind service support.

Europas Maritime Udviklingscenter (EMUC)

Amaliegade 33 B - 1256 København K

+4533337488 / +4533327938
info@maritimecenter.dk
www.emuc.dk

Industry sector: Oil and Gas

Industry role: Service; Support Organisation

Profile: The objective of the Maritime Development Center of Europe is to promote growth and development in the maritime sector.

F. Engel K/S

Norgesvej 12 - 6100 Haderslev

+4574223535 - +4574223509
f-engel@f-engel.com
www.f-engel.com



Industry sector: Oil and Gas; Offshore Wind

Industryrole: Manufacture or Supply

Profile: Safety – is paramount
Various hazardous working situations can occur in different workplaces – the Safety + range is therefore manufactured in different qualities, among other is antistatic, acid repellent and heat and flame resistant while also providing protection against welding sparks and arcs. The collections is notable for its comfortable fit, and the models which are made of fluorescent material all have LOXY reflectors and are certified according to current EN ISO standards. Your safety is our concern.

Falck Safety Services A/S

Uglviggårdsvej 3 - 6705 Esbjerg Ø

+45 7612 1314 / +457612 1313
falcksafety@falcksafety.dk
www.falcksafety.dk



Falck

Safety Services

Industry sector: Oil and Gas; Offshore Wind

Industry role: Training and Education

Profile: Falck Safety Services is an international education center which offers standard courses including among other things fire and rescue for offshore, shipping, windmills, industry and service.

Furthermore a long line of special courses within maritime security and ISPS security, chemical training, crisis management and safety advise are available.

FORCE Technology

Park Alle 345 - 2605 Brøndby

+45 4326 7000 / +45 4326 7000
info@forcetechnology.dk
www.forcetechnology.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Design; Engineering; Research and Development; Service; Training and Education

Profile: FORCE Technology is among the leading technological consulting and service companies in Denmark as well as internationally, transforming knowledge into solutions and focused on transforming highly specialized engineering knowledge into practical and cost-effective solutions for a broad range of business sectors and industries.

Fredericia Maskinmesterskole

Købmagergade 86 - 7000 Fredericia

+45 75922833 / +45 75933599
fms@fms.dk
www.fms.dk

Industry sector: Oil and Gas

Industry role: Training and Education

Profile: School providing maritime educations for almost 100 years.

Furmanite A/S

Isefjordsvej 3 - 6715 Esbjerg N

+45 3534 6080

firmapost@furmanite.com

www.furmanite.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Engineering; Installation; Manufacture or Supply; Service

Profile: Furmanite, one of the world's largest specialty technical services companies, delivers abroad portfolio of engineering solutions that keep facilities operating, onshore, offshore and subsea, minimizing downtime and maximizing profitability.

FURUNO Danmark AS

H.E. Bluhmesvej 77 - 6700 Esbjerg

+45 75132266 / +4575139514

esbjerg@furuno.dk

www.furuno.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply

Profile: FURUNO DANMARK AS are providing the maritime- offshore industry with advanced electronic systems and products for navigation, communication and fish-finding. Covering the markets in Denmark, Greenland, Faroe Islands, Island, Russia, Azerbaijan, Poland, Israel and the Baltic Countries.

GasDetect

Stensgårdvej 2 - 5500 Middelfart

+45 42 42 50 70

stm@gasdetect.dk

www.gasdetect.dk

Industry sector: Oil and Gas

Industry role: Manufacture or Supply

Geo

Maglebjergvej 1 - 2800 Kgs. Lyngby

+45 4588 4444

geo@geo.dk

www.geo.dk



Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Contractor; Design; Engineering; Laboratory Tests; Survey

Profile: Geo is a Danish full-service engineering company. We offer services ranging from off-shore site investigations to geotechnical design, including offshore geotechnical- and geophysical services. With our in-house custom made equipment and our state-of-the-art laboratory, we are able to secure high quality samples and data. Geo has participated in numerous offshore projects involving the oil and gas sector, as well as more than 50 offshore wind projects.

Grenaa Havn A/S

Neptunvej 1 - 8500 Grenaa

+45 87 58 76 00 / +45 86 32 43 71

info@port-of-grenaa.com

www.port-of-grenaa.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Installation; Service

Industry classification: Cranes (Mobile); Decommissioning and Abandonment; Land and Premises; Material and Product Handling; Personnel; Ports and Supply Bases

Grønbech & Sønner A/S

Malervej 4 - 6710 Esbjerg

+45 33266300 (day) / +45 72171494 (night)

tnk@g-s.dk

www.g-s.dk



Industry sector: Wind (on- and offshore), Oil and Gas

Industry role: Engineering & Consulting; Supply; Other

Profile: Grønbech & Sønner is a global player on major projects around the world. Our experienced offshore technicians are able to perform Pressure Safety Valves-campaigns and similar tasks. At our workshop, we are able to perform maintenance, test and repair of valves, pressure safety valves, instruments and pumps. As certified agents of CAMERON valves & measurements, KSB pumps & valves, AUMA Actuators and Bopp & Reuther in Denmark, we have a wide range of possibilities to offer outstanding components and solutions to the offshore industry.

Hafnia Law Firm

Nyhavn 69 - 1051 København K

+4533343900 / +4533343920

info@hafniafirm.com

www.hafniafirm.com

Industry sector: Offshore Wind

Industry role: Service

Profile: Maritime and international lawfirm

Hanstholm Elektronik, Esbjerg

Fiskerihavnsvej 9 - 6700 Esbjerg

+45 97 96 18 88

www.he-as.dk

Industry sector: Oil and Gas

Industry role: Consultant; Design; Service; Engineering; Installation

Hempel A/S

Lundtoftegårdsvej 91 - 2800 Kgs. Lyngby

45 93 38 00 / 45 88 55 18

hempel@dk.hempel.com

www.hempel.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply

Profile: The Hempel Group is a leader in the production and sales of protective coating solutions within the marine, container, yacht, decorative and protective market segments. Hempel provides coatingsystems with a proven performance trackrecord for use in both alkaline and acidic environments and for use on steel/alloys, as well as concrete.

Hess Denmark ApS
Østergade 26B - 1100 København K

33301233 / 333012 99
www.hess.com

HG Electric A/S
Bløden 2 - 9900 Frederikshavn

98 42 60 70 / 98 43 90 70
info@hg-electric.dk
www.hg-electric.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply; Service

Profile: HG Electric A/S is a licensed electrical installation company which has had tremendous growth within onshore as well as marine installations.

HH-Consult A/S
Garmestervej 22 - 6710 Esbjerg V

+4576104055 / +4576104056
esbj@hh-consult.dk
www.hh-consult.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Service

Profile: HH-Consult A/S employs engineers, inspectors, project managers and other highly qualified personnel in a wide range of disciplines.

