

Wind Industry in Germany

ECONOMIC REPORT: An overview of the German wind industry

COMPANIES: Leading companies in the sector present their products and services

INDUSTRY DIRECTORY: Easy access to the right contact

2016



INTERNATIONAL

Project and cooperation partners



Editorial

Dear Reader,

Inexpensive wind energy is advancing globally. Germany continues to be the largest market for wind energy in Europe and the third largest market in the world. Only China and the USA were ahead of us in 2015 in terms of newly installed capacity. With an export quota of around 66 per cent and a world market share of about 20 per cent German companies are actively participating in growing markets worldwide. The commitment of around 130,500 employees in the onshore wind sector continues to secure the technological leadership of German companies.

In the comparably young offshore wind sector, 2015 was also an outstanding year. 2,282.4 MW were newly connected to the grid in Germany – living proof of the capacity of the German offshore wind industry. The planned establishment of a production site in Cuxhaven will ensure that important value added components ranging from manufacture to erection will be located in Germany in future. This strengthens the country's industrial base and will enable Germany to draw even greater benefits from the expansion of offshore wind. Not only will this secure the existing 18,700 jobs but also offer additional employment potential.

The positive development of onshore wind energy will continue, and opportunities will open up with respect to offshore technology, if the federal government remains courageous with respect to the system change that has been announced and the introduction of an auction-based model. We need a stable tender volume of at least 2,500 MW net onshore and certainly 900 MW offshore. In parallel, it is important to work towards greater sector integration. So far, the main focus has been on the electricity market; now mobility and heating need to be included, both of which offer enormous potential for reducing CO₂ emissions. Germany is thus on the verge of the second stage of the energy transition.

The energy transition builds on a solid foundation. All actors on the market are now pulling in the same direction, designing the phase-out of nuclear energy and paving the way for decarbonisation as set out by the G7 countries in Elmau and at the 2015 UN Climate Change Conference in Paris. German federal policy is now tasked with creating a stable legal framework which has the support of all relevant actors and does not thwart wind power expansion.



With more than 3,000 companies and 20,000 members, the German Wind Energy Association (BWE) represents the know-how and experience of the entire sector. In addition to the supplier and manufacturing industry, which is rooted in the German engineering sector, the BWE also brings together project developers, specialised law firms, the financing sector, companies involved in logistics, construction, maintenance and storage technologies, as well as electricity traders, grid operators and utility companies. This makes us one of the largest associations for renewable energy in the world, allowing us to represent the entire value chain in the sector. We are driving technological development forward in our advisory committees and task forces. Together we represent the successful energy transition!

Yours,

A handwritten signature in black ink that reads "H. Albers". The signature is written in a cursive, slightly slanted style.

Hermann Albers, President of BWE e.V.

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The climate agreement in Paris has laid the political foundations for limiting the global temperature increase to 1.5 to 2 degrees. This came as a surprise, however, for in order to cut back CO₂ emissions from coal-fired power plants, onshore wind energy and also solar energy would need to be built faster than previously planned.

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Manufacturers of wind turbines from all over the world buy systems and components in Germany. Years of experience of the operational side together with specific research and development projects to reduce manufacturing and operating costs and prolong service life are much in demand everywhere.

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Planning, finance, transport, construction and marketing. The fields of planning and operation of wind turbines are a continuous growth market in Germany.

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An aerial photograph of a wind turbine tower under construction. The tower is a large, white, conical structure that tapers towards the top. It has several red and white horizontal bands near the top. The tower is supported by a network of black cables. A yellow and red ladder is attached to the side of the tower. The surrounding landscape is brown and hilly, with some tracks visible in the soil. The sky is a clear, light blue.

Economic report:

The German Wind Industry

The wind energy sector in Germany is a worldwide leader. Already today, its manufacturers, suppliers and service providers employ over 150,000 people.



Wind and solar power on the up worldwide – Renewables oust coal and oil

2015 could go down in history as the year when the world bid goodbye to fossil fuels. The climate summit in Paris sent out a political signal. Meanwhile the two most important renewable energies, wind and solar power, are achieving record expansion worldwide.

With more than 63,000 megawatts (MW) of new installed capacity around the world, in 2015 the wind industry increased its rate of expansion by around 20 per cent compared to 2014, its best result ever. The most concentrated expansion was seen in China (33,000 MW) and the USA (8,600 MW). Europe also had a record year (12,800 MW) with growth distributed not only across more countries, but with offshore wind power also achieving a constantly high level of growth. The solar industry, the second key technology among the renewables, has also gathered pace growing by around 25 per cent compared to 2014, with almost 60,000 MW, and also achieving a record result.

Overall, investments in new power plants have seen a huge shift towards renewables. In the USA 47 per cent of the development of all generation capacities was in wind, with gas following at 35 per cent and solar at 14 per cent. Conversely, power plants based on coal and oil only amounted to less than 1 per cent of the total expansion, as demonstrated in analysis by the consulting firm SNL Energy.

It is a similar story in Europe. Wind turbines with a rated capacity of 12,800 MW were added onshore and offshore, around half of which were in Germany. According to information from the European Wind Energy Association EWEA, solar plants have already expanded by 8,500 MW (particularly in the UK). Another 4,700 MW of capacity was added to coal-fired power stations, however at the same time capacity with a total of 8,050 MW was taken off

the grid, resulting in a decrease of around 3,350 MW in real terms. In addition, 3,282 MW of oil and 2,400 MW of gas powered plants and 1,700 MW of nuclear power plants were taken off grid.

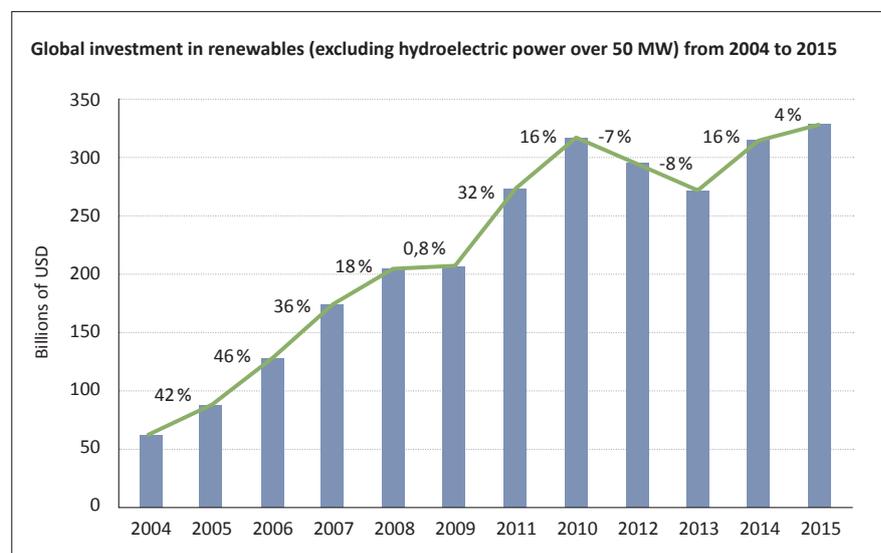
This expansion means that the installed wind capacity has increased more than tenfold since 2000, and today provides 15 per cent of the current generation capacity in Europe. 2015 was also the first time that wind left hydroelectric and nuclear power plants behind when it came to installed capacity.

The American Wind Energy Association believes it is possible that the record expansion from the fourth quarter of 2015 could “continue... in the months and years to come”.¹ In which case, we can expect

2016 to bring more growth up in the two-digit region in the USA.

The climate agreement signed in Paris in December 2015 should also give the industry added impetus. The international community agreed to limit the rise in average global temperatures to between 1.5 and 2 degrees compared with pre-industrial levels. To make this a reality, wind and solar power need to be installed even faster, as already planned however. The International Energy Agency described the agreement as “nothing less than a historic milestone for the global energy sector”. And wind power should benefit from this in the future: according to the US Energy Information Administration (EIA), wind power is the lowest-cost solution for reducing greenhouse gas emissions.²

Global increase in renewable energy investment



¹<http://www.aweablog.org/u-s-wind-sees-second-strongest-quarter-in-history-ready-for-2016/>

²<http://www.aweablog.org/renewable-energy-is-the-lowest-cost-clean-power-plan-compliance-solution-finds-new-analysis/>



International market – USA and Europe stronger than ever – Another world record

With considerable growth seen across all large markets, global wind installations set a new record in 2015: 63 gigawatts of wind power were added onshore and offshore, up 17 per cent on the previous year. In just one year, more wind power was added than was installed in a quarter of a century in Germany.

The largest market for western wind turbine manufacturers had a highly satisfactory year in 2015. According to the American Wind Energy Association, “Between October and December 2015 we had the second-best quarterly result ever.” The over 5,000 MW added in the fourth quarter of 2015 helped the year’s installations to hit the astonishing total of 8,598 MW. This is almost double the growth of 2014, and significantly more than the 6,000 MW which German manufacturers calculated for the USA.

As a result, the end of 2015 was positively euphoric in the USA after several very shaky years, because from the AWEA’s point of view, the change in political will is far more important than the actual installation figures. In December 2015 the production tax credits (PTC) compensation system was extended for another five years, a first in the country. In the USA the industry has been used to having a planning horizon of only one year. Disagreements between the government and the opposition had led to a continuous back and forth in the expansion of wind power, and this meant that growth in 2013 plummeted to around 1,000 MW. However, as of 1 January 2016, another 9,400 MW should be under construction.

Europe is also stepping up a gear. 12,800 MW represents a growth of 6.3 per cent compared with 2014. France again was just over an installed capacity of 1,000 MW, while Poland pushed ahead into this range for the first time with 1,266 MW, tripling its previous year’s result. However, the overall good result is distorted by the extraordinary effects that led to a high nominal value in the expansion of offshore wind power in Germany in 2015 (see page 14). And the great figures hide a couple of negative developments: in Spain the expansion of wind power came to a complete standstill, while in Sweden only 614 MW was installed (after over 1,000 MW the previous year). Yet overall wind power in Europe broadened its reach: small and medium-sized markets such as Belgium, Croatia, Denmark, Finland, Greece, Ireland, Italy and the Netherlands produced constant installation figures both onshore and offshore, or added moderately to their capacity.

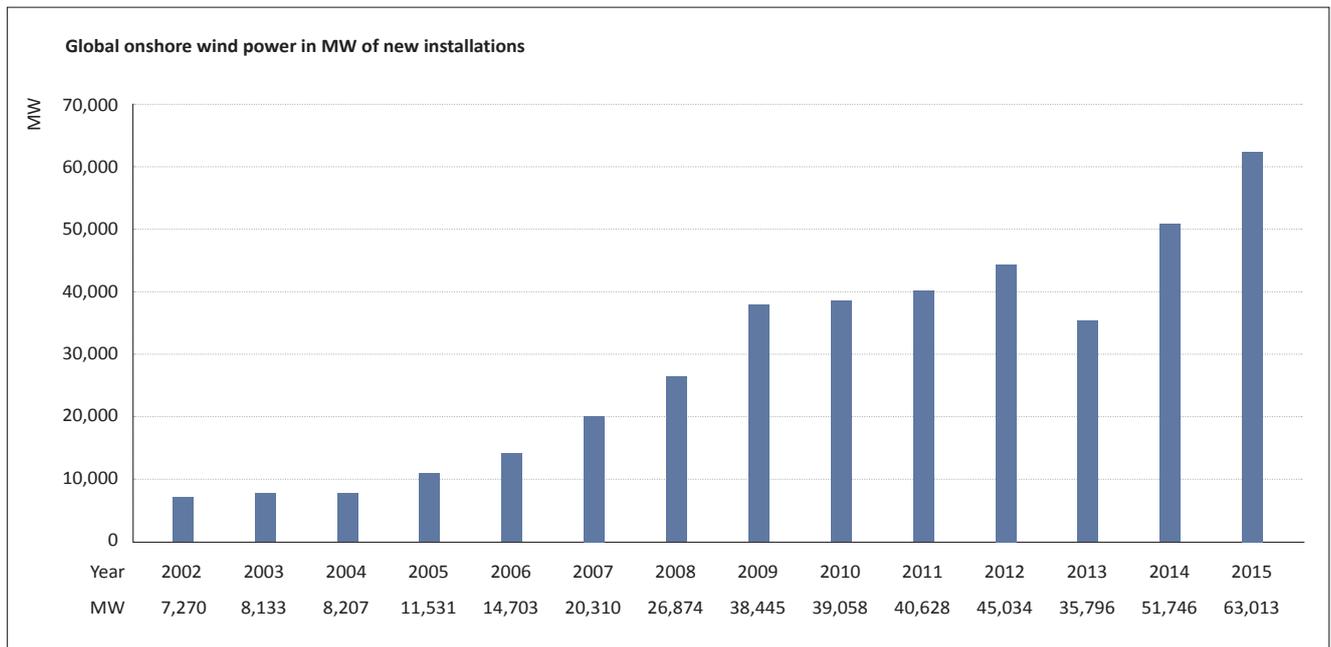
Vigorous growth was also seen by the markets in Turkey (1,000 MW compared with 800 MW 2014) and India (2,650 MW compared with 2,300 MW). In general German companies stand to benefit from this trend; according to VDMA, the export quota of wind turbine manufacturers and their suppliers is now around 66 per cent.

The expansion of wind power in China experienced the biggest leap by far. After a strong year in 2014 (23,000 MW of new installations), the market again increased by almost 50 per cent, achieving growth amounting to 33,000 megawatts. In total, China has wind turbines with a rated capacity of 129,000 MW. According to the state media agency Xinhua, this generated 186 terawatt-hours of power in 2015, amounting to a third of the annual total power generation in Germany, and corresponds to 3.3 per cent of the energy consumption in China.

The falling costs for wind power and the growing political commitment worldwide to fighting climate change means that the Global Wind Energy Council (GWEC) expects a continuous boom in new installations in the coming years.



Global market continues to grow



Wind power in Germany – Onshore stability at a high level

After the record installations of the previous year, in 2015 onshore wind turbines in Germany saw their second-best level of expansion ever: 3,731 megawatts. The industry also expects installations to exceed the 3,000 MW mark for both the next two years.

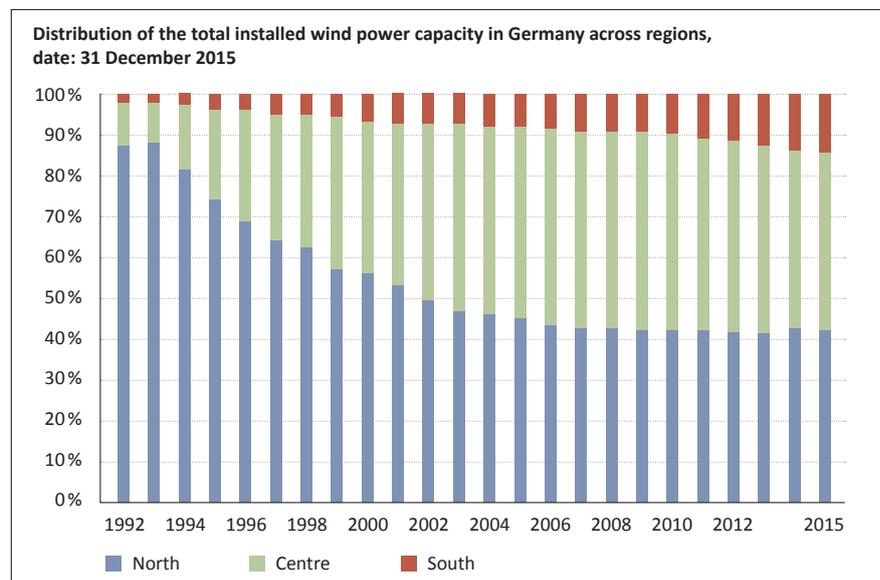
The strong increase in expansion figures in the central and southern Federal States was particularly notable in 2015. The fore-runner, once again, was Schleswig-Holstein, continuing to push ahead in terms of newly installed turbines with 888 MW. Schleswig-Holstein saw not just the most (307 turbines), but also the most powerful turbines installed, with an average rated capacity of 2.9 MW. However, unlike in previous years, North Rhine-Westphalia moved in front of Lower Saxony to take second place in the ranking. With 421 MW of installed capacity, Germany’s landlocked regions recorded growth of 37 per cent compared with the previous year. Although at a far lower level, an even more impressive leap was made by Baden-Württemberg: its expansion was eight-times greater than that of 2014, adding 144 MW.

According to the German Wind Energy Association (BWE), this is concrete evidence of the political support for the energy transition that Baden-Württemberg’s Green Party and SPD-led State Government promised when it came to power in 2011. It has taken almost an entire legislative period for the authorities to succeed in changing the existing federal state and regional planning laws to favour wind power. The political initiatives of the SPD and Green Party-led State Government in North Rhine-Westphalia are also having an impact: the Wind Power Decree (also in 2011) removed obstacles in planning and permits. The State Government of North Rhine-Westphalia aims to achieve an annual expansion of 400 MW. In comparison, in 2010 expansion dropped to just 90 MW.

The expansion in landlocked states was also made technically possible by the new turbines for low and average wind speed sites, which were brought to market by manufacturers in 2015. The impact of these technical developments is evident in the technical characteristics of the recently installed turbines. Compared with the previous year, turbine capacity, hub height and rotor diameters have all increased by 6 per cent. In 2015 the average newly installed turbine on the German market had a hub height of 123 metres, rotor diameter of 105 metres and rated capacity of 2.73 MW. Wind turbines with towers of up to 142 metres and rotor diameter of 116 metres on average are located in landlocked sites in Hesse, Bavaria or the Saarland. In the northern states the turbines are smaller (tower height of 96 metres, 103 metres of rotor diameter in Schleswig-Holstein), but

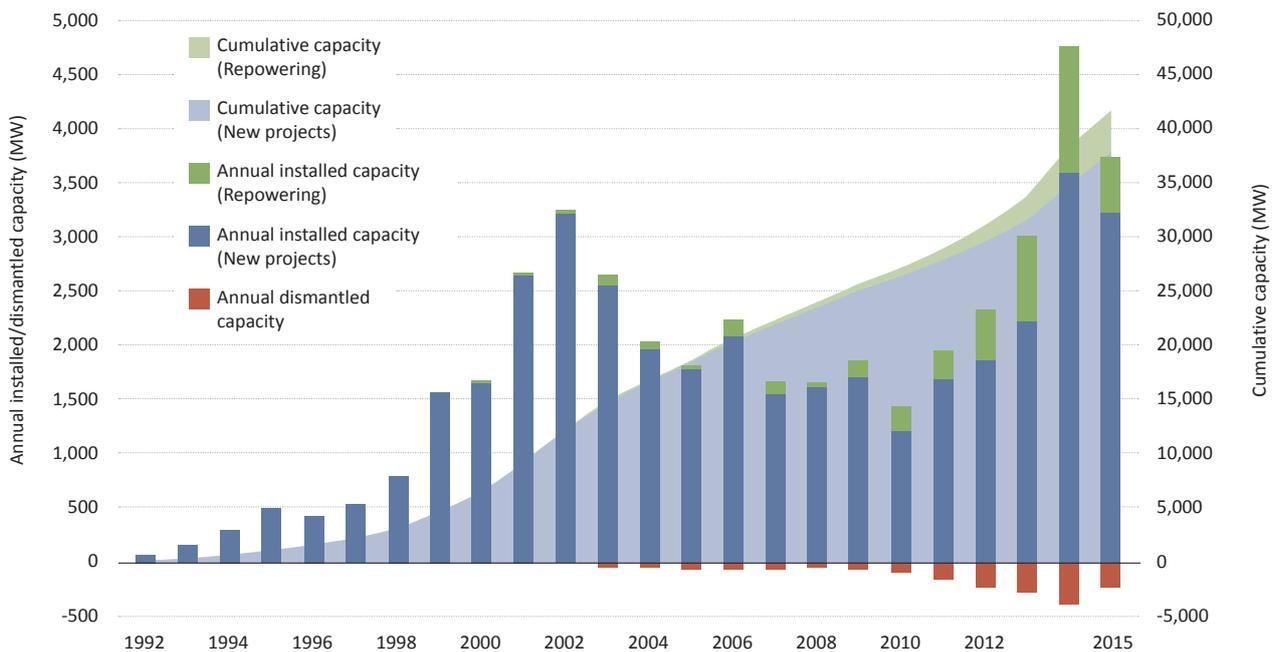
generate on average 0.2 to 0.3 MW more rated capacity as a result of the higher wind speeds.

In total, BWE and VDMA anticipate annual installation figures of between 2,900 and 3,000 MW for the period up to 2019. It is expected that North Rhine-Westphalia and Baden-Württemberg will continue to see positive development. However, there are political uncertainties in the regional planning system in Schleswig-Holstein, where there is currently a temporary halt to permits due to a wind power moratorium, and in states such as Bavaria, too, which has put the brakes on the expansion of wind power by insisting on very large minimum distances from residential areas. The expansion targets set by the German government will be crucial for further expansion in Germany. By mid 2016 we should have definitive regulations on the matter.





Development of the annual installed and cumulative wind power capacity (MW) in Germany (onshore) incl. repowering and decommissioning, date: 31 December 2015



Source: Deutsche WindGuard 2015

Offshore – An unbeatable installation record

In 2015 Germany achieved a “record for all time” for the installation of offshore wind turbines, with over 2,200 MW. However, 700 to 900 MW per year is expected here in the future. The industry is preparing itself for the period after 2020, and also for business in Asian markets and new technologies.

Exactly 546 offshore wind turbines with a capacity of 2,282.4 megawatts have been connected to the grid in Germany in 2015. That is around 70 per cent of the total capacity currently installed in the German North and Baltic Seas and so is possibly a “record for all time”. This high value is because 50 per cent of the turbines were already fully set up at the end of 2014 but still had no grid connection. Without this “surplus” of 1,340 MW there is an installed capacity of just under 1,000 MW, which is clearly a more realistic picture of the actual offshore expansion.

As a result, the industry is anticipating a steady increase of 700 to 900 MW per year in Germany for the coming years and beyond 2020. Experts are estimating the annual new construction across Europe³ at around 4,000 MW by 2020. In addition to the major markets in the UK, Germany and Denmark, it is expected that the Netherlands, Belgium and France will also play an increasingly significant role.

Looking beyond 2020, planners and manufacturers of offshore wind turbines are turning to new markets, particularly in Asia. Offshore wind power is expected to become more global. However, decreasing costs for offshore wind energy is essential for this. This is because in the long term, the renewable energy technologies with the most favourable electricity production costs will be developed the fastest. In this regard, the report on the development on the British offshore market (Cost Reduction Monitoring Framework, February 2015) shows that the costs of the technology decrease more quickly than expected. For

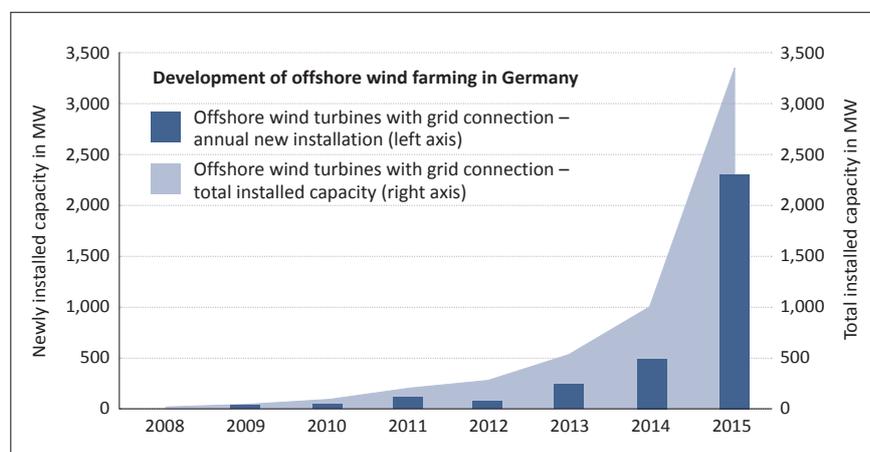
farms that entered operation in 2010/2011, the electricity production cost was still £ 136 per megawatt hour (£/MWh). For turbines whose construction was completed between 2012 and 2014, the cost was just 121 £/MWh. This is a reduction of 11 per cent. The Crown Estate, which is the public agency that is responsible in the UK, expects that the specified target of 100 £/MWh (136 euro/MWh) will easily be achieved for turbines installed in 2020. Companies such as Siemens calculate that the electricity production costs of turbines planned in 2020 and installed by 2022/23 will decrease to 100 euro/MWh. Consultancy firm Ernst & Young is also expecting a further 20 per cent reduction to 90 euro/MWh by 2030.

This would push the European offshore wind industry forward and increase its scale to that of onshore wind energy and solar energy in Germany today. It would then also be possible to use the existing expertise in Europe to open up future

markets in Asia and America. According to the Global Wind Energy Council (GWEC), in 2014 only around 800 MW of offshore wind were installed in Asia. For 2020, Asian governments, especially China and India, have launched offshore programmes which would add up to a total installed capacity of 35,000 MW in 2020. Though according to the GWEC a realistic expectation is about 10,000 MW.

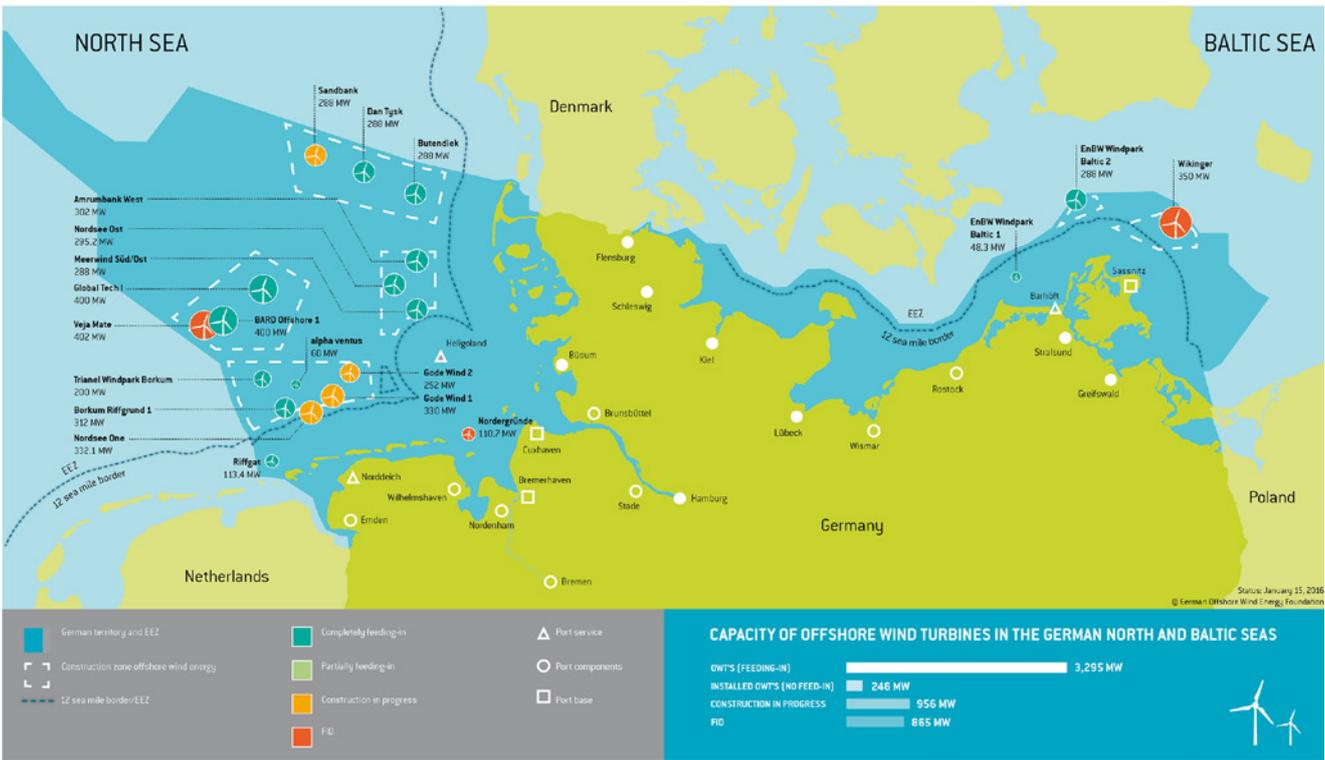
German companies have also adapted to these new markets. The largest planning and operating company in Germany, the Bremen-based wpd group, is examining involvement in Taiwan, where the first projects have already been announced. Companies such as Siemens⁴ have also started to work on pilot projects and test fields in Asia. Consultancy firms see good opportunities for European companies due to their many years of experience in the domestic market – more than 90 per cent of all offshore installations are in Europe.

Fast growth in offshore wind energy



³ Estimate by Ernst & Young, page 7. Compared to 2014 (8 GW), Europe is expected to have 28 GW on the grid by 2020, which is an increase of 20 GW in 5 years, or 4 GW p.a.

⁴ <http://www.windindustrie-in-deutschland.de/interviews/siemens-wind-ceo-markus-tacke-erst-wenn-wir-auf-50-prozent-ee-zugehen-werden-speicher-relevant-teil-2/>



Infrastructure – Offshore industry invests in decreasing costs

In 2015, companies in the offshore industry together with towns on the North Sea coast decided to make major investments in infrastructure. Better logistics is seen as key for reducing costs, especially with the increasing size of the turbines.

The largest individual investment in new production infrastructure for wind turbines in Germany in 2015 was made by electrical and mechanical engineering company Siemens: 200 million euros went into an integrated assembly for forthcoming offshore wind turbines in the coastal town of Cuxhaven on the Elbe estuary. From commissioning in summer 2017, the plant is expected to produce at least 100 offshore turbines of type D7, a gearless turbine with a capacity of 7 MW, every year. The turbines are planned to be used from around 2018 in wind farms in the North Sea, so will mainly equip wind farms in the UK, Denmark and Germany. In parallel, the city of Bremerhaven also decided to expand its existing offshore infrastructure.

Siemens cites logistics considerations as the main reason for the investment in Cuxhaven: This is because the larger the dimensions of the turbine components hub, generator and nacelle frame, the higher the costs will be for special and heavy-duty transportation between the various production sites.

Cost reductions are also in focus in Bremerhaven, which is situated on the river Weser as it flows into the North Sea and only 40 km from Cuxhaven. In 2015 the Senate for the City of Bremen started to plan a loading ramp costing 180 million euros for major components on the banks of the Weser. It is intended that wind turbines will be pre-assembled, stored and handled on the 25-hectare “Offshore Terminal Bremerhaven” (OTB). The 500-metre-long

quay provides space for two to three offshore jack-up barges, which in the future will be able to be loaded directly by Adwen and Senvion, manufacturers based in Bremerhaven. There are around 200 hectares of commercial premises available for other establishments at the port.

Optimised logistics is especially important for offshore wind energy. In order to further reduce the costs on the part of the turbines, ever larger rotors and machines with yet more rated capacity are being developed. The Vestas and Mitsubishi joint venture therefore presented a new turbine in 2015, which creates new dimensions with a capacity of 8 megawatts and a rotor diameter of 164 metres. Offshore market leader Siemens and other competitors have similar plans.

Bigger is cheaper





Tenders – System change for the wind power tariff

The forthcoming change from the fixed tariff for wind power to a tendering model was the dominant political topic for companies in the wind industry in Germany in 2015. What is certain is that the system change is coming. And the industry is adapting accordingly.