Hirtshals EL-Motorservice ApS
Cort Adellersvej 2-4 - DK-9850 Hirtshals

+45 9894 1595
ceo@elmotorservice.dk
www.elmotorservice.dk



Industry sector: Oil and Gas; Offshore Wind

Industry role: Service

Profile: We have specialized expertise in winding electric motors, and winding of electric motors of the Ex-d, Ex-e, Ex-de, Ex-n og Ex-t type is one of our services. We are certified to do servicing of ATEX-certified electric motors, for instance. We can therefore service, repair and renovate your equipment on site instead of at the manufacturer's. Winding is one of our specialist areas. It often turns out to be cheaper – and faster – to perform a new winding, instead of investing in a new generator.

Hirtshals Havn
Norgeskaen 11 - 9850 Hirtshals

+45 96 56 50 00
hirtshalshavn@hirtshalshavn.dk
www.portofhirtshals.com

Industry sector: Oil and gas

Industry role: Service

Profile: The Port of Hirtshals has a unique location directly at the North Sea, and right at the beginning of the European motorway network, E39. In 2011, the Port of Hirtshals entered the offshore market, and since then the port has been home to several rig renovations and upgrades. The Port of Hirtshals has the facilities to provide the right settings for service, repair and renovation of offshore units. Furthermore, the port is home to a wide range of service companies with experience in the offshore business.

Holtec Automatic A/S
Sallingsundvej 2 - 6715 Esbjerg N

+4576767676
holtec@holtec.dk
www.holtec.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Engineering; Installation; Manufacture or Supply

Profile: Holtec Automatic A/S – Safe controls that create value for our customers. Supplier of control products for Oil/ Gas and the industrial automation. Over 25 years of combined controls experience.

Horten Advokatpartnerselskab
Philip Heymans Allé 7 - 2900 Hellerup

+4533 34 40 00 / +4533 34 40 01
www.horton.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Service

Profile: Horten is specialised within sectors characterised by strict regulation or where technological development and innovative approaches are fundamental - such as energy and supply, Life Science and Healthcare, IT, technology and media as well as the public sector.

HSM Industri A/S
Bredstrupvej 50 - 8500 Grenaa

+4586326666 / +4586309866
hsm@hsm.dk
www.hsm.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Design; Engineering; Manufacture or Supply; Research and Development; Service

Profile: Production of large scale offshore equipment such as complex handling machines, BOP Elevators, BOP Cranes, Pipe Rackers etc.

Hub North
Boulevarden 13 - 9000 Aalborg

+45 99 31 15 84
info@hubnorth.dk
www.hubnorth.dk

Industry sector: Oil and Gas; Offshore Wind

Profile: Hub North is a northern Danish network with targeted profiling within wind energy. The operators are companies active within the windmill industry, directly or as subcontractors to larger manufacturers.

Hvide Sande Havn (The Port of Hvide Sande)

Fossanæsvej 22, Blue Tower - 6960 Hvide Sande

+45 9731 1633
hvidesandehavn@hvshavn.dk
www.hvidesandehavn.dk



Industry sector: Offshore Wind

Industry role: Support Organisation

"Profile: The harbour has been modernised and extended. The new west jetty is 210 metres long. The port has a 20,000 m2 of ISPS-secured storage area, and areas of around 200,000 m2 in its west and northern sectors. The approach is 100 m wide and dredged to a normal depth of 7 metres. The port has its own dredging equipment and can therefore guarantee stable approach conditions.
The wind industry already uses the port, and Hvide Sande is set to play a key role in the construction phase of the Horns Rev 3 wind farm, especially regarding the shipping of manpower, supplies and servicing vessels.
The services provided are also available to oil & gas customers, at this highly efficient and price-competitive port."

HYTOR A/S

Høgevej 8 - 6705 Esbjerg Ø

+45 76 14 19 00 / +45 76 14 19 09
info@hytor.dk
www.hytor.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Design; Engineering; Manufacture or Supply; Service

Profile: HYTOR designs and builds specialized systems and sells, services and rents out equipment to the oil- and gas industry, wind energy industry and the industry in general. As co-laborator and supplier HYTOR is the reliable and solution oriented business partner that with detail oriented specialists, competent experience and precision creates value adding solutions of high quality.

IAT Base & Energy A/S

Vestkraftkaj 4 A - 6700 Esbjerg

+45 7513 1022 / +45 7513 1914
base@iat.dk
www.iat.dk

Industry sector: Oil and Gas

Industry role: Consultant; Manufacture or Supply; Service

Profile: IAT Base & Energy is closely connected with the oil and gas activities in the Danish part of the North Sea. IAT Base & Energy's most important task is - 24 hours a day - to be available for service for the oil companies, operators and other partners, in order to secure that the search for and production of oil and gas can take place under the best conditions possible.

IFS Danmark A/S

Arne Jacobsens Allé 15-17 - 2300 København S

+4543 28 89 00 / +4543 28 89 01
www.ifsworld.com/dk/industries/oil_and_gas

Industry sector: Oil and Gas

Industry role: Consultant; Service

Profile: IFS is a public company (OMXSTO: IFS) founded in 1983 that develops, supplies, and implements IFS Applications™, a component-based extended ERP suite built on SOA technology.

Insatech A/S

Algade 133 - 4760 Vordingborg

+455537 2095
mail@insatech.com
www.insatech.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Design; Engineering; Installation; Manufacture or Supply; Service; Training and Education

Industry classification: Communication Systems; Control Systems; Electrical Equipment; Materials and Services; Hazardous Area Equipment and Services; Inspection and Testing; Instrumentation; Valves and Accessories; iso-9001 certification, member of Achilles.

IPS-Group A/S

Hejreskovvej 22A - DK-3490 Kvistgaard

+45 4913 2800
info@ips-group.dk
www.ips-group.dk



Industry sector: Offshore Wind

Industry role: Manufacture or Supply

Profile: IPS-Group A/S is an agency-based company with specialisation in industrial innovative products and services.
Combining world-class expertise and future-focused technologies, we meet the specific needs of our customers. IPS makes a good partner for your business.

J.A.K. Workwear A/S

Energivej 11 - 6700 Esbjerg

+457615 2929 / +457615 2939
info@jak.as
www.jak.as

Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply

Profile: Production of work wear for offshore use. Whole sale of safety shoes and personnel protection gear.

JKS a/s

Kongensgade 123 - 6700 Esbjerg

+4576141750 / +4576141751
esbjerg@jks.dk
www.jks.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Service

Profile: JKS is one of the largest temp staff- and recruitment companies in Denmark with more than 15 years experience – especially with personnel in industrial production.

Jobcenter Esbjerg, Team Energi

Exnersgade 33 - 6700 Esbjerg

+4576167300

ba-jobservice-energiteam@esbjergkommune.dk
www.esbjergkommune.dk/borger/arbejde--dag-
penge--orlov/arbejde-offshore.aspx

Industry sector: Oil and Gas; Offshore Wind

Industry role: Support Organisation

Profile: Jobcenter Esbjerg offers companies within the oil/gas and wind-sector a professional and reliable service within recruitment. Cooperating with other Jobcentres in Denmark enabling Jobcenter Esbjerg to provide the companies with labours having the right qualifications. Before employing the labours Jobcenter Esbjerg can provide the labours with required courses (safety courses).

JobTeam A/S

Kongensgade 104, 1. DK - 6700 Esbjerg

Dayphone: +45 75 45 20 20

Nightphone: +45 75 45 20 20

www.jobteam.dk

Contact person: Lone Madsen / lm@jobteam.dk



Industry sector: Oil and Gas; Offshore Wind

Industry role: Temp and Recruitment

Profile: We are experts in finding qualified employees for temporary and permanent posts as well as for short and long term projects within: Technical and Offshore industries; Office, administration, book-keeping and accounts; Sale, purchase, planning and logistics; Technical operation and maintenance; Blue color; Store and factories; Cleaning; Any occurring work. All our candidates are screened through personal interviews and we check references before they are hired. We take care of all staff management and our temps are only paid for their effective work hours.

Johnson Metal A/S

Nyholms Alle 20 - 2610 Rødovre

+4536700044 / +4536708050

j-m@johnson-metal.dk

www.johnson-metal.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply

Profile: Johnson Metal A/S supplies all kind off bronze alloys. Standard bronze bearings and special dimensions up to size Ø1700mm for all applications for marine industrial incl. sea water resistant bronze. Agent for registered trademark Ampco Metal. Custom items after drawing. Oiles. CIP composit bearings.

Jutlandia Terminal A/S

Amerikavej 1 - 6700 Esbjerg

+45 7513 6022

mail@jut.dk

www.jut.dk



Industry sector: Oil and Gas; Offshore Wind

Industry role: logistics and Port services

Profile: Jutlandia is a full-service offshore provider dedicated to providing a high level of service and strong individual commitment. Based at the port of Esbjerg, we provide all "requirements" for the local exploration and production in the North Sea. Worldwide we are operating at 300 destinations, and we have three big modern warehouses and outdoor storage, including facilities for storage of pipes and tanks.

Jyske Bank Esbjerg

Torvet 21 - 6700 Esbjerg

+45 89 89 98 20 / +45 89 89 98 21

ESBJERG@jyskebank.dk

www.jyskebank.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Service

KK Wind Solutions

Boegildvej 3 - 7430 Ikast

+45 9692 4300

main@kkwindsolutions.com

www.kkwindsolutions.com



Industry sector: Offshore Wind

Profile: Experts in combining technical knowledge and insights from our extensive experience in the field to create new and improved wind power solutions. With our strong focus on innovation and integration we are constantly breaking boundaries by improving on what we have done before.

Our expertise with system integration and our ability to provide integrated supply chain solutions set us apart from others. In every aspect of our business, we strive to not only satisfy but also exceed our customers' expectations.

Knud E. Hansen A/S

Claessensvej 1 - 3000 Helsingør

32 83 13 91 / 32 83 13 94

KEH@knudehansen.com

www.knudehansen.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Design; Engineering

Profile: KNUD E. HANSEN A/S Naval architects, designers and marine engineers - consultancy and a leading provider of innovative and customized solutions for every project phase of the design, construction and installation of offshore windfarms and design of dedicated installation vessels.

www.knudehansen.com/key-services/offshore-wind

LE34

Gasværksvej 30 R - 9000 Aalborg

+45 9813 4655

offshore@le34.dk

www.le34.dk/en/services/offshore-2

Contact person: Arne Kjærsgaard, M.Sc. Geodesy
Director, LE34 Offshore Department, +45 2078 3527,
ak@le34.dk



Industry Sector: Oil and Gas; Offshore Wind

Industry role: Service; Consultant

Profile: LE34's Offshore Department is the former Nellesmann Survey and is made up of experts with more than 25 years' experience in complex and precise surveys, both above and below water.

We provide:

- Positioning of Rigs and Wind Farm foundations (>600 installations completed)
 - Dimensional control surveys
 - 3D laser scanning and modelling
 - Survey QC-and Client Representative work within Oil & Gas and Wind
 - Bathymetric- and Geophysical surveys
- Landinspektørfirmaet LE34 A/S employs more than 350 experts.

Lemvig-Müller A/S

Nordager 1 - 6000 Kolding

+45 36 95 55 00 / +45 36 95 55 01

info@lemu.dk

www.lemu.dk

Industry sector: Offshore Wind

Industry role: Manufacture or Supply

Profile: Lemvig-Müller is Denmark's largest wholesaler, its primary business areas being: Steel & metals, electrical supplies, tools, technical articles, plumbing and heating. Lemvig-Müller has Denmark's largest and widest product range of steels and metals: steel, reinforcing steel, stainless steel, aluminum, copper, brass, zinc, lead and bronze.

LIC engineering A/S

Kirkegade 25 - 6700 Esbjerg

7518 1688 / 7518 1640

esbjerg@liceng.dk

www.liceng.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Manufacture or Supply; Service

Profile: LICEngineering is an engineering company specialised in fluid dynamics, geo technics, structural dynamics, subsea engineering and underwater acoustics.

Liftra ApS

Stationsmestervej 81 - 9200 Aalborg SV

+45 96 60 03 00 / +45 96 60 03 01

www.liftra.com

Industry sector: Offshore Wind

Industry role: Manufacture or Supply

Lindvig Consulting ApS

Solbakken 13 - 6510 Gram

+45 24 63 92 63

lindvig@mail.dk

www.lindvigconsulting.dk



Industry sector: Offshore Wind

Industry role: Consultant

Profile: Lindvig Consulting is a consultancy company offering consultancy and directorship services, primarily for companies within the Onshore and Offshore Wind Power Business. Lindvig Consulting offers professional board membership in management owned companies or in companies with a hired top management. The services also include board membership for institutional investors in fully or partly owned companies.

LORC

Kystvejen 100 - 5330 Munkebo

+45 70 23 04 30

lorc@lorc.dk

www.lorc.dk

Industry sector: Offshore Wind

Industry role: Research and Development; Support Organisation

Industry classification: Foundations and Piles; Generators; Grid Interface or Substations; Inspection and Testing; Welding; Wind Turbine

Lund Skilte A/S

Sjællandsgade 39 - 6700 Esbjerg

+4575131400 / +4575131445

ht@lundskilte.dk

www.lundskilte.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Manufacture or Supply; Service

Profile: Lund Skilte A/S manufactures all types off safety signs, IMO, Permalight (photoluminescent), instructions, prohibitions, warnings and fire & safety signs, pipeline stickers, Hazard symbols. Our signs comes inn all sizes, layout and materials. Both printet and engraved. Tailor-made signs.