The German federal government stuck to its plans to fundamentally change the tariff system for power from renewable energies in 2015. For over 20 years, fixed tariffs have facilitated a successful expansion of power generation from wind turbines and solar installations. In the future, the price for clean power will no longer be set for 20 years of operation, but determined in auctions. The level of the price obtained in this way is to be “determined competitively on the market”, explains the German Federal Ministry of Economic Affairs and Energy (BMWi).⁵

The environmental protection and energy subsidy guidelines from the European

Commission stipulate that all member states convert their subsidy systems to tendering systems. The objective of the BMWi is a “systematic control of the expansion of renewable energies by specifying technology-specific annual expansion paths and an overall corridor up to 2025 and 2035”. The aim is to achieve a proportion of renewable power of “at least 80 per cent” by 2050.⁶

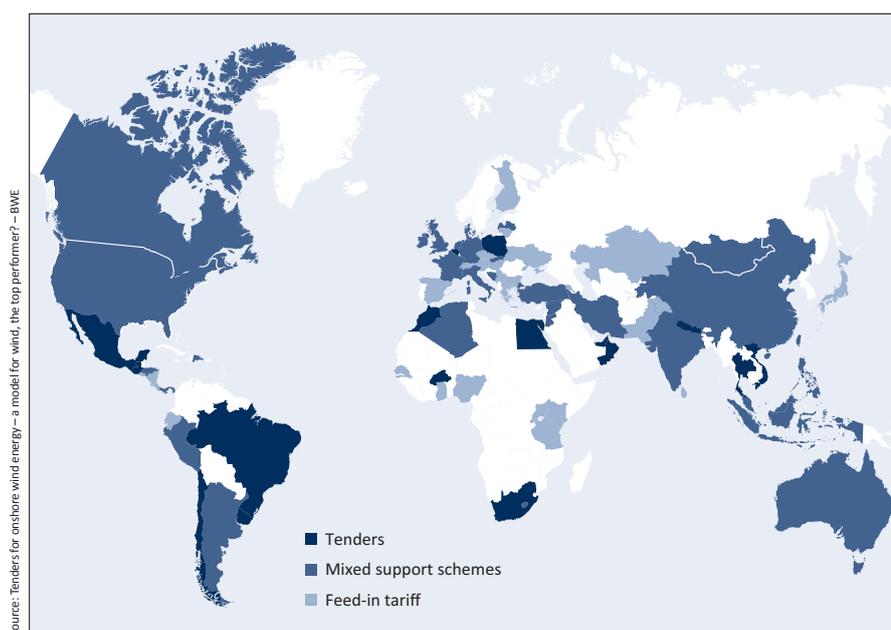
To test the new instrument, in 2015 the government issued calls for tenders for freestanding solar installations. Within three tendering procedures, an installed capacity with a total of 500 MW was auc-

tioned. How many of these installations will actually be built is still unclear, as the successful bidders have up to 24 months to put them into operation. And by the start of December 2015, still no applications had been made to maintain the funding, which is a requirement for the actual operation of the installations.⁷

The calls for tenders in this submarket of photovoltaics in Germany are used essentially to test the market-based instrument. The government sees the evaluations of the auctions as confirmation that its strategy is working. According to the German Wind Energy Association (BWE), it can therefore be expected that this system change will also come to the wind industry in 2017. Here the BWE fears that small wind farm developers and citizens’ cooperatives in particular will not receive sufficient planning security in an auction system. It is precisely the involvement of local stakeholders that is said to be indispensable for the social acceptance of the expansion of wind energy.

In interviews, larger planning companies and also turbine manufacturers say that they share the BWE’s criticism, but see fewer risks for themselves in the system change. This is because the annual total installations are more important to the manufacturers than the procedure their customers use to implement projects. And larger planners are banking on their know-how of wind farm construction being indispensable in the future.

Tenders for renewables globally



⁵ BMWi, 13/01/2016: “Gabriel: Pilot tendering rounds for photovoltaic freestanding turbines were a complete success”.

⁶ BMWi, 13/01/2016: “Tendering report in accordance with section 99 of the German Renewable Energy Act (EEG 2014)”.

⁷ Ibid., page 3



Turbine technology – Increasing yields are making wind power more and more cost-effective

In 2015, manufacturers presented a number of new turbines particularly for low-wind sites, and raised the height of the towers up to 170 metres. This increases the annual yield per turbine and the electricity feed-in becomes more even.

In the past year, wind turbine manufacturers have mainly presented new turbines for middle-wind and low-wind sites. These turbines will be on the market from 2016. Large providers such as Enercon, Vestas, Nordex, GE, Senvion and Siemens have developed models with rotor diameters of around 130 metres and rated capacities over 3 MW.

In the wind industry, sites are split into the classes IEC I, II and III (see figure) according to the average wind speed at the height of the nacelle. The average wind speed in Germany tends to decrease from the coast in a southerly direction. In order to still be able to operate wind turbines economically in more and more inland locations (IEC II and IEC III), the height of the turbine towers and the diameter of the rotor blades has continued to grow over the past few years. This trend is continuing in 2015. The capacities of turbines with a rotor diameter

of approx. 120 metres vary here from 2 MW for low-wind sites up to over 6 MW for coastal sites.

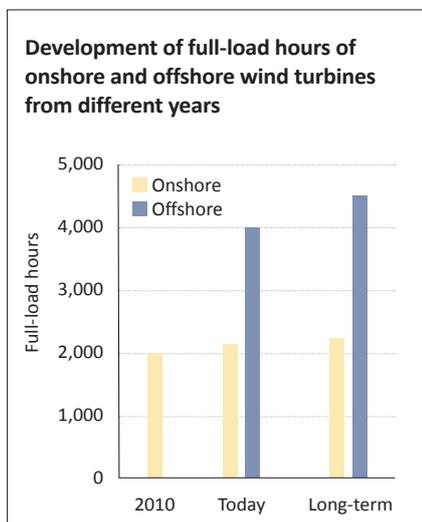
Meanwhile turbine manufacturers such as FWT Energy GmbH from North Rhine-Westphalia are offering tower heights of 170 metres in order to use even higher wind layers. But these have been individual cases up to now. According to the turbine registry of the German Federal Network Agency, tower heights between 125 and 141 metres were mainly used inland in 2015. By the end of 2015, however, a trend towards turbines with a hub height of 149 metres was apparent. And the manufacturer Nordex announced that it will bring a 164-metre tower for a low-wind turbine to the market for 2016.

Typical turbine capacities at sites with average wind speeds of 7 metres per second are currently between 2.5 and 3.5 MW. Annual yields of 3 million kilowatt hours (kWh) per installed megawatt are achieved here. This corresponds to the consumption of 1,000 average households.

The continuous progression of wind technology has led to a higher annual capacity and a more even yield. This is expressed in the number of full load hours, which specifies how long a turbine would have had to be operated constantly at rated capacity in order to reach the energy supply actually achieved. A paper by German wind energy researchers states the following: “In the past, wind turbines in Germany achieved on average around 1,640 full-load hours. [...] As an average of all sites, turbines constructed around 2010 with a hub height of approximately 100 m already achieve almost 2,000 full-load hours; all turbines set up since 2013 achieve even around 2,150 full-load hours. [...] In the long term, inland wind turbines in Germany certainly achieve around 2,250 full-load hours on average.”

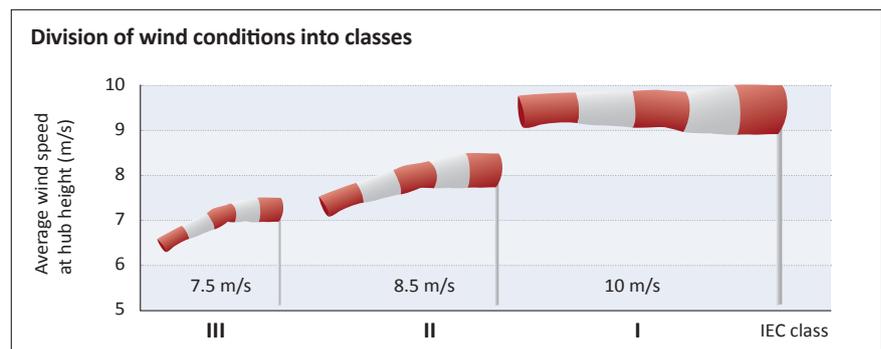
A similar development is taking place in offshore wind power. Scientists predict that their current yields of 4,000 full-load hours will increase to 4,500 full-load hours in the long term.

Higher yield, more even generation



Source: BWE/WIG

Where is the wind blowing?



Source: BWE



Power to Gas – New business models with cheaper storage facilities

Important innovations for the wind industry are increasingly taking place in the networking with solar installations and storage facilities. New concepts and falling prices for battery storage devices are accelerating the breakthrough to profitability.

The interest of the renewable energies industry is increasingly focused on predictable power generation, which is less dependent on the fluctuating wind conditions than previously. The aim is to incorporate the renewable energies into the power grid as fully controllable power plants. This interest is also reflected in a survey on the industry portal windindustrie-in-deutschland.de from the German Wind Energy Association (BWE). Here the participants rated the “expansion of the power-to-gas installations at wind farms” and the “networking of wind farms with solar installations and storage facilities” as the “most important innovations of 2015”.

Companies are watching this development closely. The wind division managers of global mechanical engineering companies such as Siemens or General Electric (GE) see a business area here that is opening up. The companies are running a number of pilot projects and test fields in Germany and other countries.

Meanwhile the Fraunhofer Institute for Wind Energy and Energy System Technology (IWES) has proved that renewable energies alone are capable of ensuring the power supply of an industrialised country such as Germany for a period of almost ten years. The first step of the “combined power plant” was to use wind, solar and biomass power and storage facilities to supply the power requirements of the public power grid, which fluctuate every hour. At the end of



2014, the researchers then showed that not only the quantities to be generated could be managed, but also that a grid built purely for renewable power generation is also secure in terms of operation (frequency and voltage stability). The final report of the Fraunhofer Institute states that “a future system can provide the quality of supply that we are used to today based solely on renewable energy sources,” so that “in the long term, no coal or nuclear-based power” will be needed.

The use of power storage facilities has been an economic stumbling block for a long time, and is only changing gradually. In the meantime, the first projects have reached economic viability. For example, the industry is taking a great interest in the construction of a battery storage system with used batteries from electronic vehicles manufactured by carmaker Daimler.⁸ The storage system erected by Daimler

near Dortmund has a charge capacity of 13 MWh, making it the largest project of its type worldwide at present. There were no subsidies for the construction; the aim is for the project to be economically viable solely through the sale of balancing energy. According to media reports, other car manufacturers want to use their used batteries in the same way.

Wind energy companies are also expanding into this new business area. In Branden-



⁸“New storage systems from old batteries” in: *Energie & Management*, issue 23/24, 2015, page 28.



burg, for example, wind turbine manufacturer Enercon is testing a 6.5 MWh battery storage system, which also supplies balancing energy, in combination with a wind farm.

This development, which is currently being deployed, particularly benefits from the price trend in battery storage systems. Battery prices have recently fallen dramatically:

According to the BWE, cells made by Asian manufacturers for energy storage systems were offered at around 300 US dollars per kWh at the end of 2015, whereas the price at the end of 2014 was still 1,000 dollars. Experts see the technical need for storage systems for the power grid from 2030 at the latest, when the proportion of renewable energies in Germany is at 50 per cent as planned.



Jobs – Record employment due to many new installations

The wind industry is always looking for young, qualified employees, both technicians and sales staff. Due to the continuous expansion of both onshore and offshore, employment figures have remained at a consistently high level.

2014 was a record year for the number of employees in the wind industry. According to the annual analysis of the German Federal Ministry of Economic Affairs and Energy (BMWi), gross employment increased from 119,000 to 130,500 full-time positions in the onshore wind industry alone. With regard to offshore, the study “Gross employment in renewable energies in Germany and reduced fossil fuel imports due to renewable energies and energy efficiency” records a further 18,700 positions (compared to 18,800 in 2013).

While the labour market in onshore wind energy has benefitted directly from the high installation figures – with around 4,750 MW of newly installed capacity, 2014 was the best year to date in the history of wind power – this correlation is not so clear in offshore wind energy. The reason was that between the work-intensive phase up to the installation of the wind turbines and the feed-in to the power grid, which is crucial for acceptance in the wind energy statistics, there were recently year-long postponements in places because the

grid access at sea had not been completed by the network operators.

However, the relationship of the employment figures between manufacture and installation of new wind turbines and the maintenance and operation of existing wind turbines is around the same for onshore and offshore. Maintenance and operation provide around 20 per cent of jobs in wind energy.

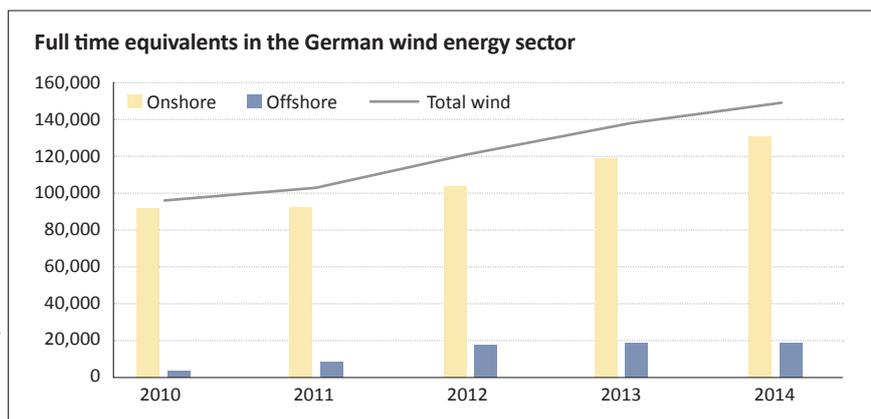
With a total of 149,200 jobs and a share of 42 per cent, the wind industry is by far the largest employer within renewable energy generation. And in terms of people seeking work, the industry has “a good image and is seen as young, innovative and ecological” according to the Kienbaum consultancy firm. The salaries of those employed are based on the market standards for the respective industry. “Wind farm operators count as part of the energy and utility industry, turbine manufacturers and their suppliers are part of machine and turbine construction, and planners and developers are included in the service sector. The respective industry-standard salaries are paid in all named industries”,

according to Kienbaum. However, the earning potential of skilled workers and “specialists with maritime experience and an international profile” is said to be particularly good.

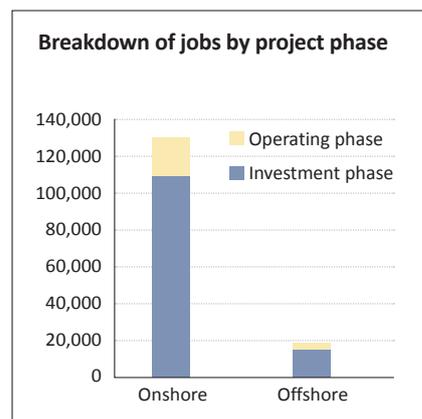
Surveys of experts and companies indicate that the high level of employment in the wind industry has also continued in 2015. Up to the end of the year, “there were no negative reports from the industry” according to the employment report for the BMWi. On the contrary, Nordex, which traditionally focuses on a high export share, had increased its workforce by a good 12 per cent⁹ by the third quarter of 2015. And Siemens has also started to set up a plant for the production of offshore wind turbines in Cuxhaven, which will employ around 1,000 employees from 2017. Further jobs are also expected to be created here as suppliers move in.

Due to the overall strong international wind energy market, companies in the industry are expecting stable growth, which may also have an effect on employment figures.

Constant growth



A fifth of the jobs in the operating phase



⁹ Nordex annual report Q3/2015, 30 September 2015, page 3.



Climate protection – Global energy transition

The climate agreement in Paris has laid the political foundations for limiting the global temperature increase to 1.5 to 2 degrees. This came as a surprise, however, for in order to cut back CO₂ emissions from coal-fired power plants, onshore wind energy and also solar energy would need to be built faster than previously planned.

In Paris, 196 states decreed an energy transition. “Global energy supply has to manage without coal, oil and gas in the medium term, as otherwise the 2-degree target and, linked to that, climate neutrality cannot be achieved in the second half of this century”, says Patrick Gaichen, managing director of the Agora thinktank, on the agreement.

In the internationally binding agreement, the global community categorises climate change as an “urgent and possibly irreversible threat to humanity and the planet”. The aim is to reduce climate-relevant emissions as much as possible so that the “global temperature remains clearly below 2 degrees above the pre-industrial level”. “Efforts are to be made” to even limit climate change to 1.5 degrees. It’s sensational: many experts have considered this target to be politically unachievable.

The International Energy Agency described the agreement as “nothing less than a historic milestone for the global energy sector”. This is because over 90 per cent of global CO₂ emissions come from burning fossil fuels, according to the IPCC report (see graphic). The implementation of the climate agreement is expected to initiate a technical turnaround and change the global economy. However, oil companies Shell,

Sinopec, Exxon Mobile, BP, PetroChina and Total are still among the top 10 companies with the highest turnover in the world. For over two decades, the states of the international community have been reluctant to move away from coal, oil and gas, as the business models of these companies cannot easily be adapted to the post-fossil fuel era. The future of these corporations is indeed significantly bleaker: In 2015, institutions such as the Bank of England expressly warned against “stranded investments”, where banks and insurance companies have invested money in fossil resources.

The Paris agreement was also made possible because renewables are in an increasingly better economic shape than coal-fired power stations, and the energy turnaround had already started in many countries. According to an inspection by the International Agency for Renewable Energy (IRENA), 164 states had already set renewable energy targets in mid-2015, whereas in 2005 only 43 countries had done so. The scope ranges from an 11 per cent share for renewables in the energy supply by 2032 in Ukraine, to complete renewable energy supply in Costa Rica by 2020, and 2,000 megawatts of wind capacity installed in Morocco in the next four years, to 230,000 megawatts in China.

In any case, these investments planned for renewables – above all in onshore wind power and in solar energy – still have to be increased. This is because the energy and emission plans introduced by around 160 states before the climate conference would likely limit the global temperature increase to only 2.7 degrees. It is expected that these plans will be adapted to the 1.5 to 2-degree target by 2018. Experts expect this to create a new impetus to expand renewable energies: “If the industry picks up the signal from the conference that coal-fired power stations and combustion engines are the technologies of the past, then the CO₂ curve can go down sharply from as early as 2020”, is the opinion from the Potsdam Institute for Climate Impact Research.

Companies:

Manufacturers of wind turbines

The innovative power of the companies operating in Germany has given them the edge in terms of technology. Manufacturers are exporting and expanding into foreign markets in Europe, North America and Asia.





ENERCON GmbH

Innovative products and a future-oriented company

For 30 years ENERCON wind turbines have stood for innovative technology, proven reliability and a high level of economic profitability. This market-leading German company has already installed more than 25,000 turbines with a combined power output in excess of 40 GW (as at December 2015).

ENERCON has been among the leading technology providers in the wind turbine sector for the past 30 years. The company was the first manufacturer to rely on a gearless drive concept which is typical of all ENERCON wind turbines. ENERCON is also leading the way in fields such as rotor blade construction, control systems and grid connection technology, and is consistently demonstrating high levels of inventiveness with a plethora of new technological developments.

The company's sustained success builds on on-going research and development, not least in production and service activities. All key components such as rotors, ring generators, and grid feed-in systems are manufactured in house. This high degree of vertical integration, unprecedented in the wind turbine sector, guarantees the high quality standard and ultra reliability

of ENERCON wind turbines. This is supported by customer-oriented service which provides operators with a guaranteed technical system availability of 97 per cent. This overall concept sets high standards in terms of technology, quality, and safety, and reinforces ENERCON's position as a market leader within Germany.

The company's product portfolio includes wind turbines capable of producing between 800 and 7500 KW. The latest turbine now in series production is the E-115/3 MW which has a rotor diameter of 115 metres. Thanks to its performance-optimised blade profile, it achieves high output yields even in the partial load range, which predestines the E-115 for deployment in locations with rather low average wind strengths. ENERCON's latest development, the E-126 EP4/4.2 MW based on the innovative 4 MW platform, is currently in the prototype phase. All ENERCON production series are characterised by technical reliability, a low service and maintenance requirement, and longevity, all of which ensures a high level of profitability for customers.

With their directly driven synchronous generators and the innovative and modular power conversion concept, ENERCON wind turbines provide a broad range of technical options in terms of grid connectivity. They incorporate a grid feed-in system certified in accordance with the latest grid code requirements. Thus, ENERCON wind turbines can be easily integrated into power supply and distribution grids of any type. In addition, ENERCON wind turbines offer a wide range of grid-support attributes.

In accordance with the corporate motto "energy for the world", ENERCON are actively promoting the use of renewables across the globe. In this context ENERCON are continuously expanding their research and development facilities as well as their production and distribution activities. ENERCON has a visible international presence in the most important markets with production facilities in Brazil, Sweden, Turkey, Portugal, Canada, France and Austria in addition to a decentralised global service and distribution network.

At the same time ENERCON's long-term stability is ensured by a prudent and sustainable growth strategy. The inauguration of the Aloys Wobben Foundation in the autumn of 2012 has cemented the company's strategic orientation, both in terms of independence and continuity. Company founder and proprietor Aloys Wobben transferred his company shareholding to the foundation in order to place ENERCON's sustainable and future-oriented corporate strategy on a permanent footing.

The ENERCON Group's extremely high credit rating has recently been reconfirmed by Euler Hermes Rating GmbH in the course of an independent rating process. The analysts awarded a score of "AA-" for ENERCON's credit worthiness and sustainability. This places ENERCON on a significantly higher level than the German economy as a whole. As such ENERCON customers can not only rely on the high level of quality and reliability of the company's turbine technology, but also on a high degree of investment security.



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Profile **Wind turbines (>100 kW)**

Category **Manufacturers**

Employees **more than 19,000**

direct and indirect

Founding year **1984**



Powerful and quiet: ENERCON's future new onshore specialists.

eno energy systems GmbH

novation for efficiency

Since the start of its wind turbine production, eno energy has stood for maximum quality, flexibility and innovation.



- 01 | Wind farm at Stäbelow with eno 92.
- 02 | Wind farm at Plauerhagen with eno 82.
- 03 | Wind farm at Brusow with eno 114.
- 04 | Gearbox of an eno 114.
- 05 | Nacelle of an eno 82.



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Profile **Wind turbines (> 100 kW)**

Category **Manufacturers**

Turnover **approx. € 100 million (2014)**

Employees **around 200**

Founding year **1999**

eno energy group has been based in Mecklenburg-Western Pomerania, Germany, since 1999. At its Rostock production site, the company produces wind turbines for the onshore sector with rated capacities ranging from 2.05 to 3.5 megawatts and rotor diameters ranging from 82 to 126 metres. eno energy systems GmbH's developments, which are designed for durability, are exclusively realised with renowned, European suppliers. With subsidiaries in Sweden, UK and France, eno is also on expansion course internationally.

The company is distinguished by its flexibility, innovativeness and considerable quality awareness. Right from the beginning, eno has accorded particular importance to its own research and development as well as to the associated close contacts with specialist engineers, institutes and university

establishments. This has enabled the company to create – at a remarkably rapid pace – a comprehensive turbine portfolio at the highest level for almost all segments.

Whereas the first wind turbine generation in the form of the 2 MW platform already showed its high quality with a very high technical availability, the company is now seeing its massive investments in its own production depth come to full fruition with the new 3.5 MW platform.

With the eno 114, which is particularly suited for windy coastal sites, and the eno 126, which is designed for inland sites, the ambitious company not only offers one of the most powerful wind turbines in the 3-4 MW class but, with the eno up.site





principle, also provides an answer to the increasingly important question as to how more turbines can be erected on the same site given the increasing shortage of available space. Self-developed rotor blades and low speed help to reduce turbulence and keep the sound level at a particularly low level.

In addition, the company has examined in detail aspects relating to the ease of servicing and maintenance, increasing efficiency, securing the long-term reliability of all components as well as the national and international requirements for grid connections. With all issues, eno energy can call on its excellent external network of consultants, insurers and suppliers, as well as on its many years of in-house expertise in all areas of wind energy utilization.

The corporate group is positioned in the national and international markets not just as a wind turbine manufacturer but also as a planner, wind farm operator and as a provider of service, maintenance and operational management. eno energy's flexibility in being able to provide not just

holistic solutions, such as the complete construction of wind farms as a general contractor, but also all individual services such as the separate supply of wind turbines, ensures that it is a competent partner for local investors and project developers in Germany and abroad.



Envergate Energy AG

Swiss Wind Turbines

Envergate's vertical-axis technology convinces fans with its intelligent structure and efficiency. Almost soundless and with a high level of functionality, even for light, changeable or gusty winds.



01

- 01 | Wind turbines of the next generation.
- 02 | Quinta99 in the south of France.
- 03 | Quinta20, standard version.



SWISS WIND TURBINES

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Profile **Small wind turbines (<100 kW)**

Category **Manufacturers**

Employees **10**

Founding year **2008**

High-tech

Envergate develops high-performance and very low-noise high-tech turbines to generate and exploit clean wind power. From 2008 the first series productions were able to supply the international markets. With know-how and experience gained over time, larger, more high-performance products were launched.

Forward-looking materials such as carbon and aluminium and performance-optimised controls are used as standard. Each wind turbine is equipped with a speed limit and safety brake.

The turbines can be integrated into hybrid systems, are used for autonomous, local power generation or as an extension to existing systems, and cause hardly any turbulence or shadows.

Guaranteed performance

Theoretically an Envergate Quinta99 wind turbine produces up to 380,000 kWh of energy every year. With an installed rated output of 99 kVA, they can be used for a wide range of applications such as power stations, reoriented wind farm operations, telecommunication, industrial or commercial applications, and can be harmoniously integrated.

The smaller Quinta20 with an installed rated output of 20 kVA can also be attached to existing objects such as mobile phone masts or roof structures thanks to its compact design. Maintenance and servicing costs for both Quintas remain extremely low as a result of their intelligent design.

The quiet and relatively slow rotations of the very aerodynamically designed wings, which weigh up to 140 kg, and the smart, compact design ensure a noise level of less than 43 dBA (as per IEC 64100-8, measured at a distance of 20 m from the mast) at full operating power.



02



FWT energy GmbH & Co. KG

A comprehensive worry-free package for international wind farm technology, with trade, service and production

FWT energy has enjoyed international success right from the outset. And no wonder – this dynamic player in the wind industry possesses the expertise of a Westerwald pioneer and employs motivated personnel whose market experience inspires confidence in operators and investors.



01

The FWT energy group offers modern turbine technology up to 3 MW (FWT Production), manufacturer-independent service (FWT Service), and international component procurement (FWT Trade).



02

The FWT group is divided into the divisions FWT Trade GmbH (global trading of components, buying syndicates, logistics and supply chain outsourcing), FWT Service GmbH (manufacturer-independent servicing of onshore wind turbines, application engineering and farm optimisation), and FWT Production GmbH (manufacture and erection of onshore multi-megawatt turbines and repowering). Active on the market since the start of 2013, the company has 100 employees and exhibited solid growth and substantial profits year by year.

The current range of FWT turbines

FWT 2000: 2.0 MW capacity, 93 and 100 m rotor, hub heights of 85 to 141 m

FWT 2500: 2.5 MW capacity, 100 and 104 m rotor, hub heights of 85 to 160 m

FWT 3000: 3.0 MW capacity, 120 and 132 m rotor, hub heights of 85 to 170 m

All turbines are based on the innovative W2E drive train concept, which replaces the long, heavy main shaft with a large main rotor bearing. FWT turbines are significantly quieter to run, because this diverts the lateral and longitudinal forces directly to the main frame. A further



03

benefit is the compact and lightweight construction of the nacelle. This simplifies transport, logistics and erection.

FWT 3000 – low weight achieves high yields

FWT is using the Winergy HybridDrive for the first time in the new FWT 3000. This combines a two-stage, medium-speed gearbox with a powerful synchronous generator. All the power runs via three 1-MW converters. This means that the FWT 3000 can be easily adapted to all international grid conditions.

This concept reduces the overall size of the construction to only 11.6 m long, 4.6 m wide and 4.0 m high, and it weighs just 105 tonnes – even with the integrated medium-voltage transformer. Because installation work at the site is kept to a minimum, it is possible to erect the turbine in less than a week.

As well as the 85 and 100 m tall tubular steel towers, the 120/140/170 m tall Ventur hybrid tower is also on offer. This combination of pre-stressed concrete components and a tubular steel section can be easily transported to the construction site and



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Profile **Wind turbines (>100 kW)**

Category **Manufacturers**

Turnover **€ 42 million**

Employees **100**

Founding year **2013**



erected using climbing construction techniques in a short amount of time and with relatively little crane capacity.

The 120 m rotor ensures that maximum yields can be achieved even at low and medium wind speeds. In its year-long test, the prototype confirmed the calculated annual yield of 6 million kWh at 5.0 m/s and 13.5 million kWh at 8.0 m/s.

Manufacturer-independent service, innovative engineering and cost-cutting procurement

Based on its years of experience in the international wind industry, FWT is able to offer tailored service solutions, from a standard maintenance package right through to a full service contract. Close cooperation between the service and engineering divisions enables prompt and permanent solutions to problems, as well as turbine optimisations for greater operational safety and higher yields.

FWT Service ensures a high level of technical availability through regular maintenance. All work is carried out with original parts according to manufacturer specifications. The service portfolio also includes machinery, drive train and rotor blade servicing, as well as preventative concepts, retrofits and remote control with comprehensive 24/7 monitoring.

Thanks to long-established contacts in the sector and excellent networking with the industry's major suppliers, FWT provides all components for W2E licensees and other manufacturers' turbines, and efficiently conducts even the most challenging projects. Cost reductions can be achieved by combining orders and taking advantage of the best buying conditions.

FWT impresses with future-oriented turbine technology and manufacturer-independent service



01 | An extremely compact drive train and the HybridDrive gearbox and generator combination mean that the FWT 3000 is both compact and lightweight.

02 | The manufacturer-independent FWT Service is based on 20 years' experience of wind energy.

03 | FWT Production has recently supplied 22 FWT 2000 turbines to the EXPO wind farm in Kazakhstan.

04 | FTW turbines can be adapted to each site due to variable tower heights and rotor sizes.

05 | FWT also stands out from the competition with its unconventional tower solutions, e.g. with lattice towers of up to 160 m or hybrid towers up to 170 m.

Nordex SE

Nordex SE is one of the pioneers of the still young wind industry and today is a trendsetter for reliable and efficient wind turbines for onshore deployment.



Copyright images: Nordex SE.

Nordex is one of the world's leading wind turbine manufacturers. With an export ratio of approximately 70 per cent, the group occupies a strong international position, particularly in the growth regions

of the world. Worldwide, the company has offices and subsidiaries in 22 countries, employing around 3,300 people. The European factory is in Rostock, Germany where Nordex produces the nacelles with the electronic and control technology as well as the rotor blades for its turbines.

Nordex has set high technological standards since its foundation in Give (Denmark) in 1985. In 2000 the company installed the first 2.5 megawatt turbine in the world.

The company's product range currently comprises wind power systems from the shared technical platform generations Gamma and Delta. The Generation Gamma range comprises the turbines N90/2500, N100/2500 and N117/2400. As the flagship of this generation, the N117/2400 is in a class of its own when it comes to efficiency at sites characterised by light wind speeds.



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Profile **Wind turbines (>100 kW)**

Category **Manufacturers**

Turnover **€ 1,734.5 million (2014)**

Employees **3,300**

Founding year **1985**





To date, over 3,800 turbines of this platform have been produced. This experience with multi-megawatt turbines gives Nordex a decisive lead over most of its competitors. With Generation Delta, Nordex is now offering the fourth generation of its proven multi-megawatt platform. With its larger rotors, increased nominal output and optimised technical systems, Generation Delta is setting new standards in terms of economic efficiency, reliability, serviceability and safety. The N100/3300 is specially designed for strong wind locations, the N117/3000 for locations with medium wind and the N131/3000 as well as the N131/3300 for light wind sites. So Nordex offers high-efficient turbines for all wind classes. Intelligent options and a range of tower solutions expand the application area of the turbines.

There are currently more than 7,000 Nordex wind turbines installed around the globe, with a total rated output of about 13,000 megawatts. The Nordex Group covers the whole technical value-added chain with its products and services, from identification of suitable sites to wind farm system planning and the technical implementation of the wind farm. Even after construction of the turbines is completed, Nordex continues to support its customers. The company offers a customised service for all of its wind turbines, which ensures the trouble-free operation of the machines on a worldwide basis. The average availability of all turbines covered by Nordex Service stands at 98 per cent.



Senvion GmbH

Having constructed over 6,400 wind turbines, Senvion is one of the world's leading manufacturers in the onshore and offshore sectors and is continuing to develop its tried-and-tested technology. With 25 years of experience, the company sets new standards in terms of quality and innovation.



- 01 | 6.2M126, Thornton Bank, Senvion GmbH.
- 02 | 3.4M104, in Clauen, Senvion GmbH.
- 03 | MM92, in Maida, Senvion GmbH.
- 04 | 3.2M114, in Norstedt, Senvion GmbH.
- 05 | MM92, in Quebec, Senvion GmbH.
- 06 | 6.2M152, in Neuenwalde, Senvion GmbH.
- 07 | 3.2M114, in Michaelisdonn, Senvion GmbH.

The international mechanical engineering company develops, produces and markets wind turbines with rated outputs of 2 to 6.2 megawatts (MW) and rotor diameters of 82 to 152 meters for almost any site. Senvion also offers its customers project-specific turnkey, service and maintenance, transport and installation as well as foundation planning and construction solutions. The company, which is headquartered in Hamburg, has around 3,900 employees worldwide and can draw on experience gained in the manufacture and installation of over 6,400 wind turbines throughout the world.

The company's experience and expertise goes back over 25 years. Since 20 January 2014 the company has been operating as Senvion. With its wind turbines in the 2 MW class, the MM82, MM92 and MM100, the company has set new standards. More than 4,400 of these groundbreaking onshore turbines are now producing electricity safely and reliably around the world.

In order to produce high yields in the long term, Senvion continuously develops its tried-and-tested technology and optimizes the efficiency of its turbines. Since 2008, the company has been expanding its onshore portfolio with its 3.XM series. The turbines are based on the technology of the MM series and are available in different versions with a rated power of 3.4 and 3.2 or 3.0 MW. Depending on the specifications, the turbines are used at sites with high, average or low wind speeds.