Maersk Broker

(Specialised Tonnage)

Midtermolen 1 - 2100 København Ø

+45 33 63 85 94

specton.cph@maerskbroker.com

www.maerskbroker.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Service

Industry classification: Business Development; Construction Vessels; Cranes (Mobile); Decommissioning and Abandonment; Foundations and Piles; Installation and Commissioning; Project Management; Support Vessels; Wind Turbine

Maersk Drilling

Jægersborg Alle 4 - 2920 Charlottenlund

+45 33 63 33 63
www.maersk-drilling.com

Industry sector: Oil and Gas

Industry role: Service

Maersk Training Esbjerg A/S

Ravnevej 12 - 6705 Esbjerg Ø

+45 70 22 79 50
infoesbjerg@maersktraining.com
www.maersktraining.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Service; Training and Education

Industry classification: Material and Product Handling; Personnel; Safety; Training; Wind Turbine

Maskinmesterskolen København

Akademivej 56 - bygning 358 - 2800 Kongens Lyngby

+45 45257600
www.msk.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Education; Training

MSK er Danmarks ældste maskinmesterskole og har uddannet maskinmestre siden 1906. Der er ca. 700 studerende og 60 ansatte. Nederst på formularen MSK er førende inden for det el- og køletekniske område og har uden sammenligning landets bedste køletekniske faciliteter, laboratorium og eksperter. MSK er med helt fremme når det gælder styring og regulering samt robotteknologi og tilbyder ekspertviden omfattende de seneste teknologier inden for solceller, vindenergi og brændselsceller.

Maskinmestrenes Forening

Sankt Annæ Plads 16 - 1250 København K

+45 33 36 49 20 / +45 33 36 49 49
mf@mmf.dk
www.mmf.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Training and Education

Profile: Engineers' Association is an organization for graduate engineers, dual purpose cadets and technical manager offshore, all trained - or in training - in an engineering school or a maritimetraining center.

Maskinsikkerhed ApS

Lejrvej 17 - 3500 Værløse

+45 4447 3156
www.maskinsikkerhed.dk

Industry sector: Oil and Gas; Offshore Wind

We are a team of specialists who offers the full range of Certification for CE Mark compliance for safety of machinery. We guide companies through the complicated product Directives and legislation assisting to correctly CE Label machinery. We inspect machinery for safety hazards. When needed, we offer solutions to machine safeguarding.

Masytec A/S

Vallensbækvej 31 - 2605 Brøndby

+45 4345 8866
info@masytec.dk
www.masytec.dk

Industry sector: Offshore Wind*

Industry role: Manufacture and Supply; Service

Profile: Lubrication systems for offshore, windpower and other industries.

MHI Vestas Offshore Wind A/S

Dusager 4 - 8200 Aarhus N

+45 8844 8900
contact@mhivestasoffshore.com
www.mhivestasoffshore.com

Industry sector: Offshore Wind

Industry role: Design; Manufacture; installation and service

The company's sole focus is to design, manufacture, install and service wind turbines for the offshore wind industry. The company aims to drive down the cost of energy from offshore wind parks by driving capital and operating savings, and increasing output of wind turbines by bringing the best technology to the market.

**Ministry of Foreign Affairs
-TradeCouncil**

Asiatisk Plads 2 - 1448 København K

+45 33 92 00 00 / +45 33 92 04 30
www.um.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Support Organisation

MT Højgaard A/S

Knud Højgaards Vej 9 - 2860 Søborg

+45 70 12 24 00 / +45 70 13 24 21
offshore@mth.dk
www.mth.com

Industry sector: Offshore Wind

Industry role: Consultant; Design; Engineering; Installation; Manufacture or Supply; Service

Profile: MT Højgaard is one of the leading building and civil engineering companies in Scandinavia. MT Højgaard offers to carry out offshore foundations on an EPCI basis, i.e. engineering, procurement, construction and installation of the foundations. MT Højgaard also offers consultancy services in all fields of offshore wind farm construction.

The Nord-Lock Group
Gydevang 39-41 - DK-3450 Allerød

+45 2178 6699
brian.troest@nord-lock.com
www.nord-lock.com



Industry Sector: Oil and Gas, Offshore Wind

Industry role: Manufacture or Supply

Profile: Our mission is to safeguard human lives and customer investments. The Nord-Lock Group believes that no one should ever have to question the integrity of mechanical solutions so critical to our way of life. As a global leader in bolting solutions, we are strengthening the public and industrial infrastructures that shape modern living in decades to come.
We help you optimize your bolted joints!

Nordisk Svejse Kontrol A/S

Hammeren 5 - DK-6715 Esbjerg N
(Day) +45 7524 6980 / (Night) +45 7524 6960
fax: +45 7515 6985
www.nskas.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Welding; Testing; Examination

Profile: Accredited by DANAK to perform Non Destructive Testing (NDT) together with certification of welders. Solving weld technical problems, Witnessing the welding of procedure test specimens and preparation of WPS, WPQR and WPQ and Destructive testing (DT) for welding of procedure and testing of materials. All our technicians are approved to carry out NDT according to PED with the following test methods: Ultrasonic Testing, Radiography, Magnetic Particle Testing, Penetrant Testing, Eddy Current Examination, Visual Examination, Rope Access. Furthermore we perform Pressure Tests, PWHT and inspection of surface treatment. Approved by Lloyd's, DNV, Bureau Veritas and ABS to perform Thickness Measurements of Hull Structure.

**Nordjyllands Beredskabs
Uddannelsescenter**

Rørdalsvej 55 - 9220 Aalborg Øst

+45 70 15 15 14
mail@nabr.dk
www.nordjyllandsberedskab.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Training; Safety

Profile: We offer a wide range of courses at our two training centres. e.g STCW, LNG, CFS, BOSCO/OPITO, Fire, GWO basic safety training, Height rescue, advanced rescue, Basic height safety & Rescue, Confined Spaces, First Aid, ITLS etc.



**NORDJYLLANDS
BEREDSKAB**

NorSea Group Denmark

Kanalen 1 - 6700 Esbjerg

+45 7912 8900
www.norseagroup.dk

Industry sector: Oil and Gas; Offshore Wind

Profile: NorSea Group Denmark (formerly Danbor) was established in 1974 where the company began supporting the offshore players in the North Sea. As the offshore industry developed the company became a multi-service supplier delivering customised solutions to the offshore industry world-wide.

In 2014 NorSea Group Denmark became a part of NorSea Group, a leading supplier of base logistics to the offshore industry.

NorSea Group Denmark offers total integrated logistics service, offshore supply base and port operations, offshore operation & maintenance, steel construction & surface treatment and facility service & infrastructure development

Nortek ApS

Ormhøjgaardvej 4 - DK-8700 Horsens

+45 7199 8909
info@nortek.dk
www.nortek.dk



Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply; Service

Profile: NORTEK offers a wide range of solutions within industrial and hydraulic hoses, couplings, hydraulic valves, pumps, filters, hydraulic system solutions and customer-required solutions. Industrial large bore hoses up to 24"; BOP Couplings; ATEX hoses; On-site fully equipped container for hydraulic hose assembly; Steel compensators and hoses; Advanced pipe bending from 4 to 60 mm pipe mounted with wide range of possibilities, among others triple-lok 37°, O-lok 90°, Bördel E-F, EO2 and Vossform; High pressure hose assembly up to 3500 bar; Hydraulic wrenches, bolt tensioner and small jack-up cylinders. Because quality matters.

North Sea Shipbrokers

Nyhavnsgade 37 - 6700 Esbjerg

+4575127077 / +4575128312
chartering@north-sea-ship.dk
www.north-sea-shipbrokers.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Consultant; Manufacture or Supply; Research and Development; Service

Profile: North Sea Shipbrokers is one of the leading Shipbrokers in Offshore Renewable Energy, Seismic support and Oil & Gas. The Broker team and Agency team can offer offshore brokerage, Consulting, Contracting, Tendering and Shipbroker services on Spot charter or long-term requirement.

Ocean Team Scandinavia A/S

Vesterhavsgade 56 - 6700 Esbjerg

+45 75180077 / +45 75181056

ots@oceanteam.dk

www.oceanteam.dk



Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply; Service

Profile: Ocean Team Scandinavia is your international partner within specialized cleaning of technical and fluid transfer systems. The company is specialized in oil flushing, chemical and mechanical cleaning. Furthermore we offer development, construction and production of customized purification systems.

Offshore & Marine - Contacts

Silovej 8 - 9900 Frederikshavn

+45 31 50 04 44

info@om-contacts.com

www.om-contacts.com

Industry sector: Oil and Gas

Industry role: Consultant; Service

Profile: Offshore & Marine - Contacts (OMC) is specialized in supplying consultants, In-house engineer and service in against the Oil- and Marine industry OMC-Consultants: Worldwide supply of consultants/Engineers in all levels, both design and field area OMC-Engineering: In-house structural/mechanical engineering of FPSO's, vessels, platforms and rigs OMC-Service.

Offshoreenergy.dk

Dokvej 3 - 6700 Esbjerg

+45 36 97 36 70

info@offshoreenergy.dk

www.offshoreenergy.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Research and Development; Service; Support Organisation; Training and Education

Profile: Offshoreenergy.dk is the official national knowledge center and innovation network for the Danish offshore industry. On behalf of its member companies and institutions Offshoreenergy.dk pushes development with the aim of growth within the Danish offshore industry. Focus areas are oil and gas, offshore wind, the offshore maritime area and wave energy. The goal is to strengthen and support the Danish offshore sector and its continued efforts towards being competitive. This includes supporting the companies in the sector in their strive towards being considered competent partners to the international offshore sector.

Olie Gas Danmark

Knabrostræde 30, st. - 1210 København K

3841 1880 / 3841 1889

info@oilgasdenmark.dk

www.oilgasdenmark.dk

Industry sector: Oil and Gas

Industry role: Support Organisation

Profile: Oil Gas Denmark is a trade organization for all companies in the upstream oil and gas production sector. This involves oil producing companies as well as partners, suppliers and service companies operating within exploration and production of oil and gas in Denmark.

Per Aarsleff A/S

Hasselager Allé 5 - 8260 Viby J

+45 8744 2222

info@aarsleff.com

www.aarsleff.com



AARSLEFF

Industry sector: Offshore Wind

Profile: Aarsleff is a leading Danish contracting company. Our expertise is to devise, plan and implement large-scale projects within infrastructure, climate change adaptation, the environment, energy etc. – from design to handing-over. Our point of departure is a strong position in Denmark and the Baltic Sea region, and we solve projects in most parts of the world. Aarsleff finds it very important to combine the many contracting disciplines of the Group in turnkey projects – for example by entering into framework and partnering agreements. In this way, we are using the synergy potentials between the different qualifications.

Persolit A/S

Tarp Byvej 147 - 6715 Esbjerg N

+4570200613 / +4570200631

koeh@persolit.dk

www.persolit.dk

Industry sector: Oil and Gas

Industry role: Consultant; Engineering; Installation; Manufacture or Supply; Service

Profile: Persolit A/S is a Danish engineering, manufacturing and contracting company with 70 years of experience in technical insulation onshore/offshore all over the world. Industry classification: Accommodation Modules; Cooling, Heating, Ventilation and Air Conditioning; Fabrication and Construction; Feasibility or Front End Studies; Installation and Commissioning; Insulation; Integrated Services; International Trade; Maintenance, Modification and Operation; Personnel; Supply Chain Management; Workshop and Hand Tools

Phoenix Contact A/S

Hammerholmen 48 - Postboks 1181 - 2650 Hvidovre

+45 3677 4411

kundeservice@phoenixcontact.dk

www.phoenixcontact.com



Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Automation; Manufacture or Supply; Service

Profile: Phoenix Contact offers innovative and robust solutions for the automation of your wind power plants. This allows you to minimize downtimes and use your wind power plant as efficiently as possible. As automation specialists, we also support you in implementing the Machinery Directive with our safety services. Phoenix Contact offers a comprehensive portfolio of hardware and software for the future-proof automation of the sometimes outdated installations involved in the production, transport, and processing of oil and gas.

PMC Technology A/S

Lammefjordsvej 2 - 6715 Esbjerg N

+45 7514 4444 / +45 7414 4545

info@pmctechnology.dk

www.pmctechnology.dk

Contact person: Hardy Jeremiassen, Sales and Project Manager, HardyJeremiassen@pmctechnology.dk, +45 8870 1239 / +45 6120 6339

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Consultant; Design; Engineering; Manufacture or Supply; Service

Profile: PMC Technology A/S is a global expert in hydraulic and lubrication solutions and can provide all kinds of customised hydraulic solutions as well as standardised hydraulic components. From simple to extensive solutions, from niche markets to heavy duty industries. We have specialist competences as well as a wide product range. PMC Technology A/S develops, designs, and constructs complete hydraulic systems in close collaboration with our customers. PMC takes responsibility all the way through to an efficient solution, including assembly, service, and maintenance.

Port of Rømø

Havnepladsen 6 - 6792 Rømø

+45 74 33 44 24

knd@portromo.dk

www.portromo.dk

Industry sector: Offshore Wind

Industry role: Service

Industry classification: Ports and Supply Bases 923 Certification

PP Techniq

Age Grams Vej 1 - DK-6500 Vojens

+45 7930 1133

www.pptechniq.com

Contact person: Jan Korff Petersen, CEO, +45 79301133, info@pptechniq.com

Industry sector: On- & Offshore Wind; O&M

Industry role: Manufacturer; Training

PP Techniq manufactures unique intelligent Blade-Guided Access Systems used for maintenance and service of wind turbine blades. The products meet the strictest requirements with regard to personal safety and offer a safe, fast and cost-effective access to servicing of wind turbine blades, both onshore and offshore.