Expansion of the 3 MW series

In order to offer customers the ideal turbine for every site, Senvion has expanded its 3 MW portfolio in 2015. With a 140 meter rotor diameter, the Senvion 3.4M140 Eco Blade Control (EBC) is the new reference for low wind speed locations. The highly efficient 68.5 meters blade combined with integrated serrations allow high yields and a very low sound power level. With an operational lifetime

SENVION
wind energy solutions

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Web **www.senvion.com**
Profile **Wind turbines (> 100 kW)**
Category **Manufacturers**
Turnover **€ 1.9 billion**
Employees **3,900**
Founding year **2001**





of 25 years, the Senvion 3.4M140 EBC can reduce the levelized cost of energy. It is therefore particularly suited to the European markets of Senvion like Germany, France, Belgium, Poland and Italy.

Integrated management for wind turbines

Whether it's a standard maintenance contract or a full maintenance contract with optional availability or production guarantee, with its comprehensive range of servicing and maintenance activities with contract terms of up to 25 years, Senvion can offer every customer the right solution and guarantee long-term, reliable yields.

Tailor-made solutions

The company has grown from a small, North German niche start-up company to an enterprise that is active throughout the world.

The profitable and reliable wind turbines are designed at the Senvion TechCenter in Osterrönnfeld and manufactured at its Husum, Trampe and Bremerhaven plants as well as in Portugal.

The company aims to set new standards in terms of innovation and quality and therefore to put wind energy in a position to compete with traditional energy sources in the long term. This does not mean doing everything in a new or different way, but rather consistently developing and improving its portfolio of wind turbines.



Siemens Wind Power

The driving force of the energy transition: Wind power contributes a key portion of the electricity powering our society from renewable energy sources. Siemens Wind Power (SWP) counts among the leading providers of wind turbines worldwide for onshore and offshore sites. The company unites technological innovation, experience and the professional expertise of a major industrial vendor with products across the energy sector's entire value chain.



From 22 to 7,000 kilowatts in 30 years

With its highly efficient, robust and reliable wind turbines, Siemens offers innovative yet tested and proven technology for virtually every application conceivable today. The foundation of Siemens' Wind Power Division was laid in 1980 by the company Bonus AS and its successful 22-kW turbines. Since then, rapid technological developments have steadily increased turbine output, while rotor diameters have grown from 10 meters to 154 meters based on today's 75m blades. In 2002, Siemens' patented IntegralBlade® process introduced a decisive advancement enabling construction of higher performance rotors, making Siemens the only manufacturer fabricating rotor blades as one piece from a single block. A decade later, Siemens further refined its technology to create its Quantum Blade series. Lighter than their predecessors while equally robust, they offer a newly designed rotor blade root. The resultant aerodynamic improvements increase wind energy yield and improve unit output at part load.

Siemens technological development effort has also focused on gearless wind turbines. The first direct-drive wind turbines with an electrical generating capacity of 3 MW were

presented in 2010. Now, the prototype of a new turbine generation has begun operation in 2015: Delivering an output of 3.3 megawatts, Siemens' Model SWT-3.3-130 sets whole new standards as a gearless onshore unit in terms of energy yield as well as operating costs and flexibility.

Direct-drive units are proving their mettle in offshore projects as well, with 35 of these innovative turbines now operating at Britain's Westernmost Rough offshore wind farm. Siemens is currently erecting 42 additional wind turbines of this type for the German offshore farm Gode Wind 1. Trial testing is already underway for the new SWT-7.0-154, a variant of Siemens' innovative offshore wind turbine designed for 7 megawatt output. This new model extracts some 10 per cent higher energy yield while retaining the proven reliability of its predecessor design.

Impressive innovation

All of Siemens' wind turbines share one thing in common: Every developmental step represents a pooling of the relevant experience gained from operating preceding generations of wind turbines. Advancements in aerodynamics, structural dynamics, noise control and grid compliance are

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Profile Wind turbines (>100 kW)

Category Manufacturers

Turnover € 5.7 billion

Employees 12,850

Founding year 1980

directly incorporated into Siemens' wind turbine designs. Regional service teams ensure that these turbine units represent a secure investment for many years. Using modern remote monitoring and diagnostics techniques, Siemens helps its customers to operate their units reliably and to the highest level of efficiency. Siemens Service provides inspection, maintenance and repair services for projects, but also contributes to the improvement of turbine performance and output. Siemens has erected over 16,300 of its turbines worldwide, representing a total installed electrical generating capacity of more than 31,000 MW. More than 1,900 Siemens wind turbines are in operation in Germany alone, delivering in total almost 3,400 MW of output capacity.

360° customer care – 365 days a year

Servicing wind turbines demands passion and attention to detail, along with a long-term partnership. Siemens' Service Wind business unit offers 360° customer care for its turbines – around the clock from the very first day, and over the entire service life. When it comes down to it, Siemens' customers can rely on the company's unique logistical capabilities both onshore and offshore, as well as its state-of-the-art remote diagnostics expertise for detecting necessary repairs before any major failure or damage occurs. Siemens' technicians can respond faster and more intelligently thanks to Siemens' extensive experience servicing wind turbines. In maintenance deployments, the safety of the company's most valued resource, the employees, comes first. Siemens has developed a policy of "Zero Harm" (no injuries) to reinforce these efforts, always putting priority emphasis on occupational health and safety.

Number one in offshore technology

With more than 20 years of experience in planning and implementing offshore projects, Siemens is a pioneer in harnessing wind power at sea. Since erecting Vindeby wind farm off the coast of Denmark in 1991, the first offshore facility of its kind in



04

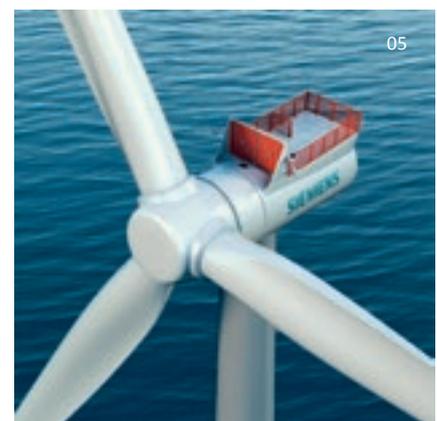
the world, the company has persistently continued to improve its products and know-how. Today, Siemens is clearly the world market leader in the offshore wind power sector, with almost 2,000 wind turbines erected at sea, representing a total generating capacity of more than 6,700 MW. The 630-MW London Array, the world's largest offshore wind farm, went on line in 2013 – a major milestone on the road to supplying climate-friendly electric power on a scale with conventional power plants. In May 2011, EnBW Baltic 1 began operation as Germany's first commercially operated offshore wind farm, with a generating capacity of about 50 MW. This was followed by six more German offshore wind farms equipped with wind turbines from Siemens: Borkum Riffgat (108 MW), Meerwind Süd/Ost (288 MW), Borkum Riffgrund (320 MW), EnBW Baltic 2 (288 MW), Butendiek (288 MW), and DanTysk (288 MW). Soon to be erected off Germany's seacoast are the Amrumbank West (288 MW), the two Gode Wind projects (252 MW and 330 MW), and the Sandbank (288 MW) and Veja Mate (402 MW) wind farms.

Siemens Wind Power in Germany

SWP has been steering its global business from Hamburg since October 2011. In addition to being headquartered in this city of the old Hanseatic League, the staff of the company's European Sales unit is also based here. SWP's Europe, Middle East and Africa (EMEA) unit for servicing

Siemens' wind turbines maintains a Competence Center in Aachen, Germany, but is likewise based in Hamburg. Since 2010, SWP's headquarters in this German city on the Elbe River pulls all the strings in many of Germany's onshore and offshore projects. As of the end of 2015, the number of Siemens Wind Power employees based in Hamburg has grown to over 900. Worldwide, Siemens' workforce in the wind power sector numbers about 12,850, with 1,200 employees in Germany.

- 01 | Wind farm DanTysk with SWT-3.6-120.
- 02 | The "Faraday" service operation vessel with the innovative Ampelmann system for safe and effective access to offshore wind turbines.
- 03 | Siemens gearless SWT-3.0-101 wind turbines in the Klibüll onshore wind farm in northern Germany.
- 04 | Installation of the SWT-3.6-120 at Dan Tysk wind farm.
- 05 | Direct-drive also in offshore units: The model SWT-7.0-154 wind turbine with a capacity of seven megawatts and a rotor diameter of 154 meters will be built in Cuxhaven starting in 2017.



05

VENSYS Energy AG

More energy for our future

VENSYS wind energy technology thriving around the world

- 13,600 VENSYS wind turbines with 22.2 GW total rated capacity on the grid
- Three product lines with numerous rotor and tower variants
- High yields through optimum site adaptations for all wind classes



01 | Wind farm at Losheim-Britten, Saarland, Germany. Photo: Vensys.

02 | Pitch system with toothed belt drive. Photo: Carlos Arias Enciso.

03 | Section view 3 MW platform. Photo: Vensys.

04 | Workshop in Neunkirchen, Saarland, Germany. Photo: Carlos Arias Enciso.

05 | Vensys100 in Wagenfeld, Germany. Photo: Carlos Arias Enciso.



VENSYS Energy AG

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E-Mail **s.baumann@vensys.de**

Web **www.vensys.de**

Profile **Wind turbines (> 100 kW)**

Category **Manufacturers**

Turnover **€ 100 million**

Employees **150 in Neunkirchen, 90 in Diepholz**

Founding year **2000**

VENSYS Energy AG is the German pioneer in the development of direct-drive wind turbines. Together with its licensees, the company has an impressive 13,600 turbines installed around the world, which currently generate a total of 22.2 GW under a wide variety of grid and climate conditions.

VENSYS's renewed growth spurt on the European and international wind markets is the result of high demand for the 2.5 MW series and the continuing success of the 1.5 MW platform. The latter has been in production since 2003 and was the most frequently installed 1.5 MW gearless wind turbine right back in 2011. 11,000 of these highly robust and efficient turbines have been installed and have proven themselves even in extreme climates. 91 per cent originate from Goldwind, VENSYS's largest licensee in China.

By the end of 2014, 919 of the 2.5 MW turbines had been connected to the grid and many more are at the planning and implementation stage in Europe, America and Asia.

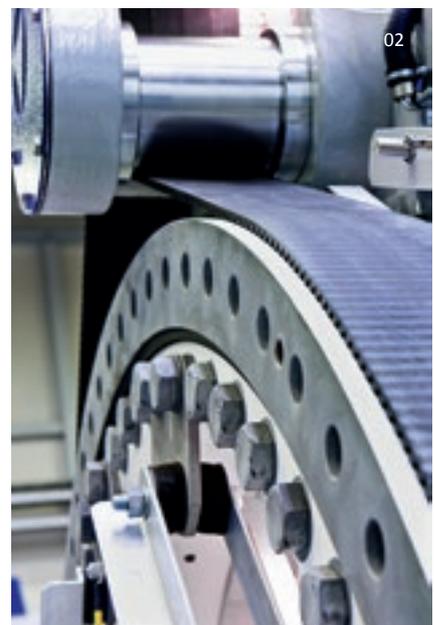
The new 3 MW turbine now plays a significant role. It is based on the technology of the 2.5 MW platform, but the generator has been further developed to produce a greater nominal output at a lower rotation speed. A prototype was operated at the Grevenbroich test field in Germany at the end of 2015.

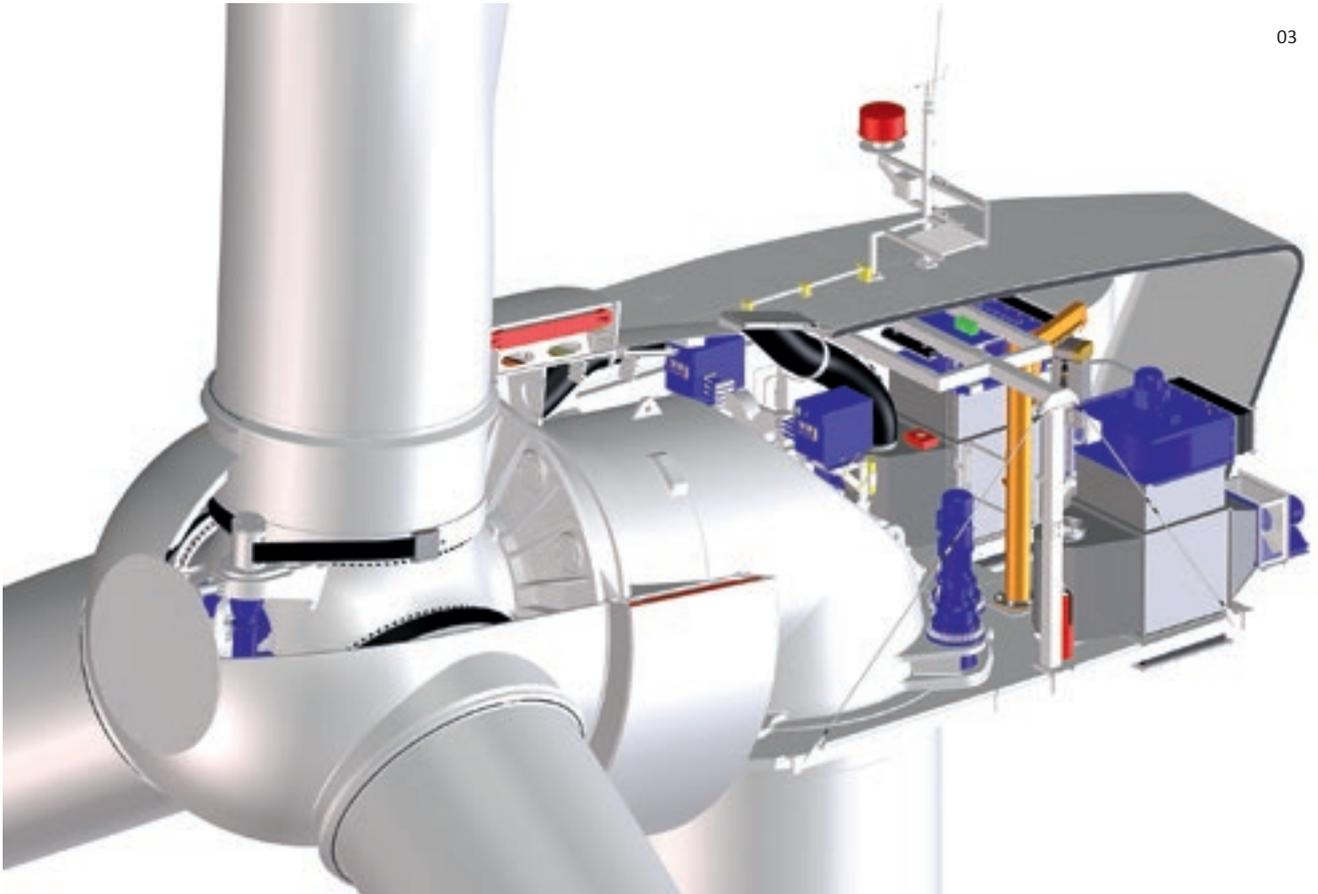
All platforms follow the VENSYS philosophy and offer the design-related benefits this

entails. Its trademark is gearless wind turbines with direct drive and a permanent-magnet synchronous generator that achieves a high level of efficiency with minimal power loss.

The use of as few high-quality components as possible in a compact design with largely wear-free operation is a recurring theme. The turbines are characterised by high levels of availability and reliable, low-maintenance performance.

The advantageous positioning of all the power electronics, including the frequency converter and transformer, in the base of the tower is common to all product lines, as is the use of the lubrication-free, durable toothed belt drive for the triply redundant blade pitch control system.





Platform-specific developments further promote the advantages of the turbine design

For example, the passive air-cooling system in the 1.5 MW series enables reliable operation even in extreme environments. The active air-cooling system in the 2.5 MW/3 MW platform, which has a considerably higher rated capacity, is both simple and effective, protected against all outside influences in a closed circuit.

The innovative rotor bearing in the 2.5 MW series, using a single slew bearing, brings about a significant reduction of the tower head mass, despite an increase in capacity and rotor size.

For optimum adaptation to the potential wind yield, VENSYS offers all platforms with various tower systems and heights, as well as several rotor diameters.

The 1.5 MW turbine can be constructed with a 70, 77, 82 or 87 metre rotor diameter. A total of eleven variants with hub heights of 61.5, 65, 70, 75, 85 and 100 metres ensure that sites with wind classes from Ia to IIIb are covered.

The 2.5 MW platform, which started out in 2010 as a prototype with a 100 metre rotor diameter, was expanded to include 109 and 112 metre diameters in 2012. Since 2013, VENSYS has also been constructing the 2.5 MW platform with a 140 metre high steel and concrete hybrid tower, which achieves optimum yields at IEC IIa and IIIa sites.

VENSYS turbines are manufactured both at the German headquarters and in the production facilities of licensees in China, India, Brazil and soon also in Egypt. Production of the 2.5 MW and 3 MW turbines is currently concentrated at the German site in Neunkirchen and the Goldwind production facilities in China.



Vestas Central Europe

World market leader Vestas – Focusing on efficient technology and on reducing the levelized cost of energy.



“With our focus on efficient technologies and the reduction of the levelized cost of energy, coupled with decades of global experience, Vestas is the partner of choice for implementing wind energy projects, and this includes the upcoming tendering system in Germany,” explains Knud Rissel, Vice President Sales Germany, Vestas Central Europe.

Vestas®

Vestas Central Europe

Address **Christoph-Probst-Weg 1–2
20251 Hamburg**

Federal state **Hamburg / Germany**

Phone **+49 (0) 40 / 467 78 - 5000**

E-Mail **vestas-centraleurope@vestas.com**

Web **www.vestas.com**

Profile **Wind turbines (>100 kW)**

Category **Manufacturers**

Turnover **€ 6.9 billion**

Employees **>1,900 in Germany,**

>19,500 globally

Founding year **1985**

Vestas has been active in the German market since 1986 and to date has installed more than 7,000 wind turbines in Germany with a total capacity in excess of 10 GW. The company in Germany includes the entire value chain, starting with R&D, through to production plants, sales locations, a unique service network and the headquarters of the Vestas Central Europe business unit. Vestas employs around 1,900 people in Germany.

Vestas' focus on constant technological advancement increases the productivity of turbines and, at the same time, reduces the levelized cost of energy. The aim is to develop the optimum turbine for each site. With this in mind, Vestas launched the new V136-3.45 MW, a further variant of the 3 MW platform, in autumn last year. The V136-3.45 MW sets new standards when it comes to the efficient use of low-wind sites. With the combination of Vestas' largest onshore rotor diameter, innovative tower technologies and our advanced blade design, the turbine offers an increase of up to 10 per cent in the annual energy production compared to the V126-3.3 MW. At the same time, the levelized cost of energy and noise emissions are reduced in relation to the current design.

The V136-3.45 MW is Vestas' answer to the upcoming tendering system in Germany in 2017.

Perfect combination of efficient turbine technology, innovative tower concepts and flexible service offers

As the next logical step in the further development of the successful 3 MW platform, Vestas presented the new 166-meter tower to the German market in November 2015. The first installation of the tower is planned for early 2017 in Germany and we expect certification in the first half of 2016. Vestas is the only turbine manufacturer on the market that is offering a tower concept in solid steel at these hub heights and as such is offering customers – even at these hub heights – all the advantages of a steel tower concept. The Large Diameter Steel Tower (LDST) concept offers crucial advantages over a hybrid concept, such as weight reduction of the tower, an effective transport concept, a short installation time and low dismantling costs. This tower concept was specially developed for high hub heights. In low-wind areas, the V126-3.3 MW and the LDST are the perfect combination for increased profitability in our customer projects. As a life-long, fleet-wide and





multi-brand service partner with a focus on safety, quality and performance, Vestas offers its customers flexible services, which maximise the security of their investment in wind.

From cradle to cradle: Vestas supports repowering projects from the start

Repowering is an elementary part of the German market in order to achieve the ambitious expansion targets for renewable energies by 2030. With the increasing size of old turbines comes an increase in complexity too. Vestas helps customers to find a second potential use for their turbines – after all, wind turbines are at their most valuable when they can generate electricity.

About Vestas

Every day, Vestas wind turbines deliver clean energy, which helps support the global fight against climate change. Wind energy from more than 55,700 Vestas wind turbines currently reduces carbon emissions by more than 60 million tonnes of CO₂ per year.

To date Vestas has installed wind turbines in 74 countries. Our company alone has created jobs for more than 19,500 dedicated people – at service and project sites, in research facilities, factories and subsidiaries around the world. With 52 per cent more installed total capacity than our closest competitor and more than 71 GW of installed cumulative capacity worldwide, Vestas is the world leader in wind energy.







Companies:

Suppliers

Manufacturers of wind turbines from all over the world buy systems and components in Germany. Years of experience of the operational side together with specific research and development projects to reduce manufacturing and operating costs and prolong service life are much in demand everywhere.

Bachmann electronic GmbH

We automate wind energy: safely, flexibly and in a modular system

A secure future for your wind farm: Bachmann offers its customers around the world the most sophisticated automation solutions for the on- and offshore wind sector.



01 | Bachmann technologies in the wind sector.
02 | Bachmann headquarters in Feldkirch, Austria.
03 | Bachmann automation system for wind turbines.

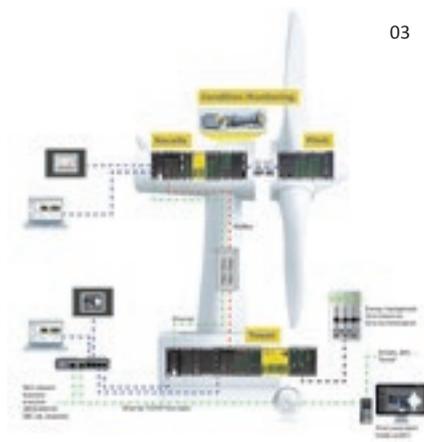


Bachmann speeds up progress throughout the world in automation technology. The Bachmann Group was established in 1970 in Feldkirch, Austria, and employs over 450 people around the world. As a high-tech company our approach to development is systematic and our solutions are fully thought through. This makes us one of the leading automation partners in renewable energies, machine tools and marine sectors, and the number 1 automation specialist for the wind sector.

To date, Bachmann has automated more than 85,000 wind turbines, helping to save over 250 million tonnes of CO₂ each year. Our system solutions are open, safe, flexible and modular. Customers confirm our system availability of over 99.96 per cent. Integrated condition monitoring and wind farm networking are just two product highlights of Bachmann. Our innovative solutions ensure efficient engineering for your wind turbines:

Operational control

- Turbines – Control/simulation
- SCADA wind farm
- Scalable from a single turbine to a wind farm
- Data models in accordance with IEC61400
- Communication based on standards such as OPC-UA



Power quality

- Grid measurement and protection
- Analysis with integrated data recorder
- Static and dynamic grid support
- Grid monitoring in accordance with international grid codes

Wind library/template

- Complete toolbox for turbine development
- Configurable software modules
- Object structure in accordance with IEC61400-25
- Event system and statistical evaluation

Wind farm networking

- Open communication interfaces
- Real-time networking via Ethernet bluecom
- Standards in accordance with IEC61400-25, IEC61850, IEC60870-xx, DNP3 (and more)
- OPC UA to SCADA and operational control

Condition Monitoring Systems (CMS)

- Over 15 years of CMS expertise
- Over 4,500 CMS installed worldwide
- The world's first GL certification of a control-integrated CMS
- Customised retrofit solutions

bachmann.

Bachmann electronic GmbH

Address **Kreuzäckerweg 33
6800 Feldkirch**

Country **Austria**

Phone **+43 (0) 5522 / 3497 - 0**

Fax **+43 (0) 5522 / 3497 - 1102**

E-Mail **info@bachmann.info**

Web **www.bachmann.info**

Profile **Controls, cables & switchgear
cabinets**

Category **Suppliers of electrical &
electronic components**

Turnover **€ 68 million (2015)**

Employees **more than 450**

Founding year **1970**

Bachmann Monitoring GmbH

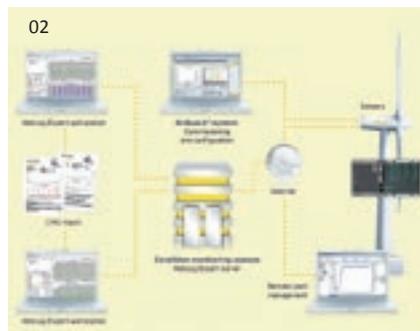
Condition monitoring systems for all manufacturers and types

Bachmann develops, produces and sells measurement systems for the condition-based maintenance of on- and offshore wind turbines. These systems guarantee a high level of availability and a secure investment.



01 | Bachmann Monitoring GmbH's **core expertise** is measuring and analysing vibrations, enabling it to closely monitor onshore and offshore wind turbines. The monitoring specialist – certified by Germanischer Lloyd and based at the technology hub of Jena/Rudolstadt in Germany for over 15 years – has been a subsidiary of Austrian company Bachmann electronic GmbH based in Feldkirch since 2011.

Intelligent solutions – The certified web-based CM teleservice (remote monitoring) is the key to efficiently monitoring decentralised turbines. Early identification and pinpointing of weak points ensures the reliable operation of turbines and increases yields on a sustainable basis. Condition-based maintenance based on structure-borne sound can be complemented by diagnostic functions, such as rotor blade and structural monitoring, as well as the drafting of expert vibration reports for the wind industry.



02 | In addition to condition monitoring solutions (CMS) integrated into control systems, Bachmann also offers standalone CMS. These CM systems also enable reliable monitoring of main bearings, for example.

The “Omega Guard” was additionally certified by Germanischer Lloyd in 2012 as a fully control-integrated CMS – a **world first**. This certification is unique in the market to date. All Bachmann CMS meet international standards such as IEC 61400-25-6. The compatibility of the information models and information exchange is always guaranteed and it is possible to incorporate CMS extensively into existing network structures and control systems.

International – Among approx. 4,500 equipped wind turbines, Bachmann currently monitors 3,500 onshore and offshore turbines in Europe, Asia and the United States. Its portfolio encompasses 23 different wind turbine manufacturers of approx. 54 different types ranging from 600 kW to 8 MW.



03 | Bachmann currently monitors 3,500 onshore and offshore turbines around the world.

02 | The Bachmann online CMS Ω-Guard® offers access to the condition monitoring data of every turbine from any online workplace worldwide.

03 | Top all-round care: Bachmann Condition Monitoring – the healthcare professionals for wind turbines.

bachmann.

Bachmann Monitoring GmbH

Address **Fritz-Bolland-Str. 7**

07407 Rudolstadt

Federal state **Thuringia / Germany**

Phone **+49 (0) 3672 / 3186 - 0**

Fax **+49 (0) 3672 / 3186 - 200**

E-Mail **vertrieb-monitoring@bachmann.info**

Web **www.bachmann.info**

Profile **Service, maintenance & repair**

Category **Operation and service**

Employees **49 (Bachmann electronic GmbH: more than 450)**

Founding year **1998**

Balluff GmbH

Sensor solutions for wind power

Over 20 years' experience in the wind energy sector and continuous innovation are the distinguishing features of sensor manufacturer Balluff.



01 | Balluff company headquarters in Neuhausen a. d. F.

02 | All sensors used are HALT tested and provide optimal and safe control of wind turbines.

03 | The company's specialists have been working with the wind energy sector for more than two decades.

BALLUFF

sensors worldwide

Balluff GmbH

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73765 Neuhausen

Federal state Baden-Württemberg / Germany

Phone +49 (0) 7158 / 173 - 0

Fax +49 (0) 7158 / 5010

E-Mail balluff@balluff.de

Web www.balluff.de

Profile Sensors

Category Suppliers of electrical & electronic components

Turnover € 324 million (2014)

Employees 3,000

Founding year 1921

Offshore wind farms are the current trend. Their high energy yield and high level of acceptance make them a favoured option. But they also have to face extreme requirements in terms of structural robustness of the turbines. The objective of high levels of availability can only be achieved if all components are fail-safe and extremely reliable.

As a long-term partner of the wind energy sector, Balluff and its global workforce of 3,000 are well aware of these challenges. Balluff sensors have been providing optimal and safe control of wind turbines for over two decades. Their exceptional reliability and robustness are the result of optimised development processes with integrated HALT tests (High Accelerated Lifetime Tests).

Identifying damage before a breakdown can occur is a must for costly wind turbines. This is why Industry 4.0/the Internet of Things and Big Data are on the rise in the wind energy sector. Intelligent sensors and PSUs with heartbeat function, which not only record various parameters but also provide information about themselves and their condition, allow the gathering of detailed information on the state of a turbine.

Balluff is the just the place when it comes to future-proofing your equipment. Track and trace procedures, as used in all large-scale automotive plants, are the optimum solution by Balluff.

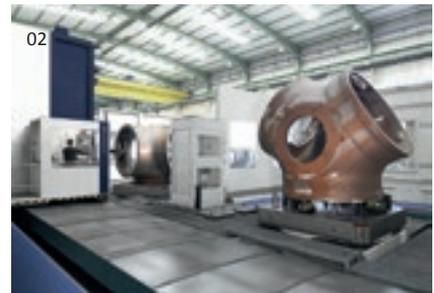
Solutions (selection) for:

- Angle and rotational speed detection
- Pitch adjustment
- Fill level measurement
- Network technology

BIMATEC SORALUCE

Zerspanungstechnologie GmbH

BIMATEC SORALUCE is a medium-sized company and the leader in Germany in the milling, turning and boring machine sector with 25 years' experience and more than 1,500 installed machines.



BIMATEC SORALUCE was established in 1991 in Limburg an der Lahn. Its business is the development, manufacture, service and sale of intelligent, flexible milling and boring centres as well as vertical turning machining centres. Our continued development of products has led to new benchmarks being repeatedly set over the decades. This makes BIMATEC SORALUCE a pioneer in linear guiding and drive system technologies. The medium-sized company guarantees its customers that milling heads can be exchanged within one hour – unique in the market. With its innovative and technologically sophisticated machines, BIMATEC SORALUCE has become a specialist for developing complete solutions in a wide range of industrial sectors – including the wind industry. The travelling column milling machines and vertical turning machine centres used in the wind industry

sector, with their large working capacities, offer optimum capability for the machining of large, heavy, and demanding workpieces.

With its high level of flexibility, short decision-making procedures and a project-structured organisation, BIMATEC SORALUCE offers individual solutions for challenging tasks in the wind power industry.

With a distribution network stretching across Germany, the Netherlands, Austria, Switzerland and Eastern Europe, BIMATEC SORALUCE is the worldwide centre of excellence for the Basque company SORALUCE. SORALUCE is part of DANOBATGROUP, machine-tool division of MONDRAGON Corporation, one of the most important holdings in Europe.

01 | Machining of a generator frame in one set up.
02 | Hub machining on a Soraluze travelling column milling and boring centre in pendulum working mode.



BIMATEC SORALUCE
Zerspanungstechnologie GmbH
Address **Am Steingraben 6**
65549 Limburg
Federal state **Hessen / Germany**
Phone **+49 (0) 6431 / 9782 - 0**
Fax **+49 (0) 6431 / 71102**
E-Mail **info@bimatec.de**
Web **www.bimatec.de**
Profile **Casting & heavy engineering**
Category **Suppliers of large components**
Turnover **€ 52 million**
Employees **82**
Founding year **1991**

Beckhoff Automation GmbH & Co. KG

PC and EtherCAT-based control for wind turbines

The openness of the Beckhoff control architecture fits perfectly with the requirements profile of the wind industry: high performance scalability, maximum design flexibility and high level of integration. A flexible modular system for automating wind turbines is available with Industrial and Embedded PCs, I/O components and TwinCAT software.



01

Consistent system solution from management to wind farm networking

The Beckhoff standard control platform consists of an Embedded PC as a master computer (tower base), EtherCAT as an ultra-fast communications system, daisy-chained Bus or EtherCAT Terminals and TwinCAT automation software.

EtherCAT provides the basis for fast communication with EMC-resistant fibre optic connection in the wind turbine between tower base and nacelle and wind farm networking systems. EtherCAT is characterised by its flexible topology and ease of use. Interfaces for all established fieldbus systems and the wide variety of signals of the Beckhoff I/O system cover all signal types and fieldbuses relevant for windpower. Subordinate fieldbuses like CANopen, PROFIBUS and Ethernet TCP/IP for controlling subsystems can be transferred to the field via fieldbus master terminals.

Software framework TwinCAT 3 Wind combines all basic functions, from management and state machine through event management and database connection to simulation. A readymade application template significantly reduces the development cost and enables modular engineering. Beckhoff is also using the TwinCAT 3 Wind Framework to systematically implement the Industry 4 concept in wind energy: Big Data enables the comprehensive collection, evaluation and provision of data from condition monitoring and power management in real time.

TwinCAT also offers a high degree of flexibility in the selection of its programming language: In addition to object-oriented extensions for IEC 61131-3, C and C++ are also available as programming languages for real-time applications. TwinCAT can also be used for turbine simulation with the integration of MATLAB®/Simulink®.

The Beckhoff solution package for the wind power sector is rounded off with more than fifteen years' experience of application-based know how. Worldwide, there are more than 40,000 wind turbines up to 5 MW in size equipped with PC and EtherCAT-based Beckhoff control technology. Fitting Beckhoff technology to industrial communication standards, like IEC 61400-25, Ethernet TCP/IP or OPC UA, guarantees the user a high level of investment security.