PP TECHNIO

BLADEGUIDED ACCESS



Ramboll Oil & Gas, Esbjerg

Hannemanns Allé 53 - DK-2300 Copenhagen S

T +45 5161 1000

F +45 5161 1001

info@ramboll.com

www.ramboll.com/energy

Industry sector: Energy

Industry role: Consultant; Design; Engineering; Research and Development; Service

Profile: With more than four decades of experience in the energy sector, Ramboll is among the 10 leading energy consultancies in Europe, and provides solutions and expertise in both conventional and renewable energy.

Region Syddanmark

Damhaven 12 - 7100 Vejle

+45 7663 1000

kontakt@regionsyddanmark.dk

www.regionsyddanmark.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Support Organisation

Profile: The Region of Southern Denmark supports the national offshore industry because the centre of the cluster is based in the region around the Port of Esbjerg. The regions target is to create more jobs in the industry by financing developing projects from regional and European funds.

Rescue Center Denmark

Storstrømsvej 39 - 6715 Esbjerg N

+45 7913 4555

www.rescuecenter.dk



RESCUE
CENTER
DENMARK

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Training and Education

Profile: Rescue Center Denmark is a unique center of knowledge and training, with expertise and specialized knowledge in Fire & Rescue, EMT treatment, Transport, Towing and Recovery Vehicles and risk assessment and prevention. We aim to match your training needs. With Rescue Center Denmark you will get a partner that can advise you on many issues, for example contingency planning, safety, vehicle constructions, choice of materials and equipment, rules and regulations.

Rope Access.dk

LL.Blovstrødvej 45 - 3450 Allerød

+454814 6146

Allan@RopeAccess.dk

www.RopeAccess.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Service

Industry classification: Freight, Logistics and Transportation; Inspection and Testing; Maintenance, Modification and Operation; Material and Product Handling; Ropes

Rybners Tekniske Skole

Spangsbjerg Møllevej 72 - 6700 Esbjerg

+4579134511

rybners@rybners.dk

www.rybners.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Training and Education

Profile: Rybners offers a wide range of educations within skilled craftsmanship, service and in-service training.

Semco Maritime A/S

Esbjerg Brygge 30 - 6700 Esbjerg

+45 79166666 / +45 75156580
semco@semcomaritime.com
www.semcomaritime.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Manufacture or Supply; Service

Profile: Dedicated to the energy sector, Semco Maritime is an international contracting and engineering company. For more than 30 years the company has been facilitating design, fabrication, service and maintenance of our customers' assets, providing comprehensive project management across all phases of energy projects.

Shell Olie- og Gasudvinding B.V. (Holland), Dansk Filial

Mikado House - 2300 København S

+45 3337 2000
www.shell.dk

Industry sector: Oil and Gas

Industry role: Operator

Profile: Partner in Dansk Undergrunds Consortium

Siemens Industry Software A/S

Borupvang 9 - 2750 Ballerup

+45 44 77 44 77
info.dk.comos@siemens.com
www.siemens.dk/comos"

SIEMENS

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Engineering; Manufacture or Supply

Profile: Siemens Industry Software A/S, a business unit of the Siemens Industry Automation Division, is a leading global provider of plant lifecycle management (COMOS) and product lifecycle management (PLM) software. The software solution COMOS, based on Microsoft technology, Supports the entire life cycle of a plant process or a machine from conceptual design through engineering, construction, maintenance and life extension to deconstruction.

Siemens Oil & Gas

Nordre Dokkaj 1 - 6700 Esbjerg

+45 4477 4477
olie-gas.dk@siemens.com
www.siemens.dk/oil-gas

Industry sector: Oil and Gas

Industry role: Consultant; Engineering; Installation; Manufacture or Supply; Research and Development; Service; Training and Education

Profile: The Siemens group in Denmark is part of the international Siemens concern, one of the Worlds biggest corporations within electronics and electro technique. The company solves assignments with in the areas: energy, industry, information, telecom, traffic, hospital equipment, hearing aids, light sources, Electrical Transmission and Distribution Equipment and electric installations. Based within the intensive research and development effort of the concern an extensive range of highly technological products and services are offered.

Siemens Wind Power A/S, Brande

Borupvej 16 - 7330 Brande

+45 96 33 44 33
www.siemens.dk

Industry sector: Offshore Wind

Industry role: Manufacture or Supply

Sihm Højtryk A/S

Guldborgsundvej 3 - 6705 Esbjerg Ø

+45 7515 9700
www.sihm.dk

SIHM HØJTRYK

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Manufacture or Supply; Service

Profile: Sihm Højtryk is your preferred partner in high-pressure technology, offering unique custom build pumping solutions from world-leading brands. Highly trained specialists guarantee unmatched levels of service and responsiveness 24/7 - 365, taking technical assistance and reliability to new heights. Innovative in design and market leaders in performance combined with fast delivery, saves you both time and money. Supplier of test systems up to 7000 bar / 100.000 psi. Supplier of high pressure hoses up to 4000 bar from day to day delivery. Dealer and service center for : **Hammelmann**Resato**Oertzen**Bolondi**Peinemann**Parker Store**

Skagen Blade Technology

Danmarksgade 56 2.tv - 9900 Frederikshavn

+45 9848 1500
adm@skagensmaleren.dk
www.skagensmaleren.dk



Industry sector: On- & offshore wind

Industry role: Service; Maintenance

Worldwide service and maintenance of wind turbine blades

- More than 30 years of experience with surface treatment
- Specialists in fiberglass repairs
- Installation and repair of power curve upgrades
- Installation and repair of leading edge protection
- Rope access qualified technicians

Smedegaarden

Vikingkaj 5 - DK-6700 Esbjerg

+45 7512 8888
contact@smedegaarden.net
www.smedegaarden.net



Industry sector: Oil and Gas; Offshore Wind

Profile: We are today amongst the leading Green ship recycling and ship scrapping companies in Europe and have a larger stock of maritime equipment from scrapped vessels such as marine engines, gearboxes etc etc of all sizes for commercial vessels.

In the item groups, you have access to a large part of our large inventory of second hand and new goods to the maritime and industrial industry. Use the search box above for you specific type or frase of your enquiry. Please don't hesitate to contact us If you don't find what you are looking for or have any question or enquiries.

Stena Recycling A/S

Damsbovej 20 - 5492 Vissenbjerg

+45 56 67 95 50 / +45 56 67 97 41
www.stenarecycling.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Service

Profile: Stena Recycling collect and recycle all types of waste and have a large range of customized solutions. The Stena Metall Group have around 200 facilities in the nordic part of Europe.

Sydbank

Kongensgade 62 - 6700 Esbjerg

+45 74376500 / +45 74376502
vestjylland@sydbank.dk
www.sydbank.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Service

Profile: Sydbank – one of Denmark's largest banks – is a full service bank covering virtually all financial requirements of retail as well as corporate clients. The Bank has special expertise in areas such as investments, pension, housing, financing, payment services and digital tools.

Syddansk Universitet, Esbjerg

Niels Bohrs Vej 9 - 6700 Esbjerg

+45 65504114 / +45 65501091
sdu@sdu.dk
www.sdu.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Research and Development; Training and Education

Profile: Knowledge is one of the prerequisites for growth in Denmark, where social welfare and competition within industry are increasingly dependent on research, highly skilled workers, and an industry with a flair for innovation and renewal. The University of Southern Denmark, with campuses located in the southwestern part of Denmark - i.e. Funen and Southern Jutland - is a research and educational institution with deep regional roots and an international outlook.

System Teknik A/S

Assensvej 2 - 9220 Aalborg Ø

+45 9631 7333 / +45 9631 7330
info@systemteknik.dk
www.systemteknik.dkContact person: Henrik Pilgaard Andersen,
hpa@systemteknik.dk, +45 4080 0609

Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply

Profile: SystemTeknik offers extensive know-how and competencies in development of automation-technology and production of control- and distribution panels. We take hand on project management end-to-end, including software design and on-site installation. Our technical resources hold the education, in-sight and training to provide solutions in compliance with regulations and standards as ATEX and UL. We are custom to the approval process from e.g. DNV, ABS, Lloyd's and others.

Industry classification: Communication Systems; Cooling, Heating, Ventilation and Air Conditioning; Electrical Equipment, Materials and Services; Instrumentation; Process Control; so-923 certification, iso-9001 certification, iso-14001 certification

Swagelok Danmark

Glentevej 13 - DK-6705 Esbjerg Ø

+45 7612 1950
www.swagelok.dk
sales@swagelok.dk
Contacts: Finn Høst"

Industry sector: Oil and Gas

Industry role: Manufacture or Supply

Profile: Swagelok Danmark is your authorized Swagelok Sales and Service Center. Swagelok® designs, manufactures and delivers an extensive range of the highest quality fluid system products on the market. Our product range includes components such as fittings, valves, regulators and many more. We also offer a number of services such as on site energy surveys and tube fitting training to add extra value, security and safety to our customers. Visit Swagelok.dk for more info.

Teknologisk Institut

DTI Oil & Gas - 8000 Aarhus C

+45 7220 2000 / +45 7220 1019
info@teknologisk.dk
www.dti.dk/oil

Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply; Research and Development; Service; Training and Education

Industry classification: Academic Institution; Architectural or Building Materials; Business Development; Certification; Environmental Assessment and Monitoring; Inspection and Testing; Metal Materials; Networking and Events; Surface Treatment; Technology Services; Training; iso-14001 certification, iso-9001 certification.

Tente A/S

Birkemosevej 32 - 8361 Hasselager

+45 7010 8210
info@tente.dk
www.tente.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Supplier

Profile: TENTE A/S is the leading supplier of casters and wheels for ports, heavy and offshore industries. We supply casters up to 12000 kg capacity, so we are able to transport you most heavy things. All our products are European produced and stands for the highest quality in the industry – your assurance for no interruptions in your daily work. We are innovative and have technical competence, give professional advice and have fast delivery time. It is very important to us that you are a satisfied customer.



Industry classification: Iso-14001 classification, iso-9001 classification

TESS Esbjerg ApS

Esbjerg: Tværkaj 4 - 6700 Esbjerg

+45 7545 7851 - info@TESS.eu

Frederikshavn: Silovej 10 - 9900 Frederikshavn
+ 45 7545 7852 - frhavn@tess.eu

www.TESS.no



Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture or Supply; Service

Profile: Profile: TESS Esbjerg ApS and TESS Frederikshavn is part of the Norwegian company TESS as with over 120 branches in seven countries: Norway, USA, Brazil, Singapore, Scotland, Spain and Denmark. TESS is the largest supplier of hoses in Scandinavia, specialized in hoses, couplings, fittings and accessories to hoses and pipes for the offshore-, maritime and windmill sectors.

TG Technology

Byledet 3A - DK - 4000 Roskilde

+45 2212 2188
info@tg-tag.com
www.tg-tag.com

Industry sector: Wind (on- and offshore), Oil and Gas

Industry role: Service

Profile: At TG we laser engrave and laser cut signs in 316 steel, anodized aluminum, and plastics. You can always get a tag sign that fits your needs. We always ensure to provide signs so it is easy for the installer to do the job, often we deliver such number series of belts, which makes it easy and manageable. Our machines can handle engraving of 3Dmatrix codes, bar codes and of course text and numbers. TG Technology is your preferred partner when it comes to tagging, advising and customized services. We deliver on time and within the agreed budget - Always.

Thyborøn Port

Tankskibsvej 4 - DK-7680 Thyborøn

+45 9690 0310
adm@thyboronport.dk



Industry sector: Oil and Gas; Wind (on- and offshore)

Industry role: Port; Service

Profile: Thyborøn Port is Your strategic partner for Installation and O&M at Northsea Wind projects and Oil fields. Thyborøn is the closest port to Vesterhav North Wind Farm, Nissum Bredning Test Site and a big range of the Danish Oil sector. New heavy lift Offshore quay with bearing capacity of 20 tons per square meter, and 15 hectares of available project area. Thyborøn has the best sailing conditions on the Danish West coast with an eastbound entrance.

Tibnor A/S

Klokkestøbervej 18 - 5230 Odense M

+ 45 4323 7700
danmark@tibnor.com
www.tibnor.dk

Contact person: Carsten Holmgaard, Sales Manager,
carsten.holmgaard@tibnor.com, +45 7740 1264

Industry sector: Wind (on- and offshore), Oil and Gas

Industry role: Supplier

Profile: A strong partner to the manufacturing industry. We purchase, store, pre-process and distribute steel and non-ferrous metals to the wind, oil&gas, engineering, processing and construction industries. We are the partner that creates conditions for long-term profitable production. We have a long tradition of cooperation with Europe's leading producers and can offer our customers the market's most extensive selection of steel and non-ferrous metals.



Total Denmark A/S

Aldersrogade 6C, 4- 2100 København Ø

+45 4581 3701
order@total-dk.com
www.totalnordic.com

Profile: Total Nordic is part of Total Marketing & Services, the commercial division of Total Group, one of the largest oil companies in the world. With its Head-Office in Copenhagen, Total Nordic has operations in all Nordic countries (Denmark, Finland, Sweden, Norway and Iceland) and operates four affiliates (TOTAL DENMARK A/S - TOTAL SWEDEN AB - TOTAL NORGE AS - TOTAL M&S FINLAND OY).