BECKHOFF

Beckhoff Automation GmbH & Co. KG
Lübeck office

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Fax **+49 (0) 451 / 203 988 - 20**

E-Mail **wind@beckhoff.com**

Web **www.beckhoff.com/Wind**

Profile **Controls, cables & control cabinets**

Category **Suppliers of electrical & electronic components**

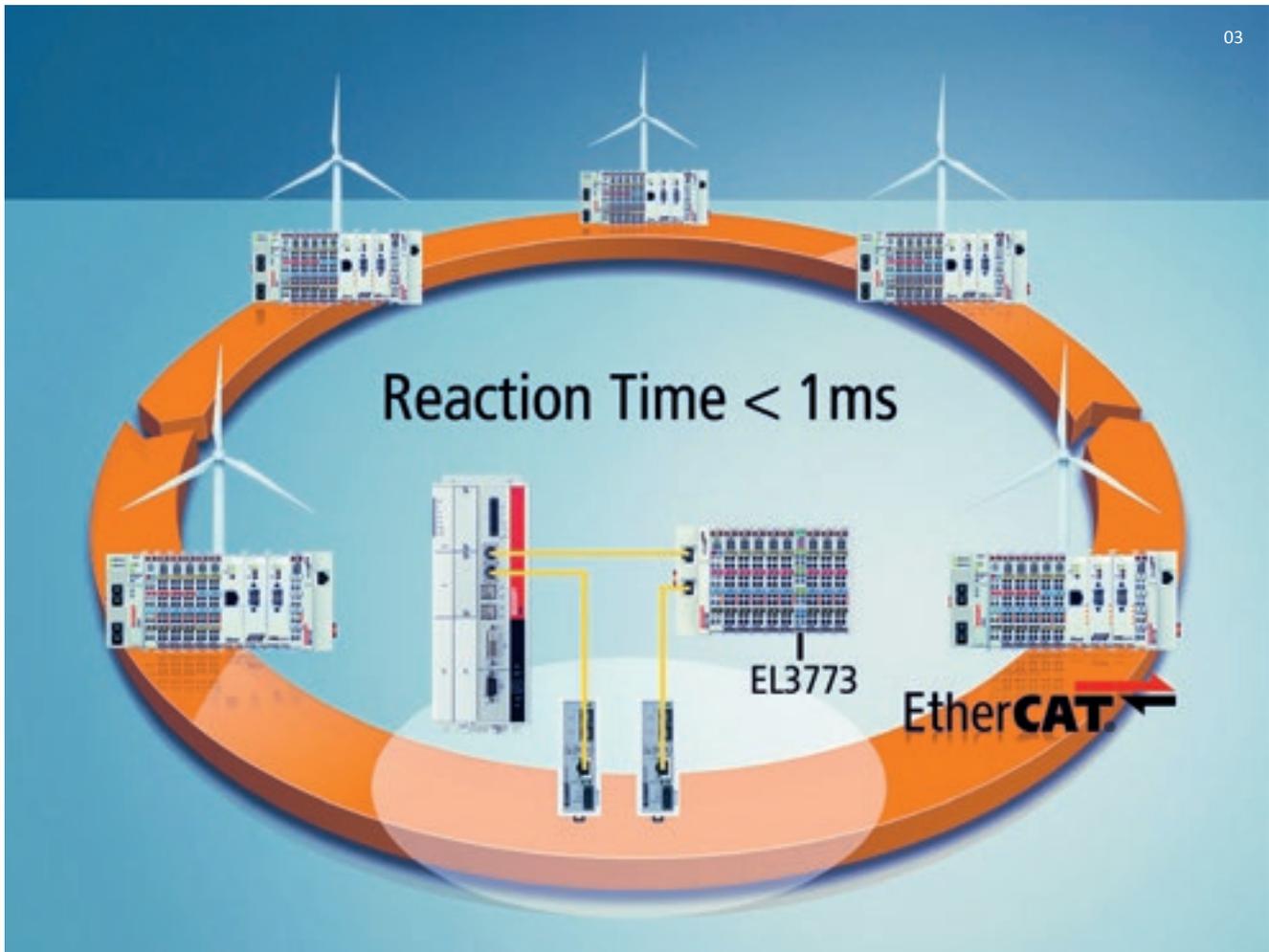
Turnover **€ 510 million (2014)**

Employees **2,900**

Founding year **1980**

02





Control platform integrates safety technology and condition monitoring

The safety functions of a wind turbine are seamlessly integrated into the control application via the Beckhoff TwinSAFE terminals, which are distributed to the various I/O stations in the tower base, nacelle and pitch system. Condition monitoring terminals enable the integration of installation monitoring. Efficient interaction of all system components optimises not only the availability of the individual components, but of the entire installation. At the same time, being able to dispense with special hardware or additional CPUs reduces the cost for basic electrical equipment in the turbine, as well as maintenance costs.

Ultra-fast wind farm networking based on EtherCAT

Wind farm networking with EtherCAT is not only faster compared to conventional IP solutions, but also offers cost benefits because it dispenses with switches and hubs. The EtherCAT EL3773 power measurement terminal, which is integrated into the automation system, enables momentary values of power and voltage to be recorded with up to 10,000 samples. The measurement values for all turbines and the measurement at the feed point of a farm can be synchronised to a timeframe smaller than 1 μ s with EtherCAT distributed clocks functionality. Existing Ethernet infrastructure (OFC technology) can be used without losses in speed across distances up to 20 km.

01 | 1 EtherCAT provides the basis for ultra-fast communication and wind farm networking.

02 | Interfaces for all established fieldbus systems and the wide variety of signals of the Beckhoff I/O systems cover all relevant signal types and fieldbuses for windpower.

03 | The EtherCAT EL3773 power measurement terminal, which is integrated into the automation system, enables momentary values of power and voltage to be recorded with up to 10,000 samples.



Clariant International Ltd.

Clariant is one of the world's leading companies in speciality chemicals. The company was founded in 1995 as a spin-off from chemicals company Sandoz, which was founded in Basel in 1886.



01

To test the compatibility of materials and components used in wind turbines with Antifrogen, Clariant is prepared to conduct trials in application technology laboratories. Certain installation conditions (e.g. pressure, temperature, concentration, etc.) can also be simulated to ensure the suitability of the Antifrogen heat transfer fluid and coolant.

Clariant also offers the service to test Antifrogen products on turbines (see also <http://www.antifrogen.com/>).

- 01 | Antifrogen – A brand you can rely on.
 02 | Static corrosion test acc. ASTM D1384.
 03 | Dynamic corrossions test acc. MTU/FVV.

CLARIANT

Clariant Produkte
(Deutschland) GmbH

Address **Industrieparkstr. 1
84508 Burgkirchen**

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Phone **+49 (0) 8679 / 746 65**

Fax **+49 (0) 8679 / 750 85**

E-Mail **johannes.harder@clariant.com**

Web **www.antifrogen.com**

Profile **Cooling & climatisation**

Category **Suppliers of electrical &
electronic components**

Turnover **6.12 billion Swiss Francs**

Employees **approx. 17,003 (as of 31/12/2014)**

Founding year **1995**

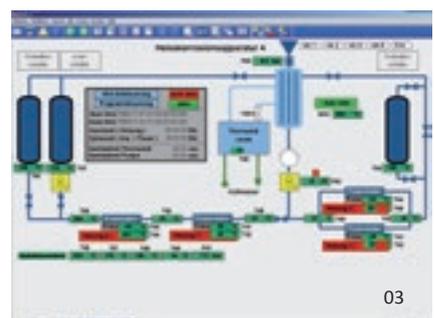
For over 50 years, the company has manufactured heat transfer fluids and coolants for diverse areas of application under the brand name Antifrogen and has a services portfolio with an excellent reputation.

The range of products is constantly being improved in terms of compatibility with materials, protection against corrosion and ecotoxicological properties.

Due to their long-lasting protection against corrosion, Antifrogen products are increasingly used in wind turbines for cooling parts such as gearboxes, generators, transformers and, in particular, frequency converters.



02



03

Columbus McKinnon Engineered Products GmbH

Columbus McKinnon Engineering Products is one of the leading component and system solution providers for mechanical drive and lifting technology with its brand Pfaff-silberblau.

Offering great performance, maximum safety and minimum maintenance, Pfaff-silberblau mechanically driven products are characterised by their special construction and high-quality materials, and are also suitable for use in demanding applications with high winds, spray and salt water.

OMEGA Offshore wire rope winch

The OMEGA Offshore manual wire rope winch from Pfaff-silberblau is used on ships, in ports and for wind turbines, among other things. Depending on the application, it can be driven by muscle-power or by a motor and is used to lift and move heavy loads of up to 800 kg. With its variable drum length and diameter, the OMEGA is suitable for any application.

Robust, corrosion-resistant screw jacks

The SHE screw jack from Pfaff-silberblau has been tried and tested over decades and is employed in many drive solutions in ports or on offshore platforms. The screw jack is available in 14 different sizes with lifting capacities of up to 2,000 kN. Its self-locking trapezoidal screw makes it not only extremely powerful and robust, but above all safe. The SHE series comprises a variety of different designs, including a "rust-proof" version with easy-to-clean, corrosion-free components.



01

HSE – powerful and safe

If greater lifting speeds and longer operating hours are required, the HSE series of high-performance screw jacks are the right choice. Eight different sizes are available with lifting capacities of up to 1,000 kN. Every HSE has a self-locking wired trapezoidal screw and a special housing for good heat dissipation – because things sometimes get hot even in the onshore and offshore sector.

01 | Milling of housing.

02 | OMEGA Offshore wire rope winch.

03 | Rustproof SSP screw jack series.



02



03



Columbus McKinnon
Engineered Products GmbH

Address **Am Silberpark 2-8**
86438 Kissing

Federal state **Bavaria / Germany**

Phone **+49 (0) 8233 / 2121 - 0**

Fax **+49 (0) 8233 / 2121 - 805**

E-Mail **info.kissing@cmco.eu**

Web **www.pfaff-silberblau.com**

Profile **Gears**

Category **Suppliers of mechanical
components**

Founding year **1867**

DAFA A/S

75 years experience in the development, production and sale of foam, rubber and plastic products. DAFA WIND solutions are developed using our experience within every field of business to your advantage in wind power.



to withstand stress, to perform better and thus to last longer. Optimise your products using our solutions within sealing, mounting and acoustics.

Rotor blades

Our foam and rubber solutions help from the very beginning; enhancing the blade design so it lasts longer and assuring safe transportation from the factory to the construction site. DAFA solutions are on hand for de-icing and maintenance tasks as well.

Tower

Our tower solutions ensure the safety of both people and materials and make maintenance easier. Use customised solutions to maximise service life.

DAFA RotaSeal™

Your best choice in protecting rotating components in the turbine against penetration of salt, sand, water or dust. Use DAFA RotaSeal™ to meet demanding requirements for the hub or tower.

DAFA Tower Foundation System™

Formwork elements matching requirements guarantee low tolerances and safe processes on the construction site. By using the DAFA Tower Foundation System you achieve a noticeable increase in the efficiency of the formwork.

For more information, visit our website at www.dafa-germany.de and arrange an appointment.

Foam, rubber and plastic solutions – seal, absorb and protect

DAFA A/S is a Danish family company with more than 75 years of experience in the development, production and sale of special foam, rubber and plastic solutions. Over 150 employees around the globe work for us in the fields of consultancy, development, customer service, production and logistics.

DAFA WIND

Our objective is to combine innovative sector-specific solutions.

DAFA WIND includes products that have been developed using our experience from every field of business for your advantage in wind power.

Nacelle

DAFA's nacelle solutions help structures and electronic components in the nacelle



DAFA Vertriebsbüro Deutschland

Address **Westfälische Str. 88
57462 Olpe**

Federal state **North Rhine-Westphalia / Germany**

Phone **+49 (0) 2761 / 94295 - 0**

Fax **+49 (0) 2761 / 94295 - 22**

E-Mail **info@dafa-germany.de**

Web **www.dafa-germany.de**

Profile **Seals & vibration control**

Category **Suppliers of mechanical components**

Turnover **€ 40 million**

Employees **150 worldwide**

Founding year **1939**

DEUBLIN GmbH

The power to your hydraulic pitch system

DEUBLIN rotating unions allow reliable fluid flow between stationary and rotating systems. Approved technology combined with global availability makes it a preferred component for many leading wind turbine manufacturers.

For more than 60 years **DEUBLIN** have been internationally renowned for supplying high quality rotating unions worldwide. Manufacturing sites are located on three continents, North America, Europe and Asia where 600 employees are dedicated to satisfying customer demands with fully developed and customized solutions. Highly qualified engineers located in 17 subsidiaries and 50 distributors facilitate projects worldwide from enquiry through to delivery. Superb products, high quality standards and the worldwide organisation enable DEUBLIN to be a preferred first tier supplier to the wind industry.

The Rotating Union is a precision mechanical component which allows the transfer of pressurized fluids from stationary systems to rotating machinery. Rotating unions must be designed considering a wide range of media, viscosities, temperatures and pressure ranges as well as velocities.

To DEUBLIN, **being a partner in the wind industry** means utilizing only specialized solutions that can meet highest expectations in terms of reliability and longevity.



01

The rotating union is a critical component in the wind turbine hydraulic pitch control system.

Quality environmental standards according to ISO 9001 and ISO EN 14001 are a cornerstone of our corporate culture. Deublin is an Authorized Economic Operator (AEO) offering lean logistic operation and simplified customs clearance.

01 | DEUBLIN high precision rotating union dedicated to wind power installations.

02 | DEUBLIN Germany, new location in Mainz Hechtsheim from summer 2016.



02

DEUBLIN GmbH
NEW address from summer 2016!

Address **Florenzallee 1**
55129 Mainz

Federal state **Rhineland-Palatinate / Germany**

Phone **+49 (0) 6122 / 8002 - 0**

E-Mail **aschubert@deublin.de**

Web **www.deublin.de**

Profile **Hydraulic components**

Category **Suppliers of mechanical components**

Founding year **1969**

Demag – A Terex Brand

Cranes and hoists

Cranes and hoist systems for the manufacture of wind turbines.
Solutions for service work on onshore and offshore installations.
Drive solutions for in-house material flow.



01

Terex Material Handling is one of the world's leading suppliers of crane technology with Demag industrial cranes & components. The core competence of Terex lies in the development, design and production of technically sophisticated cranes, hoists, components and the provision of services for these products.

As a partner to the wind turbine industry, Terex supplies lifting & transport solutions with Demag brand products for the manufacture and maintenance of wind turbine systems and their components. Leading manufacturers in the wind turbine sector rely on Demag cranes and hoists. From equipment for individual workplaces to complete in-house material flow systems, Demag cranes help to ensure that customers' production processes run smoothly.

Efficient and convenient service is also required for the maintenance of wind turbine installations. The DC-Wind chain hoist is a solution that is designed precisely to meet the needs of the wind turbine sector. It accelerates the supply of spare parts and is consequently a decisive factor to ensure that maintenance times are kept to a minimum. Featuring a maximum hook path of 180 m, the chain hoist can quickly lift spare parts, equipment and tools weighing up to 1,500 kg into the nacelles of wind turbines.

The Demag DS10 rope winch ensures that loads are transported quickly and efficiently to the nacelle. Besides its space-saving design, it offers further benefits with considerably higher lifting speeds:

loads weighing up to 1,000 kg can be lifted at a speed of 24 m/min. The Demag KBK crane construction kit is also employed in larger wind turbines to provide solutions tailored to meet specific application requirements for the simple movement of loads with a high level of precision.

01 | Demag process crane in a wind turbine production area.

02 | Rapid transport of loads to the nacelle using the Demag DC-Wind chain hoist.

03 | The complete solution for handling loads in the nacelle: KBK light crane system with Demag DS10 rope winch.



02



03

DEMAG
A TEREX BRAND

Terex MHPS GmbH
Terex Material Handling

Address Ruhrstr. 28

58300 Wetter / Ruhr

Federal state North Rhine-Westphalia / Germany

Phone +49 (0) 2335 / 92 - 0

Fax +49 (0) 2335 / 92 - 2406

E-Mail handling@demagcranes.com

Web www.demagcranes.com

Profile Hoist and crane systems

Category Transport & logistics

Founding year 1819

DHHI Germany GmbH

We think in gears

Gearboxes and components for wind turbines - engineered in Germany and manufactured in China. DHHI is well known worldwide for high quality in gearboxes, heavy machinery, and plant construction.



01



02

DHHI Germany GmbH is the German subsidiary of Dalian Huarui Heavy Industry Group Co., Ltd. (DHHI), a long standing large-scale enterprise based in China.

With its headquarters situated in Dalian on the east coast of China the DHHI Group has a nearly 100-year old corporate history. In five nearby production locations, covering a total area of around two million square metres, an annual turnover of approximately 2 billions of USD has been generated so far.

DHHI's traditional product fields cover machinery for metallurgy and bulk materials handling, as well as cranes and port machinery of various kinds.

Key areas of growth are highly advanced castings and forgings, and gearboxes for several high-quality application fields. The main aim of development is the field of core components for multi-megawatt wind turbines. DHHI Group is one of the world's

largest suppliers of components within the wind power industry.

DHHI Germany GmbH is developing and distributing gearboxes and components for wind energy turbines, as well as industrial and mobile units, which are manufactured by DHHI Group.

More information on DHHI Group can be found at www.dhhi.de.



03

01 | Gearboxes developed in Germany, manufactured in China.

02 | The 6 MW gearbox of DHHI is GL-approved.

03 | Core components for wind turbines from DHHI.



DHHI Germany GmbH

Address **Hauptbahnhofstr. 2
97424 Schweinfurt**

Federal state **Bavaria / Germany**

Phone **+49 (0) 9721 / 473 95 - 0**

Fax **+49 (0) 9721 / 473 95 - 50**

E-Mail **info@dhhi.de**

Web **www.dhhi.de**

Profile **Gears**

Category **Suppliers of mechanical components**

Turnover **US\$ 2 billion per year**

Employees **6,500 permanent**

(1,500 in the field of wind energy)

Founding year **1914**

DICHTOMATIK GmbH

Any seal. Any time.

DICHTOMATIK is a specialist and adviser for the full range of seals for wind turbines (on and offshore) from the simple O ring to highly complex sealing systems.



01



01 | DICHTOMATIK offers special seal systems for wind turbines.



Dichtomatik Vertriebsgesellschaft
für Technische Dichtungen mbH

Address **Albert-Schweitzer-Ring 1**
22045 Hamburg

Federal state **Hamburg / Germany**

Phone **+49 (0) 40 / 669 89 - 205**

E-Mail **mail@dichtomatik.de**

Web **www.dichtomatik.de**

Profile **Seals & vibration control**

Category **Suppliers of mechanical components**

Turnover **€ 105 million**

Employees **500**

Founding year **1976**

DICHTOMATIK means more than 35 years' experience and expertise in sealing

We see our main task as promptly providing our customers with the best seal for the job. **DICHTOMATIK** has the largest stock of seals in Europe stored across more than 6,500 m² in Hamburg. Our logistical services include: EDI, kanban, KLT, VDA labelling, VMI and our online shop. We continually optimise and technologically extend our range of products. **DICHTOMATIK** has been part of the **FREUDENBERG** Group since 2004.

DICHTOMATIK has been devising and implementing solutions for wind turbine manufacturers and their suppliers for decades. Our expertise makes us an experienced partner offering you advice on:

- Selection of seal and material
- Development of special seals (precision-fit solutions)
- Sealing technology solutions
- Calculating, designing and optimising installation spaces and seal geometries, including installation suggestions
- Prototypes

DICHTOMATIK WORLDWIDE

DICHTOMATIK has set up an extensive global network of subsidiaries to ensure prompt delivery to all parts of the world.

There are currently eight locations in Europe:

Germany, UK, Sweden, Netherlands, France, Austria, Hungary and Italy. There are also sites in Canada, USA, Mexico, Brazil and China.

This keeps us close at hand for all our customers. Our local storage concept is geared to the needs of the local market and ensures the fastest possible delivery.

We offer our customers the very best in terms of speed, flexibility and support with technical applications.

DICHTOMATIK – Any Seal. Any Time.

Eickhoff Antriebstechnik GmbH

Flexibility in development and production of main gearboxes for wind turbines

The Eickhoff Group looks back on 150 years of company history by now.

The family business developed from a foundry to a global technology specialist.

Since the boom in wind power at the start of the 90s, Eickhoff Antriebstechnik GmbH has grown continually with the wind industry and has a great deal of technical expertise and industry experience. In close partnership with its customers, it continues to design and manufacture highly reliable and efficient gearboxes at its main production plant in Bochum. Gearbox solutions for individual customer turbine models have been in series production at its production site in Klipphausen near Dresden since 2009.

The ongoing trend for larger rotor blades means a continuous increase in torques for the gearboxes. Eickhoff offers its customers the shortest development times for new gearboxes, enabling fast market access for wind turbines with new rotor diameters. At the same time, the German



production sites respond flexibly to changing delivery requirements and are thus able to run projects for turbine manufacturers particularly efficiently.

In order to meet the customer's quality requirements as well, all the relevant parameters of the gearboxes are tested on our own test benches and documented with the Eickhoff quality seal. All prototype gearboxes are also tested under extreme conditions (maximum overloads) and subjected to temperatures of -40°C if cold weather suitability is needed.

The product portfolio also includes individually tailored service and maintenance concepts. These include services like repairs (our own and third-party gearboxes), maintenance, replacement gearboxes, spare parts and the gearbox diagnostics system E-GOMS, which was certified in 2004. In this way, we enable our customers to reduce their operating costs and response times and hence to optimise the availability of their turbines.

01 | Eickhoff Wind Power GmbH in Klipphausen.

02 | Eickhoff service fleet.

03 | EICOGEAR wind turbine gearboxes.



Eickhoff Antriebstechnik GmbH

Address **Am Eickhoffpark 1**
44789 Bochum

Federal state **North Rhine-Westphalia / Germany**

Phone **+49 (0) 234 / 975 - 0**

Fax **+49 (0) 234 / 975 - 2579**

E-Mail **getriebe@eickhoff-bochum.de**

Web **www.eickhoff-bochum.de**

Profile **Gearboxes**

Category **Suppliers of mechanical components**

Employees **1,800 (Group)**

Founding year **1864**

ELMEKO GmbH + Co. KG

Electromechanical components for the wind industry

ELMEKO develops and delivers tailored solutions “made in Germany” for switchgear cabinet air-conditioning, dehumidifying, heating and lighting applications and accessories – also for wind turbines.



01

01 | Production in Germany, centrally located in the industrial area at Siegerland airport.

02 | ELMEKO cooling units work maintenance-free and can be installed in any position.

03 | Switchgear cabinet heaters – made in Germany –, also available with special mounting plates for wind turbines. (Photos: ELMEKO)

A proficient partner for industry with decades of experience, ELMEKO manufactures and distributes innovative premium components “made in Germany” for switchgear cabinet air-conditioning, lighting and accessories. Thanks to the close integration of engineering, manufacturing and marketing at our German plant, customised solutions can also be realised swiftly alongside the standard range.

Innovation, product quality and delivery dependability also make ELMEKO a convincing partner for the wind industry. Because our compact air-conditioners and dehumidifiers are based on Peltier technology, our heaters on PTC semiconductor technology and our lighting on LED technology, they can be installed in any position, even in the rotor hub of a modern wind turbine. With a long life and high vibration resistance, they are not only energy-efficient in operation but also maintenance-free because they incorporate no moving or sensitive parts.



02



03

ELMEKO components are used in towers, nacelles and hubs. Their deployment in electrical/electronic enclosures ensures reliable plant operation and high technical availability, even in the hot and cold conditions, high atmospheric humidity and widely fluctuating temperatures found in the world's different climate zones.

ELMEKO dehumidifiers, in particular, are predestined for use in wind turbines because they reliably remove the damaging condensate that can collect at night or in a deactivated turbine – even from rotating rotor hubs.

Thanks to ELMEKO flexibility, the company also realises application-specific solutions on economical terms.



ELMEKO GmbH + Co. KG

Address **Graf-Zeppelin-Str. 5
56479 Liebenscheid**

Federal state **Rhineland-Palatinate / Germany**

Phone **+49 (0) 2736 / 50 97 48 - 0**

Fax **+49 (0) 2736 / 50 97 48 - 30**

E-Mail **info@elmeko.de**

Web **www.elmeko.de**

Profile **Cooling & climatisation**

Category **Suppliers of electrical &
electronic components**

Founding year **2004**

EMS Elektro Metall Schwanenmühle GmbH

Engineering - Manufacturing - Service

As a competent partner to various wind turbine manufacturers and suppliers, EMS has developed and produced specially customised solutions for connecting electronic components for over 15 years.



Courtesy of Vestas Wind Systems A/S.

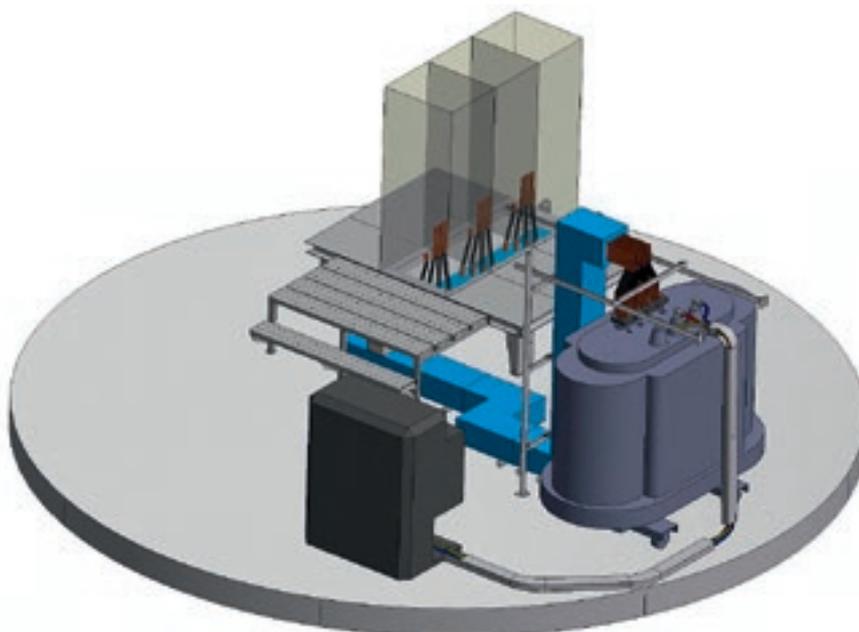
EMS is an established, medium-size company in the metal-working industry with its headquarters in Westpfalz, Germany. Around the world, global players in the electrical and chemical industry, renewable

energies, mechanical engineering and many others value the extensive technical know-how, engineering expertise and experience, unique production competence and the quality mark "Made in Germany". EMS' range covers pressure-welded flexibles, flat and round wire connectors, busbars and purpose-built items, such as for transformers, generators, switching systems, converters, electrolysis systems or the glass industry. Our wide range of components and ready-to-install systems/assemblies covers almost every electro-technical area.

EMS solutions are used in **wind turbines** in order to transfer the energy created in the generator to converters, switching systems and control units. Components/assemblies from the EMS range can also be found inside switching systems. The majority of components are optimised for special use

and developed in collaboration with the customer. In other words, EMS does not just produce items as per specifications, but is also a competent partner in the development process from the very start. A team made up of specialist technicians and engineers carries out calculations, produces dimensional drawings and 3D models with the help of simulation programs, carries out electrical and mechanical tests in its own test laboratory and supports you with choosing the right material (aluminium, copper or coppal – an aluminium-copper composite).

We provide solutions to problems. From the first idea through to assembly and after-sales service: at EMS you'll get everything under one roof!



EMS Elektro Metall
Schwanenmühle GmbH

Address Business Park Schwanenmühle
66851 Schwanenmühle

Federal state Rhineland-Palatinate / Germany

Phone +49 (0) 6307 / 9116 - 0

Fax +49 (0) 6307 / 9116 - 91

E-Mail info@ems-power.com

Web www.ems-power.com

Profile Energy and data transmission

Category Suppliers of electrical and
electronic components

Employees 200

Founding year 2000

GEDORE Werkzeugfabrik GmbH & Co. KG

As a worldwide leading premium brand, we manufacture high-quality hand tools and specialty tools for safe and productive work – even under severe conditions.



01 | High-torque cordless screwdrivers for between 90 and 6,000 Nm.

02 | 3-in-1 power wrench bits with impact fix retention.

03 | GEDORE DREMOMETER EK torque wrench.

GEDORE
TOOLS FOR LIFE

GEDORE Werkzeugfabrik
GmbH & Co. KG

Address **Remscheider Str. 149**
42899 Remscheid

Federal state **North Rhine-Westphalia / Germany**

Phone **+49 (0) 2191 / 596 - 900**

E-Mail **info@gedore.com**

Web **www.gedore.com**

Profile **Tools & machine tools**

Category **Suppliers of mechanical components**

Turnover **€ 220 million**

Employees **2,400**

Founding year **1919**

01 Wind turbines have to withstand immense forces, whilst at the same time running efficiently and safely and ensuring a long service life. This means that a great deal of accuracy and diligence is essential during installation and maintenance. Above all, screw connections must be reliable and durable, which requires particularly sturdy and precise tools. As a proven and tested torque specialist, we offer first-class torque wrenches and equipment for this purpose which guarantee that screws are tightened safely and in a controlled way: for example the GEDORE high-torque cordless screwdriver for a power range from 90 to 6,000 Nm, as well as our GEDORE DREMOMETER torque wrench, the tripping accuracy of which even exceeds the specifications of the DIN/ISO norm.

Smart solutions mean increased safety

Our product range also offers a variety of extremely safe and easy-to-use tools that facilitate working at great heights or in smaller spaces. When erecting wind turbines, technicians often have to use torque wrenches, power wrench bits and torque multipliers at the same time – which means handling three tools using only two hands. We have developed a smart solution to overcome this challenge whilst reducing the risk of injury from falling parts: Thanks to their integrated pin and spring retention including a ring, our 3-in-1 power wrench bits with impact fix guarantee a secure connection. The pins are automatically pressed into the drill holes in the square drive when the ring is being secured, preventing them from getting lost. The ring can also be easily shifted using the double ring nut on the bit. And that is just one example of how our tools make working on wind power stations easier, safer and more productive. True to our motto: Tools for life.



03



HELUKABEL GmbH

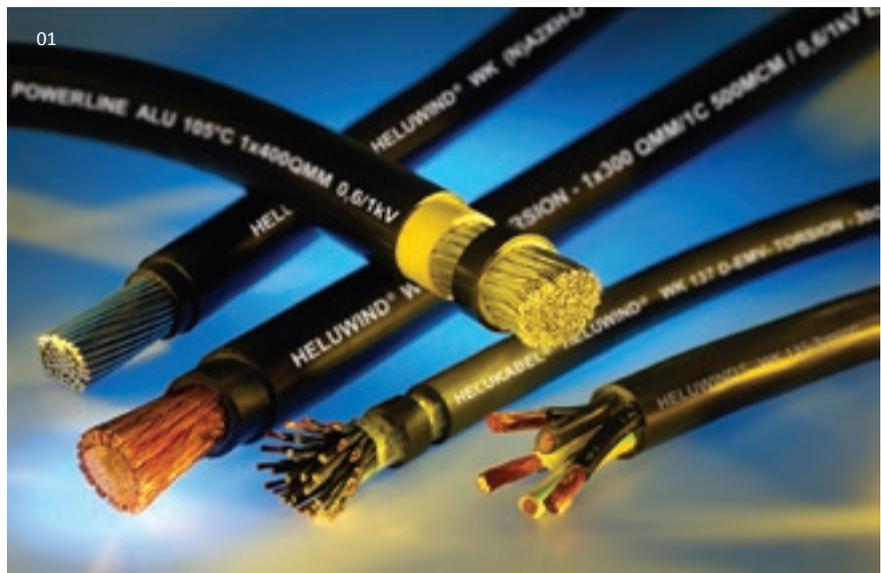
The professional cable solution for the wind energy sector.

HELUKABEL® GmbH is one of the leading international suppliers and manufacturers of all types of cables, wires and accessories. We provide optimized and individual solutions for every application within a wind farm. Our full range ensures we can provide all necessary cables, torsion cables, data and network technology and accessories.

We will advise you on:

- **Nacelle:** Increased oil- and heat-resistant, special solutions for sling ring
- **Loop:** All torsion cables tested for 18,000 cycles in our HELUKABEL 20 ft test tower
- **Tower:** Copper and aluminium cables, multi-wired and fine wired, special lift cables, fibre optic cables and fastening systems

Great performance under all climate conditions: -55 °C - +145 °C for CCV and offshore applications, internationally approved according to UL, CSA, FT4, CE, VDE and WTTTC. Our high-end model in the area of wind power is the WK 137-Torsion FT4 cable, which satisfies all the requirements of wind turbine manufacturers: from the increased rated voltage of 1.000 V – with UL/CSA approval over a large temperature



range and without the use of halogen – to the demanding FT4 flame test of the CSA (Canadian Standard Association).

Moreover, the cable is also extremely resistant to abrasion, is ideal for offshore wind facilities and has been tested for its resistance to the aggressive oils used in wind turbines. With its WK POWERLINE ALU cable, HELUKABEL® is continually increasing its lead as a supplier of innovative products for the wind power industry. Thanks to its low weight and highly flexible design, an important gap in power cabling with aluminium conductors is closed. There is a great interest in the flexible aluminium cable of the POWERLINE series. As a result, the spectrum was further expanded. We are offering a complete solution from 0,6 to 30 kV and from 2,5 to 400 mm². The specially developed connection equipment completes the product range.

01 | HELUKABEL WK series.



HELUKABEL GmbH

Address Dieselstr. 8 – 12

71282 Hemmingen

Federal state Baden-Württemberg / Germany

Phone +49 (0) 7150 / 9209 - 0

Fax +49 (0) 7150 / 817 86

E-Mail info@helukabel.de

Web www.helukabel.de

Profile Controls, cables &

switchgear cabinets

Category Suppliers of electrical &

electronic components

Turnover € 442 million (2014)

Employees 1,000

Founding year 1978

Hailo Wind Systems GmbH & Co. KG

Ladders, service lifts and fall arrest systems from one source including installation, maintenance, GWO certified safety trainings, premium after sales service and much more.



Hailo Wind Systems – High Level Access Solutions

For nearly 70 years Hailo has been a competent partner and specialist in access engineering. Hailo and Hailo Wind Systems have repeatedly set industry standards, whether as inventors of aluminum ladders for household use or in professional access and lift technology – not only for wind industry professionals.

Hailo Wind Systems now also leads the way in terms of access equipment for wind turbines as an independent company. From our initial focus on aluminum ladders the product portfolio now encompasses everything from service lifts, ladders, climbing support, fall-arrest systems and many services like installations, maintenance or GWO certified trainings by our

Safety And Rescue Academy to all other necessary equipment for professional access solutions.

The dynamic growth of the wind energy market and our excellent know-how in access engineering have led a perfect symbiosis with wind turbine manufacturers all over the world, who can concentrate on business while we develop tailor-made access concepts. Our production plants are located in booming markets across the world such as China, Brazil and the USA as well as Germany. This enables us to accompany you on your route to internationalization and to contribute to your success.

01 | Service lifts, ladder, fall arrest systems and equipment by Hailo Wind Systems.



**Hailo Wind Systems
GmbH & Co. KG**

Address **Daimlerstr. 2
35708 Haiger**

Federal state **Hesse / Germany**

Phone **+49 (0) 2773 / 82 14 44**

Fax **+49 (0) 2773 / 82 15 61**

E-Mail **info@hailo-windsystems.com**

Web **www.hailo-windsystems.com**

Profile **Access technology**

Category **Suppliers of mechanical
components**

Turnover **€ 30 million**

Employees **130**

Founding year **1947 (Hailo Wind Systems 2013)**

High Level Access Solutions

01



HANSA-FLEX AG

HANSA-FLEX is Europe's leading company for all areas of hydraulics. The key factor in this success is system partnership. It is the breadth and depth of products and services available that make HANSA-FLEX a valued partner in the wind industry sector.



01

01 | Expert advice and the provision of filter systems and oil maintenance ensure smooth operation of our customers' machines.

02 | HANSA-FLEX supports its customers from the development of the prototypes to their series production with ready-to-assemble kits.

03 | The area-wide and rapid response FLEXXPRESS hydraulic service looks after all repairs – day and night. X-CODE has revolutionised the provision of spare parts – downtimes are therefore reduced to a minimum.

HANSA FLEX

HANSA-FLEX AG

Address **Zum Panrepel 44**
28307 Bremen

Federal state **Bremen / Germany**

Phone **+49 (0) 421 / 48 90 70**

Fax **+49 (0) 421 / 48 90 78 08**

E-Mail **info@hansa-flex.com**

Web **www.hansa-flex.com**

Profile **Hydraulic components**

Category **Suppliers of mechanical components**

Turnover **€ 359 million**

Employees **3,300**

Founding year **1962**

50 years of key technology in hydraulics

What began in 1962 with a lot of entrepreneurial spirit and a green workbench in the garage of company founder Joachim Armerding is today the largest and most effective range of fastening elements and services for fluid technology in Europe. Leading global players from all sectors benefit from the international network of system partnership with HANSA-FLEX.

Industry experience in wind energy

For many years HANSA-FLEX has been valued by companies in the wind industry as a professional partner for all issues around the key technology of hydraulics. Diverse orders and individually-designed solutions enabled us to acquire comprehensive, industry-specific specialist knowledge. Our customers can build on these specialist skills as well as punctual delivery and the fast Fluid Service.

We are a one-stop shop for all solutions, including the designing, manufacturing, assembly and commissioning of annular piping for lubricating the rotating assembly of wind turbines. HANSA-FLEX has many years' experience with renowned manufacturers in the field of hydraulic piping technology for braking systems (rotor and yaw brakes). This is particularly the case for the important area of cooling circuits, in which HANSA-FLEX established itself as one of the leading suppliers several years ago. HANSA-FLEX is also a sought-after partner for the hydraulic design of high-quality plants such as laminating units for ever larger rotor blades. With seawater-resistant offshore industrial hoses for

maritime applications, we are also optimally equipped for the offshore wind farms of the future.

Individual solutions

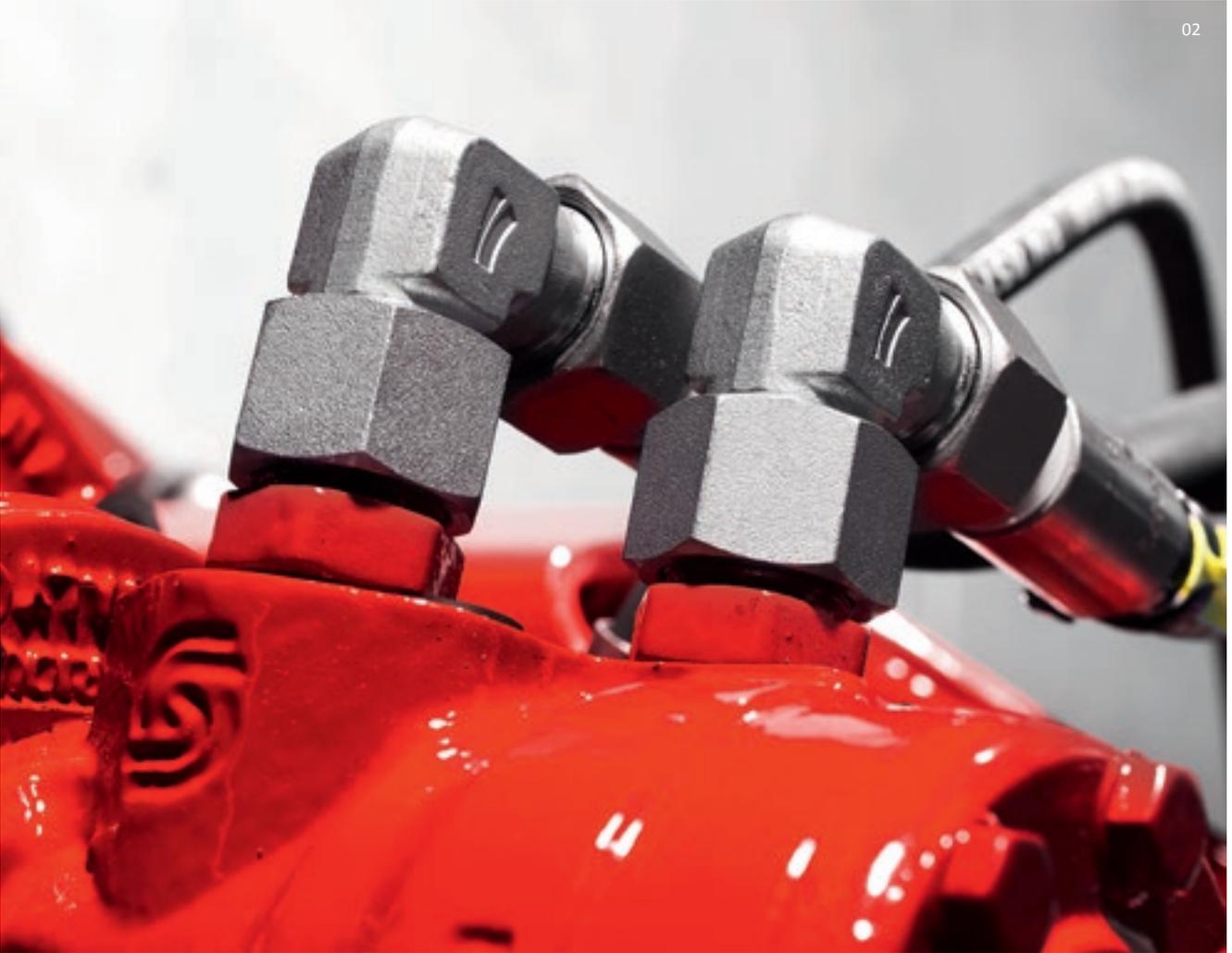
We accompany our customers from the development of the prototype to series production when producing customised hose assemblies and hydraulic components. As a result of the constant documentation of all steps, ready-for-assembly kits of all fastening elements, hose and air-conditioning piping and connections or whole assemblies can be supplied at short notice for series production. Our nationwide network of branches guarantees that customers are never far from direct, personal contact with skilled partners, available at any time.

Certified quality

All processes are evaluated by quality management pursuant to DIN EN ISO 9000:2000, thereby ensuring permanently reliable quality. As a partner of renowned classification and assurance companies, HANSA-FLEX is prepared to also comply with special specifications.

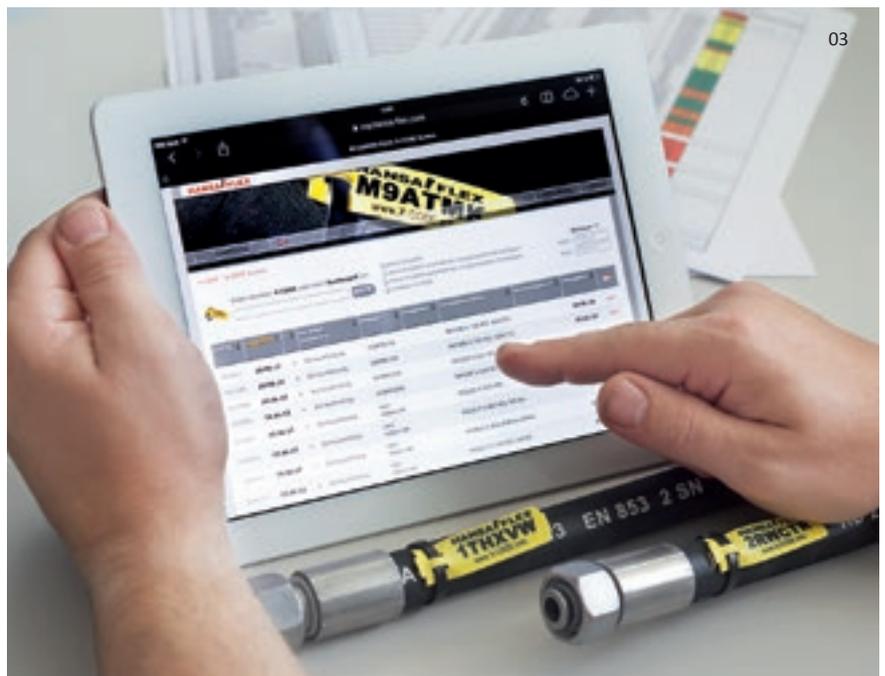
Spare parts service and repairs without delay

Even when a spare part is required at short notice, our spare parts service helps quickly and without bureaucratic delays. Whether you need a fastening element for hydraulics, seals, cooling and air-conditioning piping or components, with more than 70,000 items HANSA-FLEX has a comprehensive, complete range. All products are guaranteed to meet quality standards and are on-site as a rule within 24 hours.



With X-CODE, HANSA-FLEX has developed an identification system which revolutionised the spare parts service. When the alphanumeric X-CODE is provided, the identical hose assembly is immediately manufactured and shipped off. Providing the reference number associated to the wind turbine can prevent unnecessary transport. All changes are taken into account for the future delivery of spare parts.

What is more, HANSA-FLEX assembly teams and the mobile rapid hydraulic service (FLEXXPRESS) is always ready to carry out any work or repairs directly on-site with fully equipped mobile workshops. Unplanned stoppages are reduced to a minimum and the unlimited power generation of the wind turbine is guaranteed.



Jacob GmbH

Quality connects

JACOB is the specialist for cable entry systems and level measurement technology.



01 | JACOB cable glands and cable entry systems are well established in the energy supply industry. They are standard equipment in the energy sector.

Jacob

Jacob GmbH
Elektrotechnische Fabrik

Address **Gottlieb-Daimler-Str. 11**
71394 Kernen

Federal state **Baden-Württemberg / Germany**

Phone **+49 (0) 7151 / 40 11 - 0**

Fax **+49 (0) 7151 / 40 11 - 49**

E-Mail **jacob@jacob-gmbh.de**

Web **www.jacob-gmbh.de**

Profile **Controls, cables &**
switchgear cabinets

Category **Suppliers of electrical &**
electronic components

Turnover **approx. € 30 million**

Employees **200**

Founding year **1922**

JACOB cable glands are used in many areas of energy supply. They fulfill topmost requirements relating to explosion protection, mechanical strength and resistance to weathering, temperature, UV and ozone.

The JACOB brand represents the highest level of safety, reliability and precision. The company develops and produces cable glands made from metal and plastic, as well as level measurement technology for a wide range of application areas. In the wind energy sector our float switches take care of operational safety in transmission monitoring.

Jacob manufactures in Germany and sells its products world-wide. With representations in 55 countries, we are always close to our customers. Our state of the art storage management system ensures high availability of our products.



One of our innovative solutions is the KADP cable entry plate

The tool free connection technology enables the cabling of machines, plants and control cabinets to be performed up to 10 times faster. Cables, lines, hoses, pneumatic and hydraulic lines can be inserted.

Our products also set standards in the explosion protection sector. We offer a comprehensive range for maximum safety in areas at risk of explosion, with ATEX/IECEX cable glands for armored and nonarmored cable, Ex-housings and Ex-connectors.

In addition Jacob GmbH offers individual solutions to its customers to meet the needs of developers and decision makers.

Our application engineers will advise you when selecting the right products with regards to approval and technical requirements. We also conduct installation and user training on site upon request.

KTR

Systems for wind power technology.



For more than 25 years KTR has been involved in the wind power industry and is a global market leader in the field of power transmission in wind energy plants. Customised systems consisting of couplings and torque limiters, but also brake and cooling systems are ready for deployment in wind power plants operating in the megawatt range.

As far back as 1988 KTR had already developed the first coupling for use in the wind power industry. With the RADEX®-N steel disc coupling we have had a coupling system on the market for over 15 years, that was specifically built for use in wind power plants and which has undergone continuous development since its inception. Currently more than 70,000 KTR couplings are used in wind turbines with a nominal capacity of up to 8 MW, with thousands more added every year.

Our high-performance braking systems are used on the rotors and in the nacelle, to which end we provide products for three different applications: rotor brakes, yaw brakes and rotor lock. The systems are available in both hydraulic and electro-magnetic versions.

Our large cooling units comprise of electric motors, fans and bypass systems. The cooling elements are made of weight-saving aluminium, whilst the fan cowling and frame are constructed in robust high-grade steel. In spite of their high performance, all cooling units are extremely compact. Cooling systems and motors intended for use in off-shore applications are treated with a special coating for off-shore environments, in order to protect them against the corrosive saline atmosphere.

Made for Motion – KTR

01 | Steel lamina coupling RADEX®-N with integrated brake system – specially developed for wind power plants.

02 | For use in offshore plants the cooling systems are coated with special protective paint.

03 | More than 410 employees are working in the headquarters in Rheine.



KTR Kupplungstechnik GmbH

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48432 Rheine**

Federal state **North Rhine-Westphalia / Germany**

Phone **+49 (0) 5971 / 798 - 0**

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E-Mail **mail@ktr.com**

Web **www.ktr.com**

Profile **Couplings, brakes, cooling systems**

Category **Suppliers of mechanical
components**

Employees **more than 1,100 worldwide**

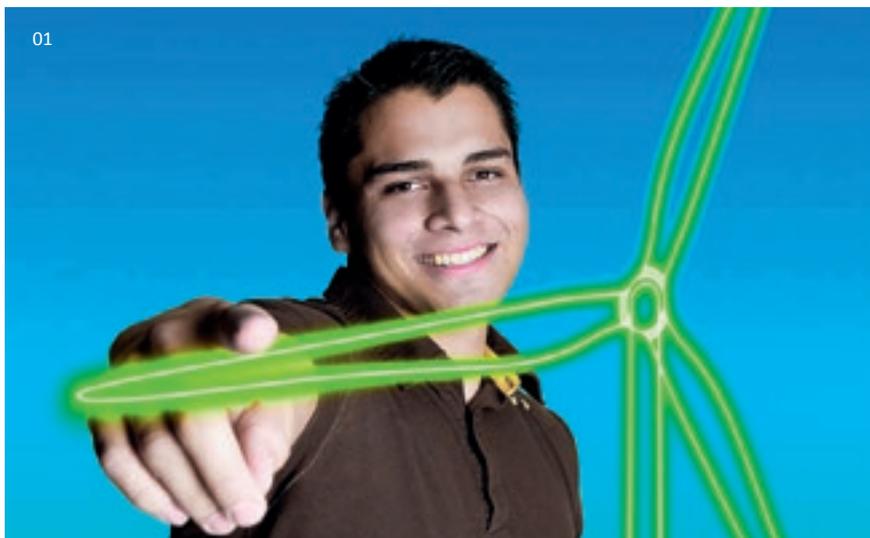
Founding year **1959**

LAP GmbH Laser Applikationen

High precision laser technology for measurement and projection

LAP has been developing, producing and distributing solutions for laser based dimensional measurement and projection of geometries since 1984.

LAP laser projectors are used for the production of large rotor blades.



01 | Laser projection of outlines for rotor blade production.

02 | Use of laser projectors for manufacturing rotor blades, laser outlines for positioning.



LAP GmbH Laser Applikationen

Address **Zeppelinstr. 23**
21337 Lüneburg

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Phone **+49 (0) 4131 / 95 11 - 95**

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E-Mail **info@lap-laser.com**

Web **www.lap-laser.com**

Profile **Rotor blades & rotor blade materials**

Category **Suppliers of large components**

Turnover **€ 35 million**

Employees **250 worldwide**

Founding year **1984**

Laser specialists

For more than 30 years, LAP has been providing special laser products and systems for industry, crafts and healthcare for the purpose of measuring geometric dimensions and projecting fixed or variable shapes and outlines. The focus is on solutions that meet the requirements of a certain application or industry. Many systems and components have been developed or optimized on the special request of customer groups.

From aerospace ...

LAP's support for the production of aerodynamic structures originates in the aerospace sector. Laser projectors are state of the art technology for the manual layout of composite layers for wings, empennage or fuselage segments – apart from other applications like assembly or painting. Clean, precise and without touching the surface, laser projectors replace former

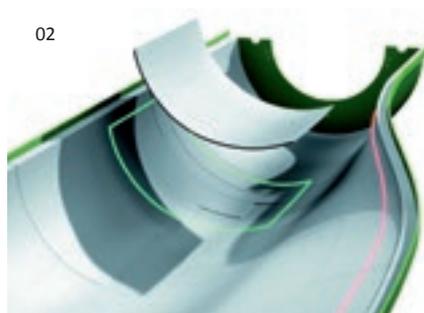
tools like templates, rulers or measurement devices. Outlines are shown on a scale of 1:1 directly on the work piece.

... to wind energy

The production of rotor blades based on electronic CAD data is still relatively new. For a long time, drawings were the method of choice of many blade manufacturers. This approach, however, has limits, and blades of growing size and complexity eventually needed to be designed in other ways. Design and construction switched to CAD software, thereby also creating the data needed for laser projection.

Outlook

In future, laser projection systems will be linked to measurement equipment and/or camera systems in order to increase throughput and enable work steps to be documented. The first customer projects have been successful and have demonstrated positive impacts on production and quality management. Especially large structures with high service life expectations, subjected to high loads and many load cycles at remote sites, will benefit from the increase in reliability.



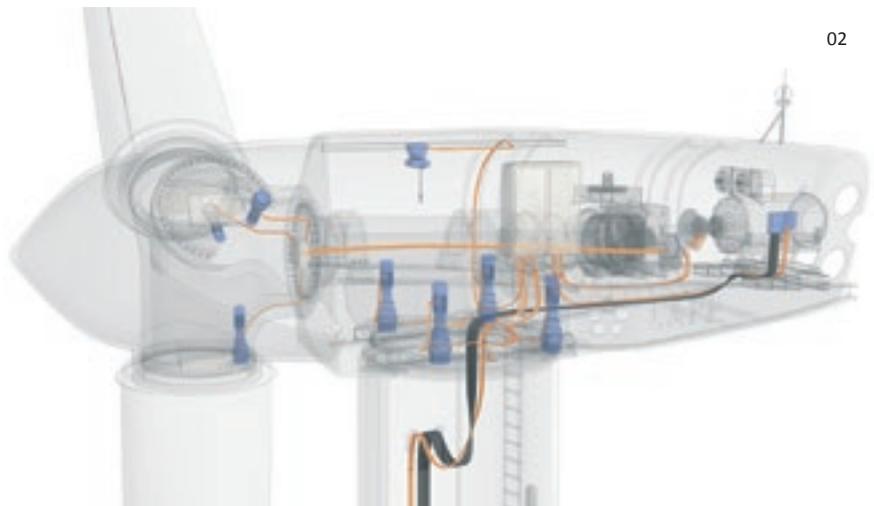
Lapp Group: U.I. Lapp GmbH

From tower to nacelle: Quality across the board

Fully integrated solutions: with Lapp Group, the wind power industry can fulfil all its cabling needs from a single provider.

The Stuttgart-based Lapp Group is a leading supplier of integrated solutions and branded products for cable and connection technology. With brands such as ÖLFLEX® (connection and control cables), SKINTOP® (cable glands) and EPIC® (industry connectors), we offer absolute quality products and complete system solutions which meet the highly demanding requirements of wind turbine manufacturers. Ready-to-connect systems are manufactured in-house by Lapp Systems.

With its own, state-of-the-art test centre, the Lapp Group assures that its products are of the highest quality. Thus Lapp customers can be sure that systems function reliably with minimum downtimes. For this purpose, the Lapp Group operates a unique 16-metres-high test facility, in which cables up to 12 metres in length can be tested under realistic conditions as found in the loop of a wind turbine.



This type of test facility where all fastening points for cables and conductors exactly match real-life conditions only exists in one other location in Europe.

Specifically for the wind energy sector we have developed and tested cables which are flame-retardant, halogen-free and torsionable and which cover a wide range of temperatures. In combination with the SKINTOP® cable glands, which provide unrivalled vibration protection, we offer a product portfolio that perfectly meets the industry's highly demanding requirements. Many of our products comply with common international standards.

With our own production sites in Europe, Asia, North and South America and a network of sales offices and logistics centres on all continents, we are always available to our customers wherever they are in the world - always working fast and to the same high quality standards.

01 | In the Lapp Group's unique 12-metres-high test facility cables are tested under realistic conditions.
02 | Complete systems for the wind energy sector.



U.I. Lapp GmbH
Andreas Müller

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70565 Stuttgart

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Web www.lappgroup.com

www.lappkabel.com

Profile Controls, cables &
switchgear cabinets

Category Suppliers of electrical &
electronic components

Turnover € 886 million (consolidated)

Employees 3,300

Founding year 1959

The Liebherr Group

A strong partner for the wind industry

For more than 60 years, the Liebherr name has stood for excellent, benefit-oriented products and services. The Group is not only one of the world's leading manufacturers of construction machinery; it is also a major supplier in many other fields of engineering like the wind industry.



01 | From assembly to surface preparation of the rotor blades, Liebherr offers the matching solution for different demands of the wind industry.

02 | Liebherr crawler crane LR 11000 positions a nacelle, weighing 220 t, on the 130 m high tower of a wind turbine.

03 | Heavy duty CAL 45000-1200 Litronic® offshore crane during the installation of rotor stars in the North Sea.

Liebherr is a powerful partner for the wind industry and offers convincing solutions for a wide range of requirements: On the one hand, components manufactured by Liebherr are installed directly into wind turbines, on the other hand, the company's mobile, crawler, offshore and tower cranes, for example, are used for erecting wind turbines or for constructing wind farms.

Offering large diameter bearings, slewing gearboxes, electric motors and hydraulic cylinders, Liebherr is the only manufacturer worldwide that can provide not only single components but entire systems for electromechanical and hydraulic pitch and also yaw adjustment in wind turbines.

One of the major elements of cooperation with customers from all over the world is application-specific engineering to perfectly adapt each of the components. In the wind industry, Liebherr collaborates with nearly all leading turbine manufacturers and so far has equipped more than 15,000 wind turbines with its own components. The product portfolio comprises



components for 800-kW plants up to solutions for multimegawatt turbines in offshore applications.

With their innovative technology, high quality and profitability as well as their longevity, mobile and crawler cranes from Liebherr own a leading position in the world market. For decades, they have also been proving their value in the construction of wind farms. As well as telescopic mobile cranes, Liebherr can also provide

LIEBHERR

Liebherr-International
Deutschland GmbH

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Phone **+49 (0) 7351 / 41 - 0**

Fax **+49 (0) 7351 / 41 - 265**

E-Mail **info.lho@liebherr.com**

Web **www.liebherr.com**

Profile **Crane manufacturers,
gears, bearings**

Category **Transport & logistics, Suppliers
of mechanical components**

Turnover **more than € 9.2 billion (2015)**

Employees **approx. 42,000**

Founding year **1949**



lattice boom mobile cranes and crawler cranes to erect wind power systems, in a variety of performance classes, specifically matched to meet the needs of the wind power industry. Liebherr keeps pace with the development of more and more powerful and efficient systems, and increasingly high masts, by offering cranes with optimized performance and new jib systems, reaching very high lifting capacities.

Cranes on narrow crawler travel gears especially developed for the construction of wind farms can move on the narrow tracks from one unit to the next in full setup condition, meaning including jib and full ballast. This is especially economical, because the machine and equipment have to be mounted only once.

For erecting wind turbines with a hub height of 110 m or more in low-wind areas, Liebherr also offers specially developed tower cranes with lifting loads of currently up to 125 t. They are mounted on the wind turbine and are configured in a way that the necessary lifting height can be reached by guying the crane to the mast at one point only. The advantage is the reduced space required by the crane, the ability to work despite high wind speeds and sensitive lifting of loads using Micromove.

Liebherr has convincing solutions for the erection of offshore wind turbines, too. Heavy duty cranes from Liebherr for offshore applications are able to lift up to 2,000 t. When it comes to offshore cranes, all customer requirements can be met: Diesel or electrical drive units, explosion protected cranes and cranes for ambient temperatures between +40 °C and -50 °C and special hoisting situations at altitudes of up to 3,400 m below sea level. Liebherr cranes are not only used successfully for the construction of offshore wind turbines, but also on oil and gas platforms, for offshore construction, pipe-laying or subsea operations.

Experience the progress.

MAHLE

SYSTEMS AND COMPONENTS FOR WIND POWER

In on- and offshore wind power systems and service platforms around the world, filtration and separation solutions from MAHLE do an excellent job. All components and systems are continuously being developed, and are highly efficient and reliable.



01

The Industrial Filtration profit center of MAHLE is one of the largest suppliers for onshore and offshore wind energy systems. Typical applications for MAHLE filters include hydraulic systems for rotor blade adjustment, for azimuth control, and for the drive train brake—generally as flange-mounted filters and air breathers. For oil filtration in transmissions, e.g. an innovative oil filter module, spin-on cartridges as well as filter elements and filter housings are employed.

MAHLE has developed an oil separator specifically for surface water oil separation in transformer and service platforms for offshore wind energy systems. It continuously separates oil, emulsions, and dispersions from the water – without backflushing or the use of chemicals. In the future, complete filter systems for drinking water treatment, fuel care, and seawater filtration will also be offered.

The bypass oil filter module Pi 8400 for absolute filtration and water absorption is a ready-to-connect module for all mineral-

oil-based transmission and lubricating oils. The high efficiency and streamlined shape of the components guarantee minimal friction losses, and the filter elements (filter rating 3 µm) boast very high separation rates (guaranteed in accordance with multipass test based on ISO 16889) as well as additional water adsorption.

The two-stage MAHLE tower climate control system ensures that aggressive, salty air particles are reliably filtered out before entering the turbine. This effectively prevents corrosion and significantly contributes to the long-term functionality of the turbine.

With its extensive application expertise, in-house research and development, technical center, laboratory, and design department, the Industrial Filtration profit center offers its customers tailor-made filter components and process engineering solutions.

01 | Oil filter module Pi 8300.

02 | Tower climate control system.

03 | 2000 deoiler.

MAHLE

Driven by performance

MAHLE Industriefiltration GmbH

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Fax +49 (0) 7941 / 67 - 234 29

E-Mail industriefiltration@mahle.com

Web www.mahle.com

Profile Hydraulic components

Category Suppliers of mechanical components



02



03

Mink Bürsten

Reliable seals with flexible brush seals on wind turbines –
Know which way the wind is blowing!



Mink Bürsten develops sealing concepts with brushes in close collaboration with leading companies in the wind energy industry. With its flexibility and numerous fibres that work at localised points, the brush has crucial advantages over comparable materials in terms of reliable protection from the effects of weather conditions, nesting insects, sand ingress or cold temperatures. At the same time, condensation can be allowed to escape, which cannot be done, or not to optimal effect, with rubber or foam. The optimal rotor speed of the wind turbine is controlled via the adjustable rotor blades. The inner or outer toothed pitch bearings are sealed with brush seals against corrosive media from the outside and against escaping grease from the inside. Because the fibres can be adapted for a very wide range of situations, gaps with high dimensional tolerances are reliably closed. Localised contact of the fibres prevents the colour from wearing off on the contacted components, as well as preventing the fibre bundles from freezing

solid. Profiles for inserting, screwing or riveting ensure very good durability. At installation, a Mink brush can be cropped without costly tools. The manufacturing technology brings other advantages for sealing rotating components. Fibre slanting in the direction in which the component rotates significantly reduces wear and tear.

Our fibre solutions can be used for far more than just sealing!

Mink brushes reduce the noise level of your turbine:

- Robust fibres on the tips of the rotor blades reduce air turbulence
- Using a cleaning brush prevents operating noises from the azimuth brake

Conductive brushes absorb voltage:

- Lightning voltages are transferred from the brushes to the spark gap
- Brushes used for equipotential bonding offer an affordable alternative and are easy to install



Flexible solutions with Mink brushes

1 Rotor Mink brushes for sealing the gap on the electric pitch control of the rotor blades.

2 Nacelle Mink brushes provide sealing concepts for all construction and assembly gaps in the nacelle's design.

3 Tower Mink brushes as a flexible seal in the area between nacelle and tower. Mink brushes are highly resistant to UV radiation and ozone, as well as temperature fluctuations.



August Mink KG
Mink Bürsten

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Fax **+49 (0) 7161 / 40 31 - 500**

E-Mail **info@mink-buersten.de**

Web **www.mink-buersten.com**

Profile **Seals & vibration control**

Category **Suppliers of mechanical components**

Turnover **€ 45 million**

Employees **390**

Founding year **1845**

Max Bögl Wind AG

As one of the leading manufacturers of high-performance hybrid wind power plants with large hub heights, the Max Bögl Group has extensive know-how across the entire process chain including the project planning, construction, plant management and repowering of wind turbines.



Max Bögl Wind AG

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E-Mail wind@max-boegl.com

Web www.max-boegl.com

Profile Foundations & footings, towers

Category Suppliers of large components

Founding year 2011

With an impressive full-service package of innovative development and state-of-the-art production and assembly processes, Max Bögl has successfully won the custom of virtually all well-known European manufacturers and project planners of wind power plants. The hybrid wind turbine towers, which were developed in-house and manufactured from reinforced concrete and steel at its production sites in Sengenthal and Osterrönnfeld (which have a capacity of 500 plants per year) ensure increased efficiency and a higher energy yield in inland areas.

Experts and specialist knowledge in every discipline

A wind energy project is a complex undertaking. The success of the project depends on the experience and special knowledge of various specialists. Interfaces between project phases and project participants

pose risks that can only be overcome by professional project management. Max Bögl Wind AG is a skilled, reliable and powerful partner, whether for selecting potential locations or testing the technical feasibility of existing project ideas. Whether client or investor, once the decision to build a wind farm has been made, Max Bögl accompanies and supports you throughout the entire duration of the project as required. Therefore you can rely on the extensive know-how of the Max Bögl Group for the development, planning and implementation even of major wind farms. Taking into account all involved parties, in-house specialists develop a detailed project plan, gladly in conjunction with local engineering firms.