Vattenfall, Esbjerg

Exnersgade 2 - 6700 Esbjerg

+45 8827 5000
info.vind@vattenfall.com
www.vattenfall.dk

Industry sector: Offshore Wind

Industry role: Operator

Industry classification: Maintenance; Modification and Operation; 923 Certification; iso-9001 Certification; ohsas-18001 Certification

Viking Life-Saving Equipment A/S

Sædding Ringvej 13 - 6710 Esbjerg V

+45 7611 8100
viking@viking-life.com
www.viking-life.com



Industry sector: Oil and Gas; Offshore Wind

Industry role: Manufacture and Supply; Safety; Service

Profile: Our in-depth knowledge of the offshore wind, oil and gas industry ensures optimized and simplified solutions in all aspects - from putting together equipment packages, producing custom designed evacuation systems, supplying the right combination of personal protective equipment to tailoring flexible, convenient and compliant servicing concepts with full global support. With an unmatched range of quality products, solutions and servicing, we help achieve uncompromising safety.

Vordingborg Kommune

Postboks 200 - 4760 Vordingborg

+45 55 36 36 36

post@vordingborg.dk

www.vordingborg.dk

Industry sector: Offshore Wind

Industry role: Support Organisation

Industry classification: Local Authority

Wind And Water Technology

Guldagervej 56 - 6710 Esbjerg V

+45 70205771

info@wawt.dk

www.wawt.dk

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Manufacture or Supply; Service

Profile: Wind And Water Technology is a small and dynamic company working with wind, water and underwater technology. The company has more than 25 years of experience in the onshore and offshore oil and gas sector and in the industrial sector supplying technical solutions.

World Courier Denmark A/S

Avedøreholmen 96-98 - 2650 Hvidovre

+45 32 46 06 80 / +45 32 46 06 85

www.worldcourier.com

Industry sector: Oil and Gas; Offshore Wind; Wave Energy

Industry role: Service

Profile: Premium Logistic Partner. 24/7/365 Hour service. Industry classification: Freight, Logistics and Transportation; Medical; iso-9001 certification, 923 certification.

Würth Industri Danmark A/S

Merkurvej 5 - 6000 Kolding

+45 73 20 73 20 / +45 73 20 73 70

www.wuerthindustri.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Engineering; Manufacture or Supply

Profile: Würth Industri Danmark A/S builds on the extensive experience and know-how within fasteners from Arvid Nilsson's history since 1918. Würth Industri Danmark A/S is responsible for supplying the industrial sector as a full service provider of C-Parts. Under the service brand "CPS® - C-Parts Solutions" the company offers customized supply and service concepts.

WSCO Advokatpartnerselskab

Frederiksgade 7 - DK-1265 København K

+45 3525 3800

info@wsko.dk

www.wsko.dk

Industry sector: Oil and Gas; Offshore Wind

Profile: WSCO is one of the leading law firms within offshore oil and gas, offshore wind, geothermal energy and other renewables in Denmark. We assist licence holders, operators, contractors and suppliers.


Zenitel Denmark A/S

Park Allé 350 A - 2605 Brøndby

+45 43437411 / +45 43437522

www.vingtor.com

Industry sector: Oil and Gas; Offshore Wind

Industry role: Consultant; Design; Engineering; Installation; Manufacture or Supply; Service; Training and Education

Profile: Zenitel Denmark A/S is part of the World Wide Zenitel Group, a leading supplier and system integrator of communication systems for the Marine & Offshore segment.

Ørsted

Kraftværksvej 53 - Skærbæk - 7000 Fredericia

+45 9955 1111

info@orsted.com

www.orsted.com

Industry sector: Offshore Wind

Industry role: Operator

Profile: Ørsted develops, constructs and operates offshore wind farms, bioenergy plants and innovative waste-to-energy solutions and provides smart energy products to its customers.

Aalborg Universitet Esbjerg

Niels Bohrs Vej 8 - 6700 Esbjerg

+45 99 40 99 40

campus@esbjerg.aau.dk

www.esbjerg.aau.dk

Industry sector: Oil and Gas; Offshore Wind

Industry role: Research and Development; Training and Education

Profile: Aalborg University Esbjerg is Esbjergs research and education institution for higher education in technology and engineering with a wide offer of educations.

HIGHLIGHTED EVENTS OF 2018

SPE One Day Seminar 2018

Hosted by Statoil, the event will take place on 18 April in Bergen and will embrace its tradition of excellence while incorporating a series of new and exciting changes that will increase its visibility and strengthen its unique position in the marketplace. Whether your goal is to discover new insights, broaden your professional network or showcase your products, the 2018 SPE Norway One Day Seminar offers an unparalleled opportunity.

During the day delegates will have an opportunity to explore research-based presentations encompassing topical panel discussions and 13 technical sessions focusing on Drilling, Well Integrity, Geosteering, Reservoir and EOR and Completion.

The event format is perfectly suited to providing a concise knowledge sharing experience but also to offering a great networking opportunity for participants from a range of oil and gas backgrounds.

Date: 18.04.2018, Bergen, Norway

For further information: www.spe.org

ONS 2018

Meet relevant people and lay the groundwork for future business at ONS 2018. Here is an opportunity to gain insight into the latest news, trends, innovations and technical solutions in the oil and energy industry. You can connect with up-and-coming young graduates and professionals at the ONS Young arena. You can participate in the reshaping of the oil and energy industry through debate, discussion and dialogue at the ONS Conference. ONS is all about opportunities.

ONS is an exhibition, a conference and a festival. The event offers a meeting place where you'll hear the latest news from the industry at the conference, meet your target audience at the exhibition and network at the evening festival.

The ONS conferences with its top speakers provide your employees with new and valuable insight that makes your company better equipped to adapt to a challenging market. Get up to speed with the current market situation, new trends, innovations and technical solutions at ONS.

Date: 27.08.2018 – 30.08.2018, Stavanger, Norway

For further information: www.ons.no

The Global Wind Summit 2018

WINDENERGY HAMBURG AND WINDEUROPE CONFERENCE TO BE HELD IN PARALLEL AT THE HAMBURG MESSE SITE.

The Global Wind Summit, to be held in Hamburg in 2018, reflects impressively the wind energy success story. Comprising (1) WindEnergy Hamburg, the world's leading wind industry expo, and (2) the WindEurope Conference, the Global Wind Summit 2018 will be the biggest and most international meeting point for business, networking and information for the whole of the wind industry – onshore and offshore.

These two top-level events will be held in parallel at the Hamburg Messe exhibition site from 25-28 September 2018.

Date: 25.09.2018 – 28.09.2018, Hamburg, Germany

For further information: www.windenergyhamburg.com

Offshore Energy 2018

Offshore Energy addresses the technical, operational and commercial challenges associated with future sector growth. Offshore Energy is a fast growing gathering of offshore industry professionals. Founded in 2008, Offshore Energy has been breaking records year after year.

Offshore Energy attracts a global audience of more than 12,145 offshore energy industry professionals. The three-day event features an exhibition where over 570 companies will showcase their products and services. The accompanying conference addresses current and future issues in the offshore industry, covering developments in oil & gas, offshore wind and marine energy.

Date: 22.10.2018 – 24.10.2018, Amsterdam, Netherlands

For further information: www.offshore-energy.biz

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ENERGY INSIGHT YEARBOOK