Complete product and service portfolio

Furthermore, Max Bögl expertly coordinates full construction site logistics and



guarantees the safe transportation of concrete and steel segments using its own vehicle fleet and partner companies. On the construction site the assembly of the hybrid tower is prepared by advance road-building and cable construction. Foundations are built and the mounting system is established. Depending on the location, the tower can be mounted by the innovation award-winning “self-climbing revolving tower crane” developed in-house or with other mobile cranes. Experienced Max Bögl assembly teams then install the tower.

If requested by the customer, the Group can also provide the necessary assembly teams and equipment for installing the nacelle, the hub and the rotor blades. Dismantling of existing installations, repowering and all services related to the technical and commercial operational management of wind farms round off our portfolio.

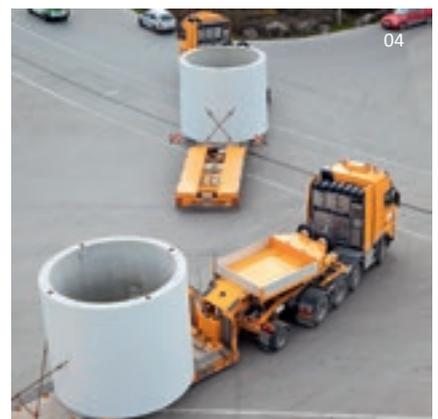
Efficiency, quality and reliability, in conjunction with a high degree of value added and the use of qualified personnel, are the premises that characterise the all-round services provided by Max Bögl Wind plc and the company as a whole.

01 | Even at wind speeds of 20 m/sec., wind turbine components with a weight up to 70 tons are raised into position using the modified revolving tower crane.

02 | With perfectly coordinated manufacturing and assembly technology, Max Bögl uses reinforced concrete and steel to construct innovative hybrid towers for high-performance wind turbines.

03 | Wind turbines with large hub heights and rotors, perfectly implemented with the Hybrid Tower System Max Bögl, enable high energy yield even on less windy, inland sites.

04 | The transportation of concrete components with a weight up to 62 tons is carried out by the in-house vehicle fleet, but also increasingly by ship.



Moog

Moog is your proven partner for reliable pitch systems – significantly increased reliability and our modular system architecture with optimized hardware design helps to significantly reduce unplanned turbine downtime.

Over the past decade, the substantial increase in installed renewable capacity has drastically transformed the global energy landscape. Renewables such as wind have become increasingly competitive. Worldwide wind power is being harnessed to produce electric power. Ever larger and better performing wind turbines are being used to meet the increasing energy demand. Innovative technologies and mature products for onshore and offshore applications are highly sought after to ensure efficient output.

When it comes to reliability, we help you get the most out of your wind turbines. Our high reliability, low maintenance pitch system reduces turbine downtime and enables your wind turbine to generate more power – all while reducing the levelized cost of energy. With Moog's latest hardware design, pitch system related failures and unplanned



downtime can be reduced by up to 50 per cent. Moog's modular system architecture helps turbine manufacturers to optimize assembly time in the hub and minimizes the engineering effort in adopting our pitch system design for new turbines. Our high reliability modular components help asset owners to optimize their spare parts inventory and reduce downtime due to reduced scheduled maintenance.

Moog Services provides staff training worldwide and guarantees spare parts

delivery and reliable, specialized service. All Moog technology solutions are designed for on- and offshore installations: Each pitch system, blade sensing system and slip ring solution meets the highest quality demands and stands for superior reliability at the highest level.

The Moog Industrial Group is a division of Moog Inc. and designs and manufactures high performance pitch solutions for wind turbines. Find out more about Moog at www.moog.com/wind.

MOOG

Moog

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E-Mail **wind.germany@moog.com**

Web **www.moog.com/wind**

Profile **Controls, cables &
switchgear cabinets**

Category **Suppliers of electrical &
electronic components**

Turnover **US\$ 522 million (Moog Industrial)**

Employees **almost 11,000 worldwide**

Founding year **1951**



A SOLUTIONS-BASED APPROACH TO PITCH CONTROL

A PITCH SYSTEMS

Space-saving solution ensures safe, high reliability

B SLIP RING SOLUTIONS

High reliable power/data transmission

C BLADE SENSING SYSTEMS

Accurate, real-time information to pitch system/
main controller

Morgan Advanced Materials

Morgan Advanced Materials (MAM) engineers and manufactures products for use around the world in regenerative energy systems with particular emphasis on slip ring transmitters and components for generators.



01

Founded in 1856, MAM has been headquartered in the UK. Nowadays, it ranks among the leaders in the world market for innovative technologies. The company operates in 50 countries, drawing on expertise of more than 9,000 employees. For decades, MAM has been supplying to the world's leading manufacturers of wind power plants.

Slip ring transmitters for guaranteed pitch control

MAM engineers slip ring transmitters for wind power plants and 50 further applications under the brand name REKOFA in Germany. One application of these products, for example, is ensuring the continuously rotating transmission, in combination of the currents and signals (or media) needed to adjust the rotors, from the nacelle to the hub.

Rotary encoders are integrated into the IP67 protected housing to continuously compare rotor speed. The ergonomically designed slip ring transmitters last for up to 200 million revolutions or 20 years on- and offshore, and are maintenance free



02

for up to 5 years. Tested for shock and vibrational resistance, they perform reliably in temperatures ranging from -40 °C to +75 °C with humidity up to 95 per cent.

High-current brush holders for lightning protection

Carbon brushes protect power plants when lightning strikes. They are mounted between the hub and the nacelle and are extremely long lasting.

Dielectric strength and decreasing temperatures

Slip ring collectors and carbon brushes made by MAM are installed in the generator where they reliably drive current generation. Configured individually for each application, they optimise the temperatures in generators.

Shaft grounding rings extend lifetimes

Generator manufacturers use AEGIS® rings nowadays to protect rolling bearings from fault currents. The rings are maintenance free and can be retrofitted. Made of conductive microfibre, they channel current away from the shaft, thus preventing damaging spark erosion in the bearings.



03

01 | Shaft grounding ring AEGIS.
02 | Slip ring collectors and carbon brushes.
03 | Slip ring transmitter 80A.



Morgan Advanced Materials
Morgan Rekofa GmbH

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53533 Antweiler

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Phone **+49 (0) 2693 / 93 33 - 0**

E-Mail **info@morganplc.de**

Web **www.morganadvancedmaterials.com**

Profile **Energy & data transmission**

Category **Suppliers of electrical & electronic components**

Turnover **GBP 921.7 million (MAM in 2014)**

Employees **9,000**

Founding year **1856**

M-PT – Matjeschk-PowerTools

Precision screwing devices and systems – development, sale, rental

The experts for electric, battery-powered, pneumatic and hydraulic assembly tools and torque wrenches.



M-PT in the wind industry

We support companies with the planning, installation and maintenance of wind turbines. The quality management requirements of our customers and our practical daily experience of assembly work form the basis of research and development at M-PT. The internationally renowned manufacturer RAD Torque Systems has authorised M-PT to be the sole German sales and service partner for its products.

Protecting screw connections

If screws are rotated further during maintenance, this impacts on the screw connection. We have therefore developed an innovative electric torque wrench with an integrated, highly sensitive test program: Unlike conventional devices, our MED electric torque wrench measures the torque on the screw as tension builds, without actually tightening the screw further. The result: the screw connection is not manipulated during maintenance.

Innovation for the precise torque

Torsion and rubbing in the gear mechanism of a screw torque wrench determine the torque during assembly. In order to avoid these impacts, our partner RAD Torque Systems has developed an internationally unique socket with integrated torque sensor, the SMART SOCKET. It measures the torque transferred to the screw directly at the screw connection. For optimal torque accuracy the torque wrenches from the series E-RAD BLU are also suitable.

Advantages of electric torque wrenches

Electric torque wrenches are particularly suitable for working on wind turbines. They are simple and speed up assembly by continuously applying torque. Compared with other torque systems such as hydraulic wrenches, the assembly time, and therefore crane time, is reduced by up to 60 per cent.

We offer: Sales and rental, as well as repairs and calibration.

01 | Assembly of blade adapter with MED 34-90.

02 | Assembly of tower flange with E-RAD BLU 8000 and SMART SOCKET.



M-PT Matjeschk-PowerTools
GmbH & Co. KG

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Profile Tools & machine tools

Category Suppliers of mechanical
components

Founding year 1994

NSK Deutschland GmbH

Partnership based on trust – trust based on quality

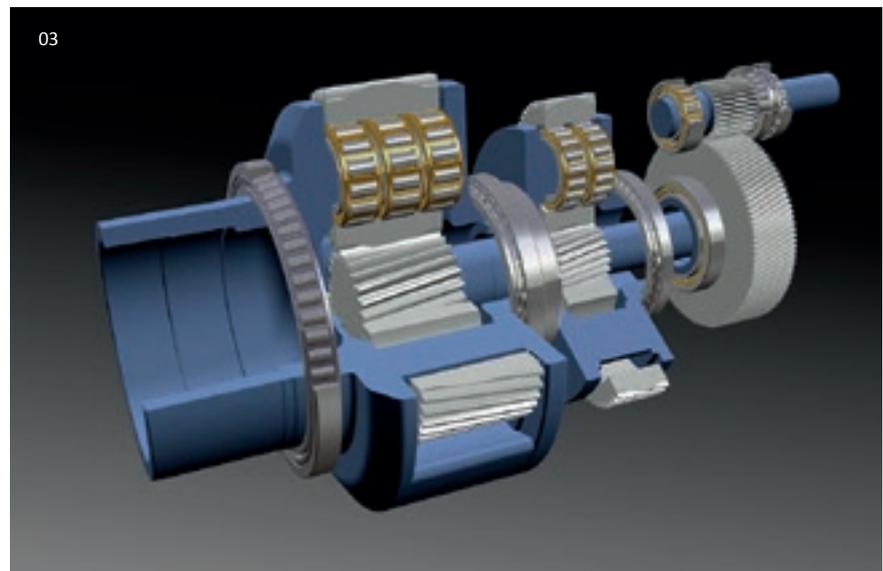
For over 15 years NSK has been a partner of the wind industry and one of the main suppliers of roller bearings for wind energy gearboxes and bearings for main rotor shafts and generators.

Combined know-how

Skills from sales and application technology are combined in the wind energy team – and also include the latest research results from our technology centres. Bearings are specifically designed using highly developed calculation and simulation tools. Our experienced engineers take account of load cycles, lubrication, deformation, thermal response and also extreme and maximum conditions. This is the only way to produce a construction with cost-optimised components that also reliably function under maximum loads and have a long service life.

NSK wind standard

As the first manufacturer, NSK defined the pioneering wind standard U303 for roller bearings back in 2008 – including a one hundred per cent traceability of the components of every single bearing and all



essential processes. NDT methods (non destructive testing) are also available to avoid grinding burn, fractures in material and structural breakdowns.

- 01 | Planet wheel gear and bearing.
- 02 | Main rotor shaft bearing.
- 03 | Main gearbox for wind turbines.



Long service life with BOC (black oxide coating) and patented materials

BOC treatment of bearings prevents untimely bearing failures caused by white etching cracks (WEC). The patented special material AWS-TF (anti white structure-tough) is also available for high-level requirements and reliably prevents damage caused by WEC. Our STF material (super-tough) has proved ideal when it comes to increasing the load rating and service life, especially for contaminated lubricants.

MOTION & CONTROL™
NSK

NSK Deutschland GmbH

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E-Mail **info-de@nsk.com**

Web **www.nskeurope.com**

Profile **Bearings**

Category **Suppliers of mechanical components**

Turnover **approx. € 7 billion (global)**

Employees **approx. 31,000 (global)**

Founding year **1916**

Ostseestaal GmbH & Co. KG

Best in 3D

CIG-Ostseestaal is a specialist in 3D cold forming of metals and realizes complex geometries for the aerospace industry and rotor blade production.



- 01 | Location.
 02 | Winding machine.
 (Source & copyright: ENERCON GmbH)
 03 | Curing tool for an aircraft fuselage.



Ostseestaal GmbH & Co. KG

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Fax **+49 (0) 3831 / 27 52 - 40**

E-Mail **ostseestaal@cig-eu.com**

Web **www.ostseestaal.de**

Profile **Steel components**

Category **Suppliers of mechanical
components**

Turnover **€ 20 million**

Employees **130**

Founding year **1996**

Ostseestaal GmbH & Co. KG is a company that specialises in the manufacture and supply of 3D formed, custom-fit metal constructions. Materials of the highest quality such as steel, stainless steel, aluminium and special alloys like INVAR, etc. are processed.

Ostseestaal is part of the international group Central Industry Group (CIG), which is active on the world market in the fields of shipbuilding, renewable energies and architectural projects. The companies in CIG complement each other; the synergies are part of our personal, customer focused approach.

Together with our sister company Formstaal, a highly specialised welding company, we are able to produce our turnkey products.

Ostseestaal manufactures large and complex tools for the production of components from carbon fibre and fibre-glass reinforced polymers (CFRP, GRP). These components are used as e.g. curing tools for a fuselage or a wing shell in the aviation industry or as moulds in rotor blade production.

No compromises

We provide the whole production process, starting with processing of free-form surfaces, cutting and 3D forming of sheets, assembly of the curing tools and, if necessary, stress relief heat treatment. All production processes are checked, analysed and documented using consistent quality assurance, guaranteeing the highest possible quality standards.



Palfinger Marine GmbH

Lifetime excellence

PALFINGER MARINE is the expert for lifting solutions especially for the wind industry.



PALFINGER MARINE is the expert for lifting and handling solutions designed especially for the wind industry. LIFETIME EXCELLENCE is our promise. Innovative products that are certified by class societies ensure efficiency and maximum performance throughout the crane's lifetime. PALFINGER MARINE offers wind cranes for nacelles, platforms and substation/accommodation platforms as well as davit systems, boats and winches.

Platform cranes

Platform cranes (PF, PS/PSM) are customised to enable fast unloading of supply vessels at sea even under challenging conditions. Special surface coating and the use of quality material protect the platform cranes against corrosion.

Substation/Accommodation platform cranes

Substation and accommodation platform cranes (PF, PSM, PKM) provide platforms with a low maintenance cargo handling tool to last for a lifetime.



Nacelle cranes

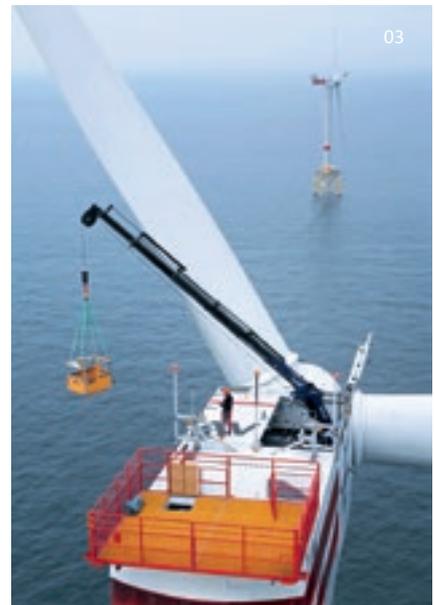
Nacelle cranes (PC, PK) feature compact design and an ideal weight and performance ratio even in tight spaces. PALFINGER MARINE nacelle cranes enable safe and fast lifting from the platform to the nacelle and back. Passenger transportation, blade and tower inspections are also simplified and available for several crane types.

Certifications and regulations

Cost-efficient manufacturing and the use of high-class materials guarantee a product with a design life of 25+ years that is certified by a number of class societies.

Best available service

A growing network of service partners specially focussed on offshore wind business ensures responsive, reliable and cost efficient service.



01 | PF 8000 platform crane.

02 | PTM 1800 hydraulic substation crane.

03 | PK 40002 M nacelle crane.



Palfinger Marine GmbH

Address **F.-W.-Schererstr. 24**
5020 Salzburg

Country **Austria**

Phone **+43 (0) 662 / 46 84 - 0**

Fax **+43 (0) 662 / 46 84 - 27 70**

E-Mail **wind@palfinger.com**

Web **www.palfingermarine.com**

Profile **Lifting technology & crane systems**
(Offshore Wind)

Category **Transport & logistics**

Turnover **€ 1,230 million (2015, Palfinger AG)**

Employees **more than 8,000**

Founding year **1932**

PFISTERER Kontaktsysteme GmbH

Cable accessories for electricity transmission lines in wind power

Versatile PFISTERER connection technology for low, medium and high voltage cables supports a modular wind turbine design and reduces installation times – onshore and offshore.



For the cabling of wind turbines, PFISTERER has easy-to-assemble connection and jointing elements available for all cable diameters and voltage levels. The range includes plug-in generator and converter terminations, plug-in or fixed tower cabling, fixed or separable branches for underground cable, suitable transformer connectors for the undervoltage and overvoltage side as well as plug-in cable terminations for switchgears.

An area that PFISTERER specialises in is connection technology for offshore wind turbines. The CONNEX connection system for medium and high voltage cable is ideally suited for this application: touch-proof, compact, maintenance free, submersible and salt water-resistant, it is the only system of its type to have been certified by DNV GL for use at sea. CONNEX is perfect for use in the inter-array cabling of wind farms and for each cable interface at the medium and high voltage levels in offshore substations up to transformer and GIS connections.

PFISTERER has been developing and manufacturing advanced components for connecting, jointing and branching electricity transmission lines since 1921. PFISTERER products shape technology standards and international norms. They are used worldwide at all voltage levels and boast the broadest range of products in the sector.

PFISTERER

PFISTERER Kontaktsysteme GmbH

Address **Rosenstr. 44**

73650 Winterbach

Federal state **Baden-Württemberg / Germany**

Phone **+49 (0) 7181 / 70 05 - 0**

Fax **+49 (0) 7181 / 70 05 - 565**

E-Mail **info@pfisterer.de**

Web **www.pfisterer.de**

Profile **Controls, cables &**

switchgear cabinets

Category **Suppliers of electrical & electronic components**

Turnover **approx. € 260 million**

Employees **approx. 1,400**

Founding year **1921**

02



The wide range of products is combined with a comprehensive service offering. If required, PFISTERER can handle the project management and laying of cable systems. For installation works at sea, we have a specially trained team of experts available.

01 | The CONNEX connection system for medium and high voltage cable is the only system of its type to have been certified by DNV GL for use at sea.

02 | PLUG – Pluggable high-current connector for wind turbines.

PHOENIX CONTACT Deutschland GmbH

... more than just a terminal

Phoenix Contact is a strong partner for the wind power industry thanks to an array of high-performance automation solutions, high-quality electronic components and innovative systems.

Phoenix Contact is the worldwide market leader of components, systems and solutions in the area electrical engineering, electronics and automation. The family-owned company employs 14,000 people worldwide and had a turnover of 1.77 billion euros in 2014. The corporate headquarters is located in Blomberg in central Germany. The Phoenix Contact Group has nine companies as well as 50 sales subsidiaries. In addition, the worldwide presence is consolidated by 30 representations in Europe and overseas. Worldwide production is occurring in nine countries with a high level of vertical integration.

Phoenix Contact is a veteran of wind energy with over 20 years experience in the field and one of the world's largest suppliers to the wind power industry. Both our electronic components and industry-



specific systems and solutions are highly respected. Interface products, power supplies, monitoring systems and our wide range of surge protection components are well-established products in the industry, in addition to electromechanic components such as plug-in connectors and terminal blocks. We offer hardware safety solutions and comprehensive service and consulting competence in the area of safety technology. In addition to our high-performance control systems, we offer a software library tailored to the wind power industry in the area of automation technology. It allows you to create a cost-effective automation solution for your wind turbine.

Our understanding of being close to the customer is to be at home no matter where we are in the world and speak the language of the user. It also exemplifies our contribution to a business relationship on par with our partners.

01 | We round off our hardware range with comprehensive consulting and related services.

02 | Our secret to success with our partners is our service team with its many years of experience, pooled knowledge and skills, and tremendous flexibility.



PHOENIX CONTACT
Deutschland GmbH

Address **Flachsmarktstr. 8**
32825 Blomberg

Federal state **North Rhine-Westphalia / Germany**

Phone **+49 (0) 5235 / 3 - 120 00**

Fax **+49 (0) 5235 / 3 - 129 99**

E-Mail **windenergy@phoenixcontact.com**

Web **www.phoenixcontact.com**

Profile **Controls, cables & switchgear cabinets**

Category **Suppliers of electrical & electronic components**

Turnover **€ 1.77 billion (2014)**

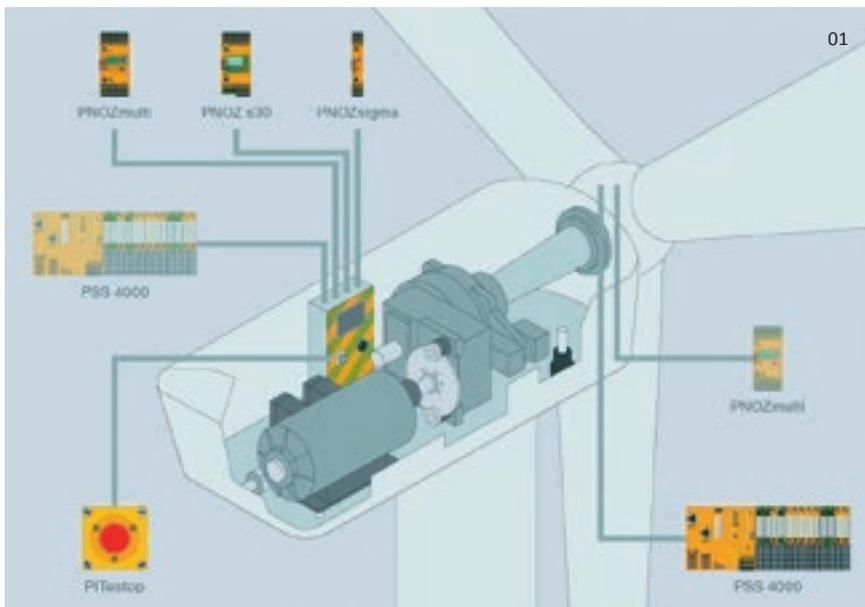
Employees **more than 14,000 (2014)**

Founding year **1923**

Pilz GmbH & Co. KG

Ambassadors for safety

Safe automation components from Pilz increase the availability of your turbine, reduce downtimes and guarantee the safety of man and machine.



- Achieve optimum standardisation in the automation of both on- and offshore turbines.
- Reduce accident risk during operation as well as during maintenance and installation work.

Pilz solutions have clear benefits, particularly in the case of standard-compliant speed monitoring. We can offer for example our automation system PSS 4000 and the control systems PNOZmulti and PNOZ s30. They are scalable for various encoder combinations, achieving a safety level up to PL d and PL e.

The following can be monitored, among others:

- All safety-relevant plant values and states
- Overspeed of rotor and generator shaft, broken shear pin
- Rotor blade adjustment (pitch) and wind direction tracking (azimuth)
- Emergency stop pushbutton on the tower and in the nacelle
- Plant values such as temperature, pressure, vibration or electrical variables for plant protection

Pilz has many years of collective experience in the engineering safety consultancy sector – so why not place your trust in our expert hands? We'll support you through a range of services specially tailored to meet the needs of wind energy plant.

01 | Pilz offers a range of options for implementing standard-compliant speed monitoring.

As your safety partner, Pilz will supply you with reliable components and solutions that have been tried and tested in the wind energy sector. At the same time you will benefit from the simple integration of our security systems, remote diagnostics and servicing options, and a series of robust product types. Our portfolio includes certified solutions (TÜV/BG/CE/UL/CCC/GOST) for worldwide use, all of which comply with international standards, such as the Machinery Directive (2006/42/EC), IEC 61400 and the guidelines published by Germanischer Lloyd.

Safe automation – a worthwhile investment:

- Implement scalable, safe automation solutions for new and existing wind turbines.

PILZ
THE SPIRIT OF SAFETY

Pilz GmbH & Co. KG

Address Felix-Wankel-Str. 2

73760 Ostfildern

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Phone +49 (0) 711 / 3409 - 0

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E-Mail info@pilz.com

Web www.pilz.com

Profile Safety features & equipment

Category Suppliers of electrical & electronic components

Turnover € 233 million

Employees more than 2,000

Founding year 1948

Prysmian Group

Linking sustainable ideas to real-world results

The Prysmian Group is the world's leading manufacturer for cables for the segments energy, telecom, data and industrial.

With a turnover of more than 7 billion euros, 19,000 employees in 50 countries and 89 factories, the Prysmian Group is a strong, reliable partner for system solutions in local and international markets.

Its certified quality management with a worldwide focus ensures that product quality is always at the highest level, from the procurement and production processes, right through to the delivery process.

With a focus on sustainable and environmentally friendly production processes, the Prysmian Group ensures that the fundamental principles of sustainable energy concepts are also implemented in its own company.

Our integrated management system complies with DIN EN ISO 9001, IRIS, ISO/TS 16949, KTA 1401, DIN EN ISO 14001, DIN EN ISO 50001 and OHSAS 18001. These are regularly monitored by independent experts.

As a world leader in special cables for wind turbines, we are able to manufacture products for the wind industry for all voltages or, if required, fully assembled cable sets in our German and international production sites:

Nacelle / Loop: Special cables (optional halogen-free / flame retardant) with increased oil, heat and ozone resistance, as well as optimized torsion properties up to 66 kV.



01 Tower: Special cables (optional halogen free / flame retardant) for fixed installation with copper or aluminium conductors with excellent installation properties up to 66 kV.

Wind farm cabling: From the low- and medium-voltage cables for the wind farm infrastructure, through to the high-voltage grid, we supply all cables for onshore and offshore applications.

In addition, we are able to supply cables as pre-assembled cable sets, as well as a service for fitting / commissioning or maintenance / turbine monitoring.

- 01 | As the world's leading manufacturer we can offer you a full product range of cables.
- 02 | Pre-assembled cable sets.
- 03 | Our service for fitting / commissioning or maintenance / turbine monitoring.



Prysmian Kabel und Systeme GmbH
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 Fax **+49 (0) 30 / 36 75 - 55 89**
 E-Mail **renewables.de@prysmiangroup.com**
 Web **www.prysmiangroup.com**
 Profile **Energy & data transmission**
 Category **Suppliers of electrical & electronic components**
 Turnover **€ 7 billion**
 Employees **19,000**
 Founding year **1879**

Ringspann GmbH

Innovative achievements have made RINGSPANN a leading manufacturer for power transmission components, clamping fixtures and remote control systems.



01 | Rotor brake.

02 | Shrink disc.

RINGSPANN®

Ringspann GmbH

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61348 Bad Homburg

Federal state **Hesse / Germany**

Phone **+49 (0) 6172 / 275 - 0**

Fax **+49 (0) 6172 / 275 - 275**

E-Mail **info@ringspann.com**

Web **www.ringspann.com**

Profile **Hydraulic components**

Category **Suppliers of mechanical components**

Turnover **€ 65 million**

Employees **Group 450**

Founding year **1944**

RINGSPANN customers include some of the most important international manufacturers of machine tools and systems as well as the aerospace industry.

From our headquarters in Bad Homburg, Germany, a world-wide network of subsidiaries and sales agencies ensure personal on-site service. Production and assembly plants in various countries provide rapid, reliable delivery.

With more than 70 years experience in research and design, RINGSPANN is a specialist for power transmission components, clamping fixtures and remote control systems. Professional application engineering guarantees RINGSPANN customers optimum

technical and economical solutions in the following product fields:

- Brakes
- Shaft-Hub-Connections
- Freewheels
- Overload Clutches
- Couplings
- Precision Clamping Fixtures
- RCS® Remote Control Systems

For wind turbines RINGSPANN offers the following customized products:

- Yaw Brake
- Rotor Brake
- Shrink Discs
- Cone Clamping Elements
- Precision Clamping Fixtures

Rittal GmbH & Co. KG

From rotor to tower: Rittal products are employed in all parts of a wind turbine. Rittal has supplied leading global system integrators and turbine manufacturers for many years.

Rittal GmbH & Co. KG, headquartered in Herborn, Germany, is a leading global provider of solutions for industrial enclosures, power distribution, climate control and IT infrastructure – as well as software and services. Systems made by Rittal are deployed across a variety of industrial and IT applications, including vertical sectors such as the transport industry, power generation, mechanical and plant engineering, IT and telecommunications.

Housings and enclosures from the “Rittal – The System.” portfolio are ideal for all on-shore and off-shore wind power applications.

Highly robust AE compact enclosures protect pitch-control systems in turbine **hubs** to prevent malfunction. The AE range delivers exceptional resistance to corrosion, shock and vibration, helping wind power plants to operate reliably. Rittal’s TS 8 baying enclosure system and SE 8 freestanding enclosures protect the controllers installed in **nacelles**. Efficient heaters and filter fan units condition the air. TS 8 enclosures provide effective protection for the inverters installed in wind turbine **towers**. Customer-specific configurations can be implemented quickly and easily with standardised, modular components. Furthermore, all TS 8 models are rated IP 55 and Nema 12, and are UL certified.

The new Rittal Blue e+ units maintain optimum conditions inside the enclosures. Leveraging a hybrid cooling method, they can cut energy costs by as much as 75 per cent. Rittal’s modular Ri4Power system



supports the configuration of low-voltage switchgear in compliance with relevant standards. Stainless steel and aluminium outdoor enclosures keep grid feed-in and monitoring components safe from harm. Rittal housings are highly corrosion-resistant and can withstand extreme weather conditions.

01 | The company’s “Rittal – The System.” range includes solutions for all requirements of wind turbine manufacturers: from housings to enclosures or power distribution components, plus software and services.



Rittal GmbH & Co. KG

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35745 Herborn

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E-Mail **info@rittal.de**

Web **www.rittal.com**

Profile **Controlling, cables & switchgear cabinets**

Category **Suppliers of electrical & electronic components**

Turnover **€ 2.2 billion in 2014 (F.L.G.)**

Employees **10,000 worldwide (Rittal)**
11,500 (F.L.G.)

Founding year **1961**

Schraubenwerk Zerbst GmbH

Fasteners for wind turbines

We fasten your wind turbine components safely and reliably. Wind turbine and component manufacturers around the world rely on Zerbst screws and fasteners.



**SCHRAUBENWERK
ZERBST GMBH** **SZ**

Schraubenwerk Zerbst GmbH

Address **Altbuchsland 22
39261 Zerbst**

Federal state **Saxony-Anhalt / Germany**

Phone **+49 (0) 3923 / 713 - 0**

Fax **+49 (0) 3923 / 713 - 200**

E-Mail **info@schraubenwerk.com**

Web **www.schraubenwerk.de/
index_en.html**

Profile **Bolts & fasteners**

Category **Suppliers of mechanical
components**

Turnover **€ 50 million**

Employees **200**

Founding year **1919**

The Zerbst plant has been manufacturing high-quality screws and fasteners for 100 years.

Schraubenwerk Zerbst has been supplying screws made of high-quality steel to the automotive industry as early as the 1920s. At that time, 30 per cent of overall production was exported to the US, UK, India and the Netherlands.

Nowadays the plant in Zerbst is a highly sophisticated production plant for fasteners. In addition to an extensive product range for rail track technology, Zerbst supplies industrial screws and screw fasteners to many industries. Customers around the world from the crane industry, automotive engineering, mechanical and plant

engineering, and chemical plant construction trust the Zerbst brand.

Sustainable production and sustainable business management are among the corporate principles of Schraubenwerk Zerbst GmbH. Products in the field of renewable energy and wind turbines are ideally suited to this philosophy and are a dynamically growing business segment for the company.

Tower construction: HV sets up to M72, ready for installation with preset friction coefficient.

Offshore: Screw fasteners joining wind turbines to sea bed.

Rotor blade: Combination of cross bolts and specially designed thermo bolts, from smaller rotor blades to over 80 m long rotor blades for offshore wind turbines.

Nacelle and components: Standard screws, specially designed screws and bolts in strength categories 8.8, 10.9 and 12.9.

Services and logistics: From the warehouse to punctual delivery to building sites around the world.

Coatings: Galvanised and lamellar zinc coated fasteners can be supplied as standard. In addition, customers can order whatever type of coating they require.

SICK AG

SICK – Efficient solutions for wind energy

With the SICK portfolio, we fulfil your requirements to the highest of standards.

The perfect basis for your automation: Sensors, safety technology and system solutions from SICK.

When movement becomes order, when wind turbines and wind farms have to deliver high productivity and when it comes to finding an intelligent solution, then you can profit from SICK's many years of experience. Your industry is in our focus with intelligent sensors and sensor solutions, solid application know-how and comprehensive services. For getting the best solution based on your requirements and the optimization of your applications – worldwide.

Wind power systems must operate at near 100 per cent availability – hence quality and reliability are extremely important. Variable-speed, pitch controlled systems are the current state-of-the-art in wind energy system construction. They can be efficiently deployed in the harsh conditions prevalent in both onshore and offshore operations. Build on SICK's competence – a competence demonstrated by over fifteen years' experience in this sector and,

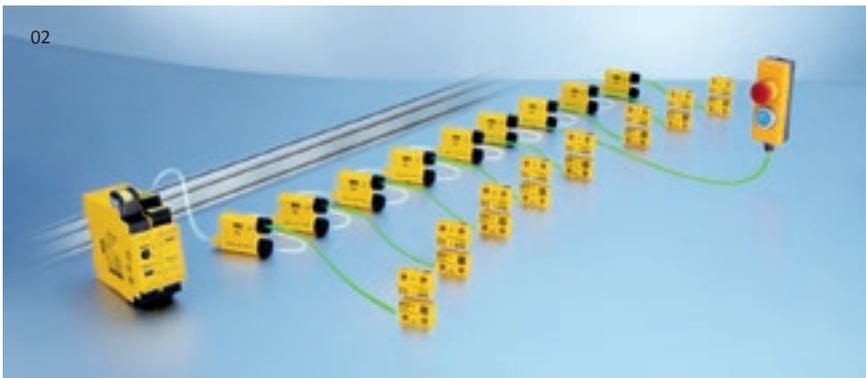


for instance, more than 20,000 encoders installed in pitch-controlled systems.

Our wind power industry experts are as deeply rooted in their profession as you are. That means you are always communicating on equal terms with specialists who understand your task requirements from the word go. Conclusive solutions that can be practically implemented for your individual requirements emerge in the shortest of time frames. Whether you require safety technology, pitch adjustment, azimuth control, rotational speed measurement, monitoring of temperature, level or pressure in gearboxes, generators or hydraulic systems – put us to the test. We will be happy to prove ourselves to you!



01 | Headquarters.
02 | Safety system solutions.
03 | Highest reliability for harsh environmental conditions.



SICK
Sensor Intelligence.

SICK AG

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79183 Waldkirch
Federal state **Baden-Württemberg / Germany**
Phone **+49 (0) 7681 / 202 - 0**
Fax **+49 (0) 7681 / 202 - 3863**
E-Mail **info@sick.de**
Web **www.sick.com**
Profile **Measurement equipment**
Category **Suppliers of electrical & electronic components**
Turnover **€ 1,099 million**
Employees **more than 7,000**
Founding year **1946**

Siemens AG

Creating the most from wind

Designed for high performance, the wind equipment from Siemens encompasses products and systems that have proven themselves thousands of times over in the harshest conditions. All components communicate seamlessly over all levels – for high availability.



01 | Components for power distribution – maximum efficiency thanks to reliable components working perfectly together.

02 | High performance SIMATIC PC-based controller with integrated safety functionality for turbine automation, converter control and wind farm management.

03 | Siemens portfolio for wind turbine plants.

Creating the most from wind

As an experienced and reliable partner, Siemens offers perfectly harmonized products and systems for the electrical equipment of wind turbine plants.

Our portfolio includes

- 1 Industry-proven automation and turbine control systems including wind-specific software: highest reliability for maximum availability with SIMATIC Wind Automation and SIPLUS CMS Condition Monitoring and SIPLUS extreme – even under difficult to extreme ambient conditions.
- 2 SIMATIC WinCC Open Architecture is both a “State-of-the-Art” SCADA solution for optimized (multiple) wind farm management and a central service portal with integrated communication for wind turbines (Multilevel Wind SCADA Center).
- 3 Industrial Communication for the control and monitoring of wind turbines or for the coordination of entire wind farms ensures that all system components work together safely and reliably even in harsh environments. Siemens provides the foundation for the required data networks with SCALANCE and RUGGEDCOM.
- 4 and 5 Pitch and yaw systems: efficient components for rotor blade adjustment and nacelle tracking based on SIMATIC automation systems, SIRIUS industrial controls and SINAMICS frequency converters.
- 6 Low-voltage power distribution: perfectly coordinated protection, switching, measuring and monitoring devices from the SENTRON range.
- 7 Reliable energy transport with SIVACON 8PS busbar trunking systems. Medium-voltage energy distribution: reliable connection between the wind turbine plant and the power supply with NXPLUS C Wind and 8DJH 36 medium-voltage switchgear.
- 8 Generators for turbines with or without gears: maximum energy yield with highest reliability. Converters: maximum flexibility with modular Dynavert XL wind converters.
- 9 Industrial controls: reliable switching, protection, starting and monitoring of motors and communication via IO-Link. All these products and systems interact perfectly with one another. The result: maximum availability and efficiency, low production and maintenance costs, time savings in engineering and commissioning and a shorter time to market for new wind turbines.
- 10 Intelligent solutions for energy storage based on battery systems or electrolysis systems for the production of hydrogen.

SIEMENS

Siemens AG

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90475 Nuremberg**

Federal state **Bavaria / Germany**

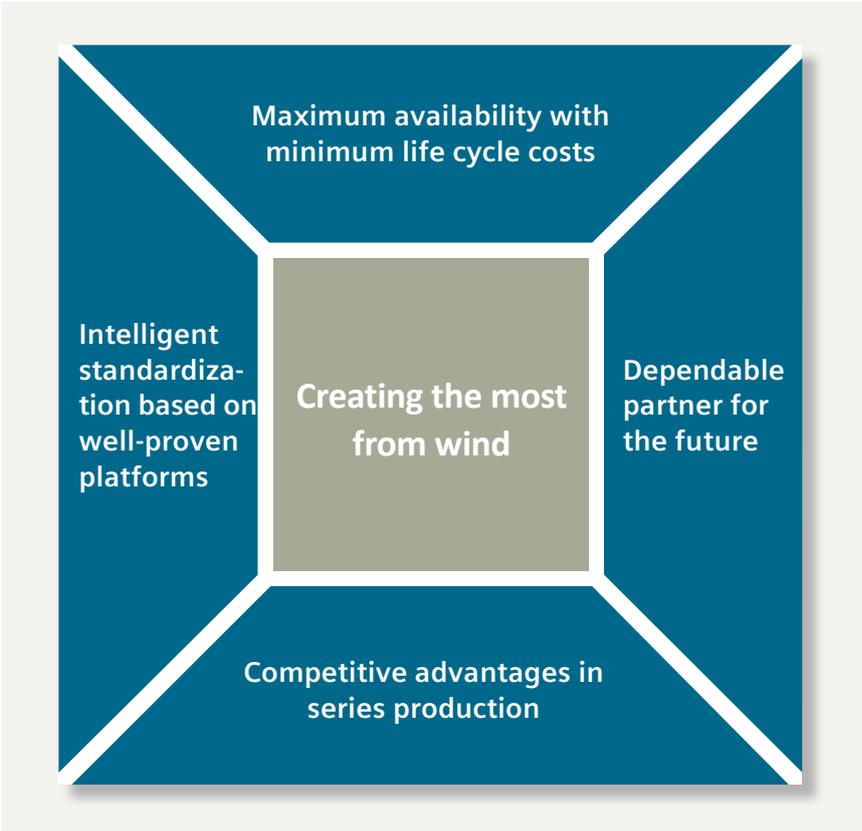
E-Mail **wind-equipment.
industry@siemens.com**

Web **www.siemens.com/
wind-equipment**

Profile **Safety features & equipment**

Category **Suppliers of electrical &
electronic components**





Support from every perspective: We provide our complete wind know-how to secure your success.

Siemens AG



Our customers benefit from

1. Maximum reliability with minimum life cycle costs

Our products and systems interact perfectly with one another and thus increase plant transparency and availability. They communicate seamlessly across all levels – from the HMI terminal up to the SCADA system. As a consequence, all of the wind turbines can be consistently monitored and optimally controlled. Even in extreme situations, fast and targeted response is possible in order to avoid damage to the plant. Downtimes for carrying out repair work can be minimized or even completely eliminated through preventive and predictive maintenance and servicing concepts. We offer customer-oriented services with our global service network, which is available to you 24/7, 365 days a year. The standard portfolio includes, among others, remote maintenance, servicing, spare parts logistics and online support.

2. Intelligent standardization based on proven platforms

Intelligent standardization ensures that no complex customized products are required to address wind- and manufacturer-specific requirements. We employ platform strategies and use components and harmonized systems that have proven themselves hundreds of thousands of times in harsh industrial environments. They can be combined in such a way that the relevant specification is precisely complied with. It goes without saying that we consistently observe industrial standards, machine guidelines and safety regulations. The perfect interaction of the standardized products and systems is ensured through extensive systems tests of the hardware and software at an early stage. This means that complex system tests for the customer are not necessary. Uniform engineering tools reduce overheads for programming and commissioning and minimize the risk of faults. One example is the Industry Library with wind-specific blocks in which 80 per cent of all functions of a wind turbine plant are stored.

3. Competitive advantages in series production

Increasing competition and cost pressure mean that the wind sector must sustainably optimize its development and manufacturing processes. Our portfolio supports you in the transition to optimized series production with our hardware and software, including standardized modular systems for your platform strategies, reduced component variance and industry-compatible logistics and support processes. Future automation concepts for the

manufacture of wind turbines will benefit from product life cycle management software: it optimizes the layout of turbine production already during the planning phase. This allows saving potential to be exploited at an early stage and avoids bottlenecks in later production. Furthermore, our software ensures transparency over the entire life cycle. It is the sole data source for all product and process knowledge in turbine production. New wind turbines are developed and modified with special design software. A wide range of simulation options help you to correctly evaluate scenarios and replace turbine prototypes which are expensive and complex to produce. As a result of the time saved, the wind turbines can be brought to market faster.

Dependable partner for the future

We are an experienced and reliable partner for all products, systems and solutions for the automation, energy distribution and the electrical drive train in wind turbine plants. Our decades of unique expertise in industrial automation make us the world's leading supplier. This expertise is now directly incorporated in our range of solutions and products for the wind sector.

One example: more than 18,000 of our generators for wind turbines are operating reliably around the globe. Our experience in industry in general and in the wind energy sector in particular allows us to deliver products in large quantities – and to link these products in an application-specific manner.

01 | Components and systems for wind turbine plants.



SSB Wind Systems GmbH & Co. KG

Be consistent

Thousands of pitch systems worldwide, self-developed switch and control cabinets or on- and offshore solutions for WTGs: Just a few highlights from nearly 25 years of experience in the wind energy sector.



01 | Perfect solutions for new generations.
 02 | The new SSB PerfectPitch Drive: numerous functions have been integrated into the pitch converter.
 03 | In connection with PerfectPitch, SSB Wind Systems developed the first App for electrical pitch systems.

Perfect solutions for new generations

Since 1990, we have offered our technologies and know-how for onshore and offshore:

- Pitch systems (750 kW to 10 MW)
- Switch and control cabinets
- Service (upgrades & solutions, spare parts, training, support)

On this basis, we develop solutions so outstanding that, even over the long term, you won't ever have to worry about if and how they work. The fact that an entire generation will also benefit from your clean solution is not a side effect. It is rather the main objective driving all our actions.

Perfectly in tune: Our pitch systems

From pitch drives to PerfectPitch Drive, our range of products is as comprehensive as a pitch system. A perfect combination of components, harmonized to deliver a complete solution: our Perfect Pitch System. Designed to fulfill your individual

requirements and your wishes for WTGs up to 3.X MW and rotor sizes of up to 140 meters, a large part of our system is comprised of the Perfect Pitch Drive as well as the Perfect Pitch Interface applications module. The integration of numerous functions within the Perfect Pitch Drive halves the total area of the pitch drive in the nacelle.

Not only do we consider pitch systems as a whole but we also develop and build them. This level of hands-on knowledge guarantees the highest quality and availability of your pitch systems.

Highest quality service: at eye-level

We don't just develop and build pitch systems. We maintain them too. Our service teams support you with commissioning, on-site services and spare parts procurement for all systems we deliver. Additionally our service offer includes the training of your service technicians and installers.



SSB Wind Systems GmbH & Co. KG

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48499 Salzbergen
 Federal state **Lower Saxony / Germany**
 Phone **+49 (0) 5976 / 946 - 0**
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 E-Mail **info.ssb@emerson.com**
 Web **www.ssbwindsystems.de**
 Profile **Controls, cables & switchgear cabinets**
 Category **Suppliers of electrical & electronic components**
 Employees **300 worldwide**
 Founding year **1970**



thyssenkrupp Rothe Erde GmbH

Achieving greatness requires great work

thyssenkrupp Rothe Erde is the world market leader in the design and production of slewing bearings and a leading producer of seamless rolled rings.



Slewing bearings get things moving

Rothe Erde® slewing bearings prove their worth every day as key design and connection elements in wind turbines, cranes, excavators and tunneling machines, to name only a few applications. This diversity of slewing bearings is reflected also in their dimensions, as we supply slewing bearings of up to 20 meters in diameter.

Seamless rolled rings keep everything in place

Rothe Erde® rings are an integral part of many diverse applications. They are used in slewing bearings, large gears, production plants, sprockets, wind turbines or pipeline construction and can have a diameter of up to 8 meters and can weigh up to 30 tons.

Our position

12 companies with a total of 17 plants in 10 countries demonstrate our global

presence and represent our clear objective to be close to our local customers. Worldwide, 7,000 employees at thyssenkrupp Rothe Erde turn thousands of tons of steel into tailor made solutions every month.

Holistic mindset and technical skills

Dedicated specialists work closely with customers starting from the development phase to the final solution. With decades of experience in slewing bearings and rings our skilled employees at thyssenkrupp Rothe Erde apply the very latest manufacturing and testing methods alongside innovative in-house analysis tools. Testing takes place at our Research & Development Center on full-size equipment and under realistic conditions.

With dedication and expertise, thyssenkrupp Rothe Erde is your partner to shape current and future market trends – challenge the thyssenkrupp Rothe Erde know-how.



thyssenkrupp

thyssenkrupp Rothe Erde GmbH

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Phone **+49 (0) 231 / 186 - 0**

Fax **+49 (0) 231 / 186 - 2500**

E-Mail **rotheerde@thyssenkrupp.com**

Web **www.thyssenkrupp-rotheerde.com/
GB/index.htm**

Profile **Bearings**

Category **Suppliers of mechanical
components**

Employees **approx. 7,000**

Founding year **1861**

Winergy

With over 100 GW gearbox capacity supplied Winergy is the world's leading component manufacturer for wind turbines. Winergy offers gearboxes, couplings & service of 750 kW–8 MW and more.



01

01 | Winergy gearboxes – The Drive Solution for Onshore & Offshore.

02 | The Winergy HybridDrive.

03 | Quality makes the difference.

Reliability is the foundation of a long-term partnership

In 1981, Winergy started to manufacture gearboxes specifically designed for wind turbines. Today, with more than 30 years of experience, Winergy offers the complete mechanical part for the drive train. To date we have supplied more than 100 GW of gearbox capacity. That means globally almost every third wind turbine reliably converts wind into electric power using our components.

To support your customers globally – you must be represented locally

Since Winergy's foundation, we have successfully implemented a globalization strategy and today operate production and service facilities in Europe, USA, India and China.

Quality is more than just a word to us – it is the essence of our products

The quality that we demand from our products is also reflected in our processes. Our customers all around the world benefit from our high-quality products and short

delivery times. This is achieved with our comprehensive and fully integrated process management, lean operation and zero defect tolerance.

Our drive train components are as unique as your requirements

Detailed wind turbine specification is the foundation of individual drive train development. Winergy takes its long-term experience into account to develop cost-effective solutions that perfectly fulfill customer requirements. The result: Mechanical components which increase energy efficiency.

Reliable service solutions

We have service concepts that are individually tailored to the requirements of our customers. The objective is to ensure high availability of your systems, resulting in reduced operating costs.



Winergy
Siemens AG

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46562 Voerde

Federal state **North Rhine-Westphalia / Germany**

Phone **+49 (0) 2871 / 92 - 4**

Fax **+49 (0) 2871 / 92 - 2487**

E-Mail **info@winergy-group.com**

Web **www.winergy-group.com**

Profile **Gears**

Category **Suppliers of mechanical components**

Founding year **1981**



02



03

Woodward Kempen GmbH

CONCYCLE Wind – Modular frequency converters for wind turbines up to 10 MW

Development, production and service of modular frequency converters for wind turbines in on- and offshore applications.

Reliable frequency converters with highest power density and maximum energy yield

For more than 20 years Woodward has been an independent and leading developer and manufacturer of frequency converters for wind turbines.

More than 14,500 installed frequency converters with a total power of up to 30,000 MW for on- and offshore wind turbines indicate the expertise and experience of Woodward in the wind industry.

Well structured processes and high quality standards of Woodward are an important success factor of the product lines itself and will have a significant influence to the very good market success of the Woodward customers.

Woodward's frequency converters are used flexibly as partial or full scale converters in the low voltage range as well as the medium voltage range in onshore and offshore wind turbine applications.

With the modular and entirely liquid-cooled frequency converters Woodward is setting the benchmark in wind power technology.

CONCYCLE® frequency converters are smaller, lighter and more powerful. Its application allows different arrangements in the nacelle or tower installation and ensures highest reliability and optimal efficiency at high quality of the supplied energy.

The intelligent controls of CONCYCLE® frequency converters meet all current international grid code requirements for a high possible energy yield.

Specially skilled, highly motivated and experienced WOODWARD employees in international service offices are able to offer fast spare part delivery and competent customer support at the highest level.

The development and application of the CONCYCLE® converter technology has played a substantial role in the success story of wind turbines in the multi-megawatt class.



01

- 01 | Concycle full size converter.
- 02 | Woodward Kempen GmbH.
- 03 | Power stack.



02



03



Woodward Kempen GmbH

Address **Krefelder Weg 47
47906 Kempen**

Federal state **North Rhine-Westphalia / Germany**

Phone **+49 (0) 2152 / 145 - 321**

Fax **+49 (0) 2152 / 145 - 468**

E-Mail **concycle@woodward.com**

Web **www.woodward.com**

Profile **Transformers, converters &
power resistors**

Category **Suppliers of electrical &
electronic components**

Employees **316 (278 in the field
of wind energy)**

Founding year **1996**





Companies:

Service & logistics

Planning, finance, transport, construction and marketing. The fields of planning and operation of wind turbines are a continuous growth market in Germany.

ABO Wind AG

Project developer with 20 years of experience and 350 employees

We erect and maintain wind farms with commitment and competence. Models for citizen participation, pioneer projects in electric storage and tourism projects complement our range of services.



01



02



03

Who we are

In 1996, Dr. Jochen Ahn and Matthias Bockholt founded ABO Wind. We have been growing steadily ever since and with an annual project volume of 250 million euros, we are among Europe's experienced

project developers. ABO Wind currently plans and erects wind farms in six European countries and in South America. We already installed more than 550 turbines with a capacity of 1.100 megawatts.

We plan your energy

ABO Wind initiates projects, acquires sites, carries out commercial and technical planning, completes bank financing and erects turnkey wind farms and biogas plants.

Wind farm management

We take care of the technical and economic success of your wind farm throughout the entire lifecycle of a project. No matter whether it is maintenance, inspections, repairs, 365-days on-call service or technical management: we offer just the right modules.

Storage of wind energy

Among other things, the department "future technologies" works on pioneer projects with the goal of storing wind power.

01 | ABO Wind enhances acceptance of the energy transition by catering for tourism.

02 | Wind energy is firmly rooted in society, which is obvious during the very social wind farm celebrations of ABO Wind.

03 | Experienced engineers and technicians ensure optimum operation of the turbines.

Tourism

We capture people's imagination with respect to wind energy. Interactive adventure trails and play areas in the vicinity of wind farms enable a sensual experience of wind energy and upgrade sites to tourist destinations.

Citizen participation

ABO Invest and its "Bürgerwindaktie" (citizen wind share), initiated by ABO Wind, operates wind farms throughout Europe in order to produce electricity. 4,000 citizens as well as foundations and cooperatives have already participated. The portfolio of ABO Invest consists of more than 62 wind turbines and is steadily growing. The ABO Invest share (ISIN DE000A1EWXA4) is traded at the open market of Düsseldorf stock exchange.



ABO Wind AG

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65195 Wiesbaden**

Federal state **Hesse / Germany**

Phone **+49 (0) 611 / 267 65 - 0**

Fax **+49 (0) 611 / 267 65 - 599**

E-Mail **kontakt@abo-wind.de**

Web **www.abo-wind.com**

Profile **Planners & project developers,
Service, maintenance & repair,
Technical & commercial
operational management**

Category **Planning, Operation & service**

Turnover **€ 250 million (project volume)**

Employees **350**

Founding year **1996**

Aero Enterprise GmbH

Sustainable airborne quality assurance

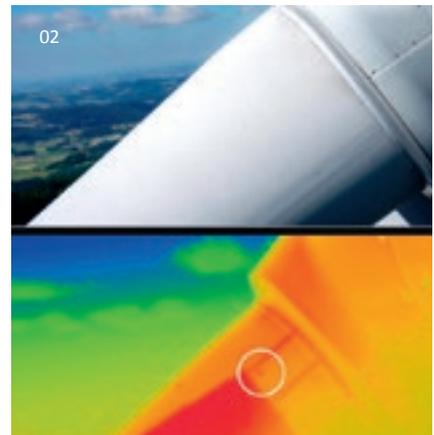
Subjective damage assessments are yesterday's news. Today the SensorCopter is in the air.



03



01



02

Austrian company Aero Enterprise GmbH uses a drone, the "SensorCopter", to inspect vertical objects such as wind turbines or industrial plants for possible damage. The company focuses on the display and comparative evaluation of damage data and expert services.

The advantage of the new method is the standardised inspection and comparability of measured values from recurring surveys. It provides standardised data about abnormalities on surfaces and structures over long periods of time. This combination of drone, measuring station and evaluation software is completely unique.

Damage localisation with the SensorCopter

The "SensorCopter" is an unmanned, semi-automatic and robust helicopter equipped with high-resolution cameras and a range of sensors. The precision flight is run by autopilot.

Data evaluation – accurate, fast and objective

The control tower acts as an all-terrain ground control centre, equipped with all the necessary hardware and software for ongoing aerial monitoring, data transmission and data evaluation. Data collected during the flight is evaluated and classified using software developed by Aero Enterprise, "AERO-Lyse". The result is a clear report about the current actual condition of the facility.

Sustainable quality assurance – reliable forecasts

Comparable and traceable data are needed to monitor facilities over long periods. Using the in-house software packages we developed, anomalies on a facility are recorded, compared and classified over the years. This makes it possible to predict how damage will develop. By detecting trends, preventive measures can be decided on.

01 | Sustainable quality assurance from the air.

02 | Image comparison of wind turbine with infrared.

03 | The SensorCopter.

AeroEnterprise GmbH
intelligent airborne inspection

Aero Enterprise GmbH
Address **Bürgerstr. 7**
4300 St. Valentin
State **Austria**
Phone **+43 (0) 7435 / 21 11-0**
E-Mail **office@aero-enterprise.com**
Web **www.aero-enterprise.com**
Profile **Service, maintenance & repair**
Category **Operation & service**
Employees **7**
Founding year **2013**

Availon GmbH

United Wind Service

Availon is the global leader of multibrand service providers in the MW class. Today, more than 400 highly qualified employees attend to over 2,600 MWs. Almost half of them with full maintenance.



01

01 | Headquarter Rheine, Germany.
02 | Multibrand Service.

Along with the headquarters in Rheine, Germany, and further German locations, Availon is also on site in Italy, Spain, Austria, Poland, Portugal and the USA. Further locations are being planned. The focus of the cooperation with our customers are their needs and wishes. Availon sees customers as partners and considers them equals in an open dialogue, from sole operators to energy corporations.

The offer ranges from flexible, modular service solutions right up to full maintenance. Always contractually adhered to and implemented. Multibrand, particularly for GE®, Vestas® and Gamesa® WTGs. Services range from remote monitoring to cost-reducing upgrades and WTG optimisations to spare parts supply, even with major components. We always offer what makes the most technical and economical sense for the WTGs. And what offers customers actual benefits or added value.

Availon relies on the expertise of its engineers. In Rheine and Hamburg, along with general optimizations, improvements for specific WTGs are also being developed. The engineering department is also a part of the pro-active fault analysis, allowing servicing to be even better planned for increased system availability and better yield opportunities.

Our quality as well as our environmental and work safety is subject to strict ISO 9001, ISO 14001 and OHSAS 18001, certified by DNV GL Group for our divisions in Germany – Rheine, Hamburg and Erfurt; and also in Italy - Rome.

“Vestas” is a registered trademark of Vestas Wind Systems A/S, DK. “Gamesa” is a registered trademark of GAMESA CORPORACION TECNOLOGICA, S.A., ES. “GE” is a registered trademark of GENERAL ELECTRIC COMPANY, US



Availon GmbH
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48429 Rheine
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 Phone **+49 (0) 5971 / 80 00 - 0**
 Fax **+49 (0) 5971 / 80 00 - 1009**
 E-Mail **windservice@availon.eu**
 Web **www.availon.eu**
 Profile **Service, maintenance & repair**
 Category **Operation & service**
 Turnover **€ 62 million**
 Employees **400**
 Founding year **2007**

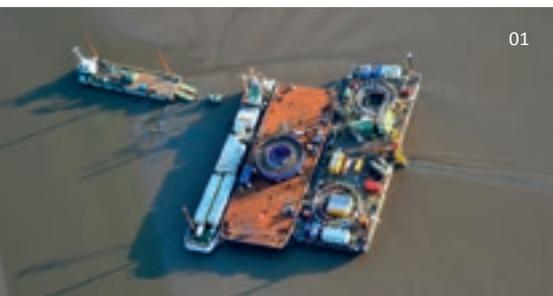


02

Bohlen & Doyen GmbH

WE MOVE ENERGY

Offshore cable laying and installations: A powerful partner for maximum availability of offshore wind farms.



01



02



03

Bohlen & Doyen offers a comprehensive portfolio of services with regards to the offshore wind sector. Bohlen & Doyen is an independent service provider offering the following skill sets to maintain offshore wind energy.

Our services

- Submarine cable laying
- Submarine cable inspection (diagnostics, fault location and analyses)
- Submarine cable detection
- Submarine cable repair
- Service for substations and transformer platforms
- Service for wind energy plants

Submarine cable laying, grid connection and power connection components are the focus of our portfolio. Primarily this includes installation and maintenance of export and infield cables and the assembly of medium voltage and fiber optic network connections. Maintenance and repair work on the WTG and transformer platforms round off our portfolio. Our control center provides a 24/7 emergency service and is open 365 days a year. The coordination of service activities is carried out in the event of a fault without delay.

In German Waters

Bohlen & Doyen is considered an expert of cable laying in the tidal areas and in the sensitive area of the Wadden Sea. Our shipping fleet and the special, environmentally friendly equipment allows precise, economical laying methods at highly variable water levels.

Bohlen & Doyen deploys state-of-the-art concepts for maintenance to ensure maximum wind energy availability. Our main focus is on the medium voltage connection, the network connection components of the wind turbine and the transformer platforms.

Our service "Fast Response"

Damage to cables and components are expensive with regard to wind energy interruption. With our technical capabilities, the downtime of wind turbines and platforms can be significantly shortened.

01 | Construction site Wadden Sea.

02 | Accessing the topside.

03 | Cable on the barge.



Bohlen & Doyen GmbH

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Fax **+49 (0) 4944 / 301 - 411**

E-Mail **info@bohlen-doyen.com**

Web **www.bohlen-doyen.com**

Profile **Service, maintenance & repair**

Category **Operation & service**

Turnover **€ 220 million (project volume)**

(€ 45 million in the field of wind energy)

Employees **1,900 (80 in the field of wind energy)**

Founding year **1950**

BayWa r.e. renewable energy GmbH

r.e.sponsible for your success

BayWa r.e. is one of the leading providers within the renewable energy sector in wind power, solar, bioenergy and geothermal. Our many years of experience in the wind energy sector in conjunction with a service range that covers all key areas benefit customers and business partners alike.



A specialist in developing, planning, financing, building, managing and maintaining wind turbines, BayWa r.e. is a solid and experienced partner. BayWa r.e. offers a diverse range of services:

Project development and turnkey construction

BayWa r.e. has developed and implemented wind farms with installed capacity of over 1,450 MW worldwide. Among BayWa r.e.'s customers are local councils, local developers, energy cooperatives and institutions. In addition to developing and implementing its own projects, BayWa r.e. also handles the turnkey construction of wind turbines as a service for third parties.

The range of services includes:

- Site analysis and evaluation
- Land acquisition
- Planning permission/implementation
- Turnkey construction as a general contractor
- Project management
- Project structuring and funding

Technical and commercial management

As a service provider for investment funds, banks, international investment companies, municipal utilities and citizens'

cooperatives, BayWa r.e. manages the technical and commercial aspects of wind and solar energy projects with total rated capacity of over 1,500 MW all over Europe.

The range of services includes:

- Multilingual control centre, round-the-clock support
- Control of maintenance and servicing
- Manufacturer-independent operational management system
- Comprehensive reporting
- Regional service staff for checks and immediate troubleshooting
- Servicing and maintenance work in medium to high voltage range
- BGV A3 electrical equipment tests
- Contract and stakeholder management
- Ongoing accountancy
- Financial management
- Budget and liquidity management
- Insurance management
- Representation and assertion of the operator's assets

Range of rotor blade services

As a certified and manufacturer-independent service provider, BayWa r.e. provides extensive services to optimise and maintain rotor blades of all manufacturers and performance categories:



BayWa r.e. renewable energy GmbH

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Fax +49 (0) 89 / 38 39 32 - 32

E-Mail info@baywa-re.com

Web www.baywa-re.com

Profile Project developers

Service, maintenance & repair

Technical & commercial

operational management

Direct marketers

Category Planning

Operation & service

Direct marketing

Turnover € 786 million (2014)

Employees 860

Founding year 2009





- Servicing and maintenance of rotor blades, on site and at the factory
- Assessments, warranty inspections and periodic inspections
- Cleaning and sealing of rotor blades, as well as cleaning of nacelles and towers
- Distribution of used wind turbines
- Developing add-on components to optimise rotor blades
- Heavy-duty transportation fleet to convey rotor blades and large components
- Disposal of rotor blades
- Storage of rotor blades and replacement blade sets

Planning and consulting

BayWa r.e. offers comprehensive technical consulting and planning services for renewable energy.

The range of services includes:

- Project evaluations and due diligence reports
- LIDAR measurements
- Yield and emission reports
- Feasibility studies
- Planning permission and management
- Planning implementation and monitoring construction
- Project management
- Optimising operation

Energy trading

BayWa r.e. also offers electricity marketing for producers of renewable electricity generated from wind, solar, biomass and geothermal sources, as part of the market bonus model and in the electricity balancing market:

- Energy trading of renewable electricity: Generation forecasts, EEG energy trading, accounting group management, remote control
- Assumption of marketing risks
- Optimising revenue potential: Marketing in the energy balancing market and wholesale market
- Usage of own electricity and regional marketing models for electricity producers; processing via internal accounting groups and billing systems

01 | Campomaggiore wind farm (Italy).

02 | Heavy-duty transportation with our own fleet of vehicles.

03 | Construction of Klågerup wind farm (Sweden).

04 | Gunzenhausen wind farm (Germany).

Together with experienced employees from BayWa r.e., numerous customers and business partners have been able to realise the most appropriate solution for their business success. Moreover, backed by the financial strength of BayWa AG, BayWa r.e. is a reliable business partner for the long term.

The company is aligned to international markets and operates in the core markets of Europe and the US.

CUBE Engineering GmbH

Thinking outside the box

25 years of leading renewable energy projects. What makes that possible?

Our enthusiasm is what motivates us. It has shown us the way and been our constant companion now for more than 25 years.



- 01 | CUBE Comic decentralized energy systems.
- 02 | Wind measurement, Sirt/Libya.
- 03 | Foundation work, Dorubantu/Romania.



CUBE Engineering GmbH

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34119 Kassel
 Federal state **Hesse / Germany**
 Phone **+49 (0) 561 / 28 85 73 - 10**
 Fax **+49 (0) 561 / 28 85 73 - 19**
 E-Mail **kassel@cube-engineering.com**
 Web **www.cube-engineering.com**
 Profile **Planners & project developers**
 Category **Planning**
 Employees **70**
 Founding year **1991**

CUBE Engineering is one of the top 20 companies in the world in the wind consulting sector. Its services are based on a quality management system (e. g. DIN ISO 17025) and produce certified and bankable results.

CUBE Engineering has successfully accompanied more than 4,800 projects around the world with a total installed rated capacity of over 16,300 MW.

Skills

The portfolio of services includes management consulting (e. g. feasibility studies), wind assessments (e. g. LiDAR- and field-measurements, wind assessment reports), planning and project management (e. g. due diligence, tendering and construction supervision), decentralized energy systems with electricity marketing (e. g. biogas, smart grids, wind-diesel-/island hybrid systems), environmental and solar assessments, electrical grids and education and training. The company is regularly involved in national and international research

programmes to develop new products and advance the sector, which is still comparatively young.

References

At an international level, CUBE Engineering focuses on selected countries and markets in which current or future renewable energies have a significant share of the energy supply and security. This direction demands particularly professional and comprehensive project management, in connection with advice and training (e. g. capacity building) throughout the process.

The company supports the principles of the United Nations Global Compact.

Company sites

The headquarters of CUBE Engineering is in Kassel; other German offices are in Hamburg and Hanover. Worldwide the company is working with a network of project offices.



DAL Deutsche Anlagen-Leasing GmbH & Co. KG

DAL is part of the German Savings Banks Finance Group and is one of the leading providers of asset finance solutions in the energy, logistics and property industries in Germany.



We structure investment or financing projects for the long term, and work as an arranger to bring our customers' projects together with the financing strength of the German savings banks and Landesbanken, as well as our partner Deutsche Leasing AG. We establish new sources of financing and support financial diversification, both on a local and a national scale. The assets under management of around 11 billion euros and new deals of over 1 billion euros annually are full of more ideas and solutions which have been implemented in order to facilitate investments.

Core expertise in structuring and financing renewable energy projects

We were structuring renewable energy projects long before the introduction of the EEG. We therefore have many years of experience and extensive expert knowledge on the latest state of the art. As well as developing an optimum financing structure (project financing, leasing, hire-purchase) from a single source, we actively support our customers in networking, therefore

optimising the project structure. On presentation of the basic key parameters of a wind project (onshore), we guarantee a quick response time for initial financing indications. Our mission is to improve the profitability of every project by optimising the integration of subsidised loans.

In order to provide our customers with extensive, individual consulting services, we have constantly extended our energy sector in recent years. Whether a new construction or repowering (onshore), we make our customers' visions a reality.



01 | Whether new construction or repowering – visions become reality with DAL.

02 | Financing concepts for new energies. Smart. Future-proof. Quick response.

03 | DAL office in Mainz-Kastel.



DAL Deutsche Anlagen-Leasing GmbH & Co. KG

Address **Wilhelm-Theodor-Römheld-Str. 30**
55130 Mainz

Federal state **Rhineland-Palatinate / Germany**

Phone **+49 (0) 6134 / 565 - 277**

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E-Mail **info@dal.de**

Web **www.dal.de**

Profile **Banks, financial institutions & financial service providers**

Category **Finance & law**

Turnover **over € 1 billion annually**

Employees **250**

Founding year **1962**

Deutsche Kreditbank

Financing know-how combined with technological expertise

With 9 billion euros, DKB is one of the largest financiers for renewable energies in Germany.



Jörg-Uwe Fischer, head of the Renewable Energy Competence Centre at DKB.



Deutsche Kreditbank AG (DKB)
 Address **Taubenstr. 7–9**
10117 Berlin
 Federal state **Berlin / Germany**
 Phone **+49 (0) 30 / 120 30 - 9930**
 Fax **+49 (0) 30 / 120 30 - 9902**
 E-Mail **joerg-uwe.fischer@dkb.de**
 Web **www.DKB.de/erneuerbare-energien**
 Profile **Banks, financial institutions & financial service providers**
 Category **Finance & law**
 Employees **about 3,200 (group)**
 Founding year **1990**

Facilities for using renewable energies not only need to be appropriately implemented, but have customised financing too. DKB knows the challenges of the sector and offers financing solutions for a wide range of technologies, turbine types, project sizes and funding conditions.

Our experience, which includes over 1,900 financed wind turbines, 1,500 photovoltaic installations and 570 bioenergy plants, is a clear advantage for our customers. They can expect comprehensive technical know-how from our consultants who work alongside our financing experts in the customer teams. Our technical consultants include not only agricultural and structural engineers but notably process and environmental technicians too.

We aspire to know the full extent of renewable energies at least as well as the banking business. Working actively with professional associations on both a national and regional level is essential according to our understanding. “We not only want to know what the new general conditions of the sector are but have an influence on them too,” explains Jörg-Uwe Fischer, member of the communications committee of the financing board in the German Wind Energy Association and head of the Renewable Energy Competence Centre of DKB.

DKB creates new sales and development opportunities for its customers while connecting the actors involved in its customer groups – farmers, turbine manufacturers, regional public utilities companies and national energy providers, as well as local authorities. We also create individual solutions within the sector, which, for example, involve citizens economically in wind and solar farms, local heating networks or residential and school projects. Since 2004, DKB has initiated or supported 70 such public participation schemes.



Deutsche Messe AG

Wind energy sector to convene at world's leading industrial trade fair in Hanover, Germany, in 2016.



The wind energy industry meets in Hanover

This year's HANNOVER MESSE for the wind industry is an ideal platform for the sector to showcase itself under the slogan of "integrated energy" and to demonstrate that it is an important part of the overall value chain in the energy economy. Decentralised power generation is on the increase, which creates significant challenges for the grids. Success and acceptance of renewable energies are highly dependent on how they can be stored or distributed in the future. At the HANNOVER MESSE 2016, more than 1,300 companies will reveal how they are contributing to a secure and competitive energy supply. The Integrated Energy Plaza is at the centre of the event. This is where the energy system of the future will be presented –

and where wind energy plays a prominent role. This sector will be on show in hall 27 near other types of renewable power generation, including innovative storage technologies.

In conjunction with Partner Country USA, HANNOVER MESSE 2016 will also offer an attractive market for the entire wind industry. According to an initial forecast by The Windicator, in 2015, after China, most wind turbines were installed in the USA. Around 5.9 gigawatts were connected to the grid there last year.

More than 200,000 industry specialists from around the world are expected at the HANNOVER MESSE. According to surveys taken in recent years, one out of every three visitors is interested in wind energy.

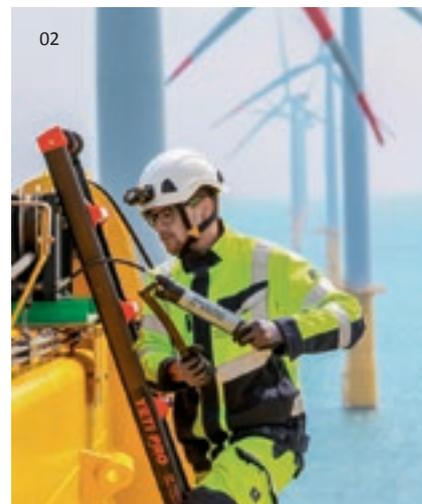


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Federal state **Lower Saxony / Germany**
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Fax **+49 (0) 511 / 89 - 311 48**
E-Mail **thomas.pinkowski@messe.de**
Web **www.messe.de**
Profile **Trade fairs & conferences for the wind energy industry**
Category **Other services**
Turnover **€ 312 million**
Employees **more than 1,000**
Founding year **1947**

Deutsche Windtechnik

International service for the entire system – onshore and offshore

It's not only in Germany that there is a constant demand for independent service. Interest for ISPs is growing on an international scale, both on- and offshore. Deutsche Windtechnik is right at the center of it all.



01 | More than 200 service teams operate for Deutsche Windtechnik internationally.

02 | Deutsche Windtechnik offers a complete, integrated service for offshore wind farms as well from foundation, to blade, to offshore substation (OSS). The majority of our processes are certified to ISO 9001:2008.



Deutsche Windtechnik

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E-Mail **info@deutsche-windtechnik.de**

Web **www.deutsche-windtechnik.de**

Profile **Service, maintenance & repair**

Category **Operation & service**

Turnover **€ 95 million (2015)**

Employees **750**

Founding year **2007**

Expertise, flexibility and more value for lower costs – these are what set apart the quality of our service. With its diverse range of core competencies, the company is able to offer the full package of services from a single source. We now service over 3,500 wind turbines in Europe, 2,700 of which as part of permanent maintenance contracts (basic maintenance and full service). Our ultimate objective is to secure technical systems operation as best as possible and operate in a cost-efficient way.

Based in Germany, at home in Europe

Our decentralised service network enables us to swiftly reach the customer, the wind turbine and spare parts warehouse. Our company's head office is based in Bremen, Germany. In addition, we are also becoming increasingly active abroad: locations in Spain, Poland, the United Kingdom, the Netherlands, Denmark and France provide the foundation of high-quality systems maintenance in European countries out-

side Germany. We trade in spare parts of electronic components around the world.

Maintenance from A to Z

Whether it is the entire wind turbine, the controlling system, nacelle, rotor or the foundations, from large components to the smallest electronic components, through to the substation – our team consists of experts who understand your wind turbine portfolio and can provide economical benefits from a service point of view. Onshore and offshore.

Our range of services includes in particular:

- Full and basic maintenance (Vestas, NEG-Micon, Siemens/AN Bonus, Nordex, Senvion, Fuhrlander)
- Reconditioning
- Improvements to relevant components
- Creation of expert reports
- Safety inspections
- Development and sale of spare parts
- Repowering

DunoAir Windpark Planung GmbH

The energy transition comes first

As a specialist for the planning, construction and management of sites for wind turbines in Germany and abroad, DunoAir promotes climate and environmental protection.

We are a family-oriented company and safeguarding the future for the generations to come is important to us. The energy transition is an important move towards a time when access to energy is clean, inexhaustible and affordable. This goal strengthens our resolve every day to commit ourselves to wind power.

DunoAir originally began with Arjen C.F. Ploeg as a project buyer. The company developed dynamically in the years that followed and successfully established itself on the market. With the creation of its own planning department in 2009, DunoAir Windpark Planung GmbH, we have finally become a successful full-service company covering the entire value chain. From planning and construction to operation, DunoAir covers all the relevant fields for implementing projects in a serious, prompt and reliable manner.

Qualified and motivated staff are particularly important. They are the reason that DunoAir was able to grow into an international company with offices in Germany, the Netherlands and Ireland, and with projects boasting a total installed capacity of 130 MW.

Communities and local companies are closely involved in project development and are kept regularly up-to-date. Transparency like this creates trust and forms the basis for good and sustainable collaboration, with a view to adding value at a regional level.

The DunoAir team looks forward to giving investors, planners and operators the benefit of its expertise. Contact us and discover a reliable partner for the successful implementation of your projects.



01

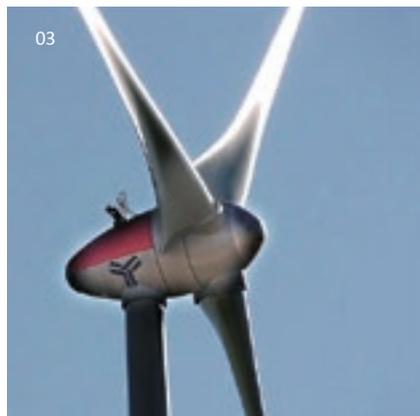
01 | A relaxed glimpse of the future – wind farm festival in Weibern-Rieden.

02 | Company founder Arjen C.F. Ploeg.

03 | One of 14 wind turbines in Mastershausen.



02



03

DUNO **AIR**

DunoAir Windpark Planung GmbH

Address **Brotstr. 1
54290 Trier**

Federal state **Rhineland-Palatinate / Germany**

Phone **+49 (0) 651 / 99 98 89 13**

E-Mail **c.wuertz@dunoair.com**

Web **www.dunoair.com**

Profile **Project developers**

Category **Planning**

Employees **10**

Founding year **2004**

EcofinConcept GmbH

Consulting, project development, investments and project placement

In the budding wind power industry, EcofinConcept GmbH is a very experienced, successful and independent company with a 100 per cent focus on renewable energy.



01

01 | Wind farm in Northern Germany.

02 | Managing Partners of EcofinConcept GmbH: Guido Vieten (left) and Christian Sperling (right).

EcofinConcept GmbH has been successfully operating in the wind energy sector for over 10 years.

As well as conventional consulting services, EcofinConcept's **range of services** also primarily includes project acquisition, project development and marketing, commercial due diligence, transaction support, securing of project financing, and the conceptual design of participation options.

In the field of **consulting**, EcofinConcept works for energy supply companies, financial and private investors, planning offices, operators and project developers. The experienced management team have extensive expertise both in terms of commercial knowledge and the necessary insight into the market and sector.

In **project development**, EcofinConcept offers a complete range of services for a successful project, from the acquisition of suitable sites, through project planning, to installation of the turbines. This is carried

out in close collaboration with land owners, communities, public authorities and project partners. The company is not only interested in new wind farm sites, but also in project optimisation and repowering of existing wind turbines.

Investment opportunities are available in entire wind farms and individual turbines.

Brief **references** for the company and managing directors: Project management, project design, development, structuring, financing and/or marketing for more than 70 projects with a total investment volume of more than 578 million euros and an installed nominal capacity of nearly 360 MW.

The company's philosophy is to be able to offer tailored solutions in a reliable, uncomplicated and professional manner.

EcofinConcept GmbH

Renewable Energies

EcofinConcept GmbH

Address **Rheinstr. 7**

41836 Hückelhoven

Federal state **North Rhine-Westphalia / Germany**

Phone **+49 (0) 2433 / 970 - 471**

Fax **+49 (0) 2433 / 970 - 107**

E-Mail **info@ecofinconcept.de**

Web **www.ecofinconcept.de**

Profile **Consulting & business consulting**

Category **Finance & law**

Founding year **2005**



02

The Koopmann Group

Professional services for energy suppliers

Condition based maintenance and repairs are carried out according to manufacturer instructions, and focus on operating conditions and the requirements of the equipment.

We are in our element with energy

With its five sites in north-west Germany, the Koopmann group is an up-and-coming, medium-size family company in its second generation.

A team of specialists is available around the clock 365 days of the year and equipped with both the expertise and the technology required to meet all needs.

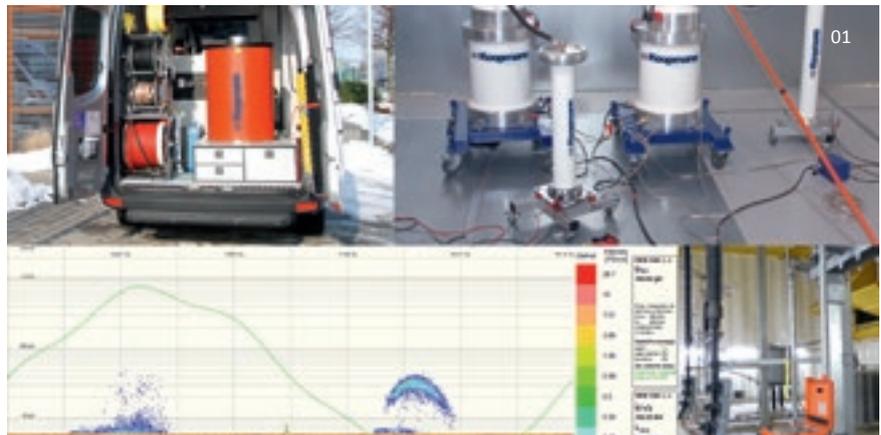
Onshore/offshore service profile

Our portfolio in the field of wind power includes installation, maintenance, repairs, inspections, commissioning and delivery of turnkey distribution and switching stations.

We carry out both routine inspections and maintenance and repair following a fault. Our fields of activity include new installations of switching stations, cable sections and transformers up to 110 kV. The field of installation and assembly is extended with commissioning and repeat tests. This ensures that we can detect defects in good time, which occur due to the effects of ageing, external influences and due to assembly errors even years after commissioning.

Extensive equipment

Our equipment includes cable monitoring cars incl. pre-locating and pin-pointing, partial discharge measuring systems, high-voltage testing systems up to 250 kV, the CPC 100 test system and measuring devices for insulation, transmission ratio, winding resistance and dielectric frequency response measurements to check transformers.



In our transformer service centre we offer repairs and maintenance of transformers as well as sales and leasing. Furthermore, we look after repairs and procurements of switching systems of various manufacturers.

As an experienced partner we are available for reliable and long-term operation of energy supply facilities.

01 | MV diagnostic vehicle, 100 kV partial discharge measuring system, reflection measurements on HV cables.

02 | Offshore wind farm.



Elektro Koopmann GmbH Headquarters

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49661 Cloppenburg

Federal state **Lower Saxony / Germany**

Phone **+49 (0) 4471 / 9494-0**

Fax **+49 (0) 4471 / 84895**

E-Mail **info@hk-c.de**

Web **www.hk-c.de**

Profile **Service, maintenance & repair**

Category **Operation & service**

Turnover **approx. € 19 million**

Employees **134**

Founding year **1982**



EMD Deutschland

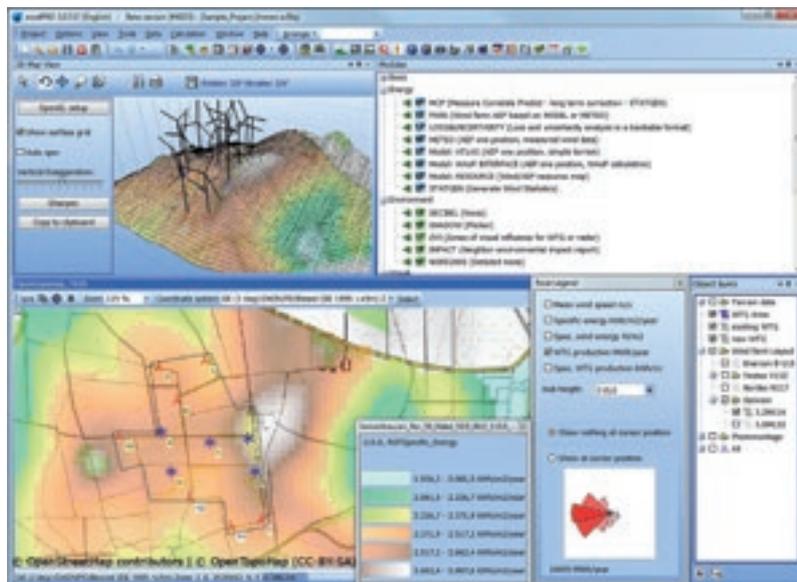
Software and training from a single source

EMD Deutschland is the exclusive distributor of windPRO and energyPRO software in German-speaking countries and Eastern Europe. EMD has been a one-stop shop for software & training for over 20 years.

EMD Deutschland

EMD Deutschland GbR was founded in 1999, but EMD's business in Germany goes back to 1991 when Stefan Chun introduced the "Windatlas System" DOS software from the Danish company Energi-og Miljø-data onto the German market.

As well as selling the two software packages windPRO and energyPRO and providing technical support, software training is also part of the core business. To date EMD Deutschland has trained more than 1,000 users from all over the world.



windPRO 3.0 map window with wind resources and 3D view.



EMD Deutschland GbR

www.emd.dk

EMD Deutschland GbR

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Fax **+49 (0) 561 / 310 59 - 69**

E-Mail **emd-de@emd.dk**

Web **www.emd.dk**

Profile **Education & training**

Category **Education & training**

Turnover **€ 5.8 million**

(EMD International A/S)

Employees **7 (EMD Deutschland)**

Founding year **1999**



windPRO – the software for planning wind power projects

windPRO is a modular software package for planning, designing and documenting wind power projects covering various areas of application, from calculating the energy yield, analysing wind data and calculations for environmental studies to electrical grid connection. Its ease of use and constant further development including new conditions and industry-specific findings makes windPRO the world's leading software for planning wind power projects. Users include developers, consultants, wind turbine manufacturers, energy supply companies, banks and supervisory authorities.



energyPRO – the simulation software for energy systems

energyPRO is a progressive modelling tool for the techno-economic simulation of the runtime of energy systems including combined heat and power plants, thermal energy storage, district heating, solar collectors, photovoltaic plants, wind farms, refrigeration plants, furnaces and biogas/biomass plants. Planners, developers and operators of energy systems simulate the interaction of generation, storage and use. Different variants in the design of plants and plant-related infrastructure (virtual power plants) can be calculated quickly and easily.

EnBW Energie Baden-Württemberg AG

Whether it be in the development, acquisition, construction or operation of wind energy installations – EnBW is active along the entire project value added chain independently and as a partner.

EnBW Energie-Baden-Württemberg AG is systematically expanding its commitment in the field of wind energy. Whether it be in the development, acquisition, construction, operation or direct marketing of energy installations, our company is active along the entire project value added chain independently and as a partner.

In 2010, EnBW put into operation the first commercial offshore wind farm in the German Baltic, EnBW Baltic 1. The EnBW Baltic 2 farm was officially put into operation in September 2015. We also intend to continue to expand our offshore portfolio in the North Sea. Currently planning has been started for the offshore wind farm EnBW Hohe See. Furthermore EnBW has completed all approval procedures for the



offshore wind farms He Dreihl and Albatros.

In the onshore segment, EnBW currently operates around 100 turbines throughout Germany with a total output of roughly 200 MW as at the end of 2015. EnBW's onshore team has its headquarters in Stuttgart and also has offices in Hamburg, Berlin, Trier and Erfurt. The goal of EnBW is to operate onshore wind energy installations in Germany with a total capacity of 1,000 MW by the year 2020.



01 | EnBW Berghülen wind farm.
02 | EnBW Baltic 1 offshore wind farm.
03 | EnBW Westerheim wind farm.



EnBW Energie
Baden-Württemberg AG

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70567 Stuttgart

Federal state Baden-Württemberg / Germany

Phone +49 (0) 711 / 289-0

E-Mail renewables@enbw.com

Web www.enbw.com

Profile Energy services

Category Energy services

Turnover € 21,002.50 (2014)

Employees 20,092 (2014)

Founding year 1997

Energiekontor AG

The Energiekontor Group plans and implements wind farms and solar parks in Germany, Portugal and the UK. With more than 25 years of experience, the company is a pioneer in its field.



The core competencies of the Energiekontor Group include the planning, financing, implementation and management of wind farms and solar parks. Since 1990, the company has planned and set up

580 wind turbines in more than 100 wind farms as well as two solar projects with a total rated capacity of more than 840 MW in Germany, the UK and Portugal. The total investment volume for these projects is over 1.3 billion euros. The group has acquired a large number of windy and sunny locations for future projects.

a few years now: the Group's own wind farms make up around 30 wind farms with 265 MW in Germany, Portugal and the UK. These own farms generate a stable cash flow and make a significant contribution to the company's success. Energiekontor is also taking over and continuing the operation of wind farms situated in Germany to further expand the Group's own farms.

All Group-owned, sold and additionally bought wind farms are managed by Energiekontor AG. This includes 24-hour remote maintenance 365 days a year, as well as measures for technical optimisation.

Energiekontor was founded in 1990 in Bremerhaven by Dr Bodo Wilkens and Günter Lammers. The company currently employs approximately 170 people.



Energiekontor is also redesigning the areas of already existing wind farms and is developing projects with modern, powerful wind turbines as part of its repowering plans.

As well as the projects planned on dry land, the company also prepared offshore projects in the North Sea off the German coast. To date, project rights have been sold for around 150 wind turbines.

As an independent, medium-sized electricity producer, the Energiekontor Group has also been operating its own wind farms for



Energiekontor AG
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28359 Bremen
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 Phone **+49 (0) 421 / 33 04 - 0**
 Fax **+49 (0) 421 / 33 04 - 4 44**
 E-Mail **info@energiekontor.de**
 Web **www.energiekontor.de**
 Profile **Project developers**
 Category **Planning**
 Turnover **€ 153.3 million (2014)**
 Employees **approx. 170**
 Founding year **1990**

envia THERM GmbH

envia THERM has many years of experience in generating power and supplying heating in eastern Germany. The company is closely connected to the region, keeping value creation local. To implement the energy transition in eastern Germany, envia THERM is looking for new partners for wind power projects.

envia THERM is a wholly owned subsidiary of envia Mitteldeutsche Energie AG (enviaM), the leading regional energy provider in eastern Germany.

The company combines all the generation activities of the enviaM-Group and has extensive knowledge and expertise in planning, building and operating power generation plants. envia operates power plants at 33 sites across eastern Germany, which generate energy from biomass, biogas, hydropower and wind power.

Partnership of equals

envia THERM's aim is to actively shape the energy transition in eastern Germany. The company is especially keen on close, dependable collaboration with local players. Whether it is local communities, land owners, or project planners, envia THERM stands for a partnership of equals.

The company takes special care to ensure the full involvement at an early stage of all leading individuals. In addition, envia THERM offers investment models tailored to the needs of citizens, local authorities and municipal utilities. And it's not only here that the company wishes to keep value creation local.

In addition to acceptance and involvement, envia THERM places great emphasis on achieving sustainable earnings from the renewable energy plants it operates. That's why the company values solid planning and financing for its projects.



Competence centre for renewable energies

envia THERM has in-depth experience of searching for, analysing and evaluating sites. The same goes for operating power plants – from contract management to direct marketing of the energy generated and repowering of wind turbines.

Local councils, municipal utilities and project developers in eastern Germany wishing to implement new projects in the field of renewable energy will find envia THERM a competent and reliable partner.



envia THERM GmbH
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06112 Halle (Saale)
Federal state **Saxony-Anhalt / Deutschland**
Phone **+49 (0) 345 / 216-0**
E-Mail **info@envia-therm.de**
Web **www.envia-therm.de**
Profile **Technical & commercial operational management**
Category **Operation & service**
Turnover **€ 156 million (2014)**
Employees **132 (2014)**
Founding year **2006**

Energiequelle GmbH

Our company philosophy: combining economy and ecology

Energiequelle GmbH is perfectly at home with the full range of services for onshore wind energy. We carry out projects from site selection to grid connection. As an operator we guarantee maximum availability and perfect commercial management of wind turbines.



Review and outlook

In 2015 we were able to draw on the great business results of the previous year. Both in Germany and in France, our most important foreign market, we again constructed numerous wind turbines, which began feeding power into the grid by the end of 2015 or were commissioned at the start of the new year.

Our installation plan in Germany and France for 2016 covers around 80 MW. Gregor Weber, Head of International Projects at Energiequelle GmbH: "Our success in France has encouraged us to gain a foothold in other European countries. In 2016 we'll be setting up an office in Finland."

The installation of the "Regionales Regelkraftwerk Feldheim (RRKW)" (regional balancing power station), a joint project with Enercon GmbH, was completed late in the summer of 2015.

Our management business unit is continuing to develop very dynamically. To date it covers a total of 652 turbines totalling 1,161 MW, enabling us to consolidate our excellent position among Germany's largest wind farm managers. Unit manager Lars Schiller: "In the past year we have once again succeeded in convincing a range of third-party operators of the quality of our services, and exceeded the 1,000 MW barrier for managed wind power in Germany."

About us

For almost 20 years Energiequelle GmbH has been implementing renewable energy projects throughout Germany and Europe as a project development company. It takes care of the entire process, from selecting the site and construction through connection of turbines to private and public grids. With 150 employees at five different sites, Energiequelle GmbH has planned and installed more than 650 wind turbines with a total installed capacity of around 1,150 MW. Energiequelle GmbH is one of the biggest service providers in Germany in the field of technical and commercial management.



Energiequelle GmbH

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Phone **+49 (0) 33769 / 87 11 00**

E-Mail **info@energiequelle.de**

Web **www.energiequelle.de**

Profile **Project developers**

Category **Planning**

Turnover **€ 120 million (2015)**

Employees **150**

Founding year **1997**



Regionales Regelkraftwerk Feldheim (RRKW) – Primary balancing power for the energy transition

In the village of Feldheim, Brandenburg, in autumn 2015 the then largest battery storage system in Europe was finally commissioned after a one-year construction phase. The Regionales Regelkraftwerk (RRKW) is a joint project between Energiequelle and Enercon GmbH and received funding from the EU. The 3,360 lithium-ion cells from the Korean manufacturer LG together add up to a rating of 10 MW and a working capacity of 10.7 MWh. The large battery storage system will be used for primary control to stabilise frequency fluctuations in the transmission grid. Commercial use through the primary balancing power market will begin in the first quarter of

2016. The RRKW will be fed from the neighbouring Feldheim wind farm. The village of Feldheim has been self-sufficient in energy since 2010. This means that power and heat are generated locally by wind turbines and a biomass power plant, and supplied to the consumption points via the village's own grids.

Energiequelle: We make energy transition a reality – through sustainability and innovation

Energiequelle GmbH is making an active contribution to sustainable, modern power generation. Environmental protection and the drive for constant innovation and high service quality are what spur us on and lead to healthy, organic company growth.

01 | Official opening of the Regionales Regelkraftwerk Feldheim (RRKW) on 8 September 2015.

02 | RRKW: Facade design according to the winning design of a student competition.

03 | The team at Energiequelle is well-equipped for the tasks ahead.

**Tomorrow's energy
for today's people**



eueco GmbH

Public participation. Made easy.

We offer optimal support: Our IT solutions and services let you offer public participation that is standardised yet customised to your projects.



Implementation examples of public participation portals with regiocap® for project planners, energy suppliers, public utility companies and regions.



eueco GmbH

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E-Mail **info@eueco.de**

Web **www.eueco.de**

Profile **Software solutions**

Category **Other services**

Founding year **2012**

eueco has been professionalising the financial participation of citizens for years. We support renowned players in the field with regiocap®, the leading online portal solution for citizens' participation. Using our extensive know-how, we ensure the success of your participation scheme, from structuring to implementation.

Ensuring that the motivations and goals of those participating in community-funded projects are optimally matched is key to the success of your project. We accurately coordinate the current legal conditions, standardised handling, communication and financial organisation, thus setting standards for participation in energy projects or grids.

Optimum efficiency and convenience for citizens' participation

Handling of the financial participation of citizens via regiocap®: eueco has developed the leading online portal solution in the market, regiocap®, to support efficient management of citizens' participation. regiocap® depicts the entire lifecycle of participation, from the presentation of the project and advertising for funds to its handling and management. As a flexible white label solution, it renders public participation consistent, replicable and does away with the usual administrative expenses. A citizens' participation project becomes easy to carry out without using up resources thanks to the high level of automation. regiocap® is also suited to managing investors in existing community wind farms.

Public participation. Made simple.

Our services/your benefits

- Public participation also without a prospectus via crowdfunding
- Automated advertising and management via our portal solution regiocap® (contracts, payments, online access for investors, payouts, tax certificates, etc.)
- Public participation on the basis of a limited partnership, cooperative, loan and others
- Creation of prospectuses and legal conditions from one source
- Marketing (sales documents, communication, etc.)
- Simple import of existing investment data of existing

EWIS GmbH & Co. KG

A company of the QSB Group Germany

With over 30 years' experience and expertise, EWIS is a reliable partner for its customers when it comes to material testing, damage inspections and welding technology in the wind energy sector.

The construction and manufacturing requirements for components are now higher than ever. Safety and product/installation profitability – often in conjunction with liability issues – are increasingly at the forefront of customer's concerns. It is even more important to get to grips with material properties and the use of components in different environmental conditions.

We are an international group of companies with locations in Germany, Austria and Norway, and we have successfully implemented numerous complex projects over several years:

- Non-destructive tests
- Mechanical and technological inspections
- Chemical inspections
- Construction supervision
- Welding supervision
- Welding tests
- Welding procedure tests (PED)
- Documentation

The QSB Group (quality assurance, service & consultancy) offers you the full range of QC/QA and non-destructive materials testing. In addition to conventional tests, we also provide:

- Visual testing (VT)
- Penetration testing (PT)
- Magnetic particle testing (MT)
- Ultrasonic testing (UT)
- Radiographic testing (RT)



as well as partial or fully automated special testing technologies, such as:

- Ultrasonic phased array (UT)
- Ultrasonic TOFD (UT)
- Immersion ultrasonic technique (UT)
- Eddy current testing (ET)
- Eddy current array technique (ET)
- Digital radiology (DR)
- Hardness tests (HAT)
- Spectral analysis (OES)
- Push-out tests
- Chemical analyses (wet and dry)
- Pressure tests on hoses (dynamic)
- EDX analysis
- IR spectrometry
- Corrosion inspections
- Macroscopic and microscopic inspections
- Mechanical and technological tests
- Oil and grease-free requirements
- Scanning electron microscopy

All tests are performed in accordance with current standards or adjusted to the customer's particular specifications.



01 | EWIS NDT supervisor performing QA work on Meerwind-OSS in the North Sea.

02 | EWIS inspectors support the manufacture of wind turbines. Weld seam testing on tower segments.



EWIS GmbH & Co. KG
European material and
inspection service

Address **Einsiedelstr. 6**
23554 Lübeck

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Phone **+49 (0) 451 / 484 76-0**

Fax **+49 (0) 451 / 484 76-29**

E-Mail **ewis@qsbgroup.eu**

Web **www.qsbgroup.eu**

Profile **Certification**

Category **Experts**

Turnover **€ 5 million (€ 1 million in the field
of wind energy)**

Employees **78 (17 in the field of wind energy)**

Founding year **1997**

FGH – Research Association for Power Systems and Power Economics

Your first point of contact for the grid integration of your generating plant
– professional, reliable, experienced.



FGH GmbH provides electrotechnical engineering services for manufacturers, project developers and grid operators. These services include e. g. grid and system studies, planning and engineering of electrical layouts, configurations and components, engineering of mobile fault-ride-through (FRT-)testing laboratories and consulting services concerning grid integration of international projects. Furthermore, FGH develops individual software solutions for network planning and the collection and evaluation of disturbance data.

Our experience from the relevant standardization committees of FGW, DKE and IEC, together with our high level of methodological expertise, ensures that our customers receive the best technical accuracy. We constantly develop our methods in national and international R&D projects and share this knowledge regularly in seminars with industry experts.



For the past 90 years FGH e. V. has been providing tailored R&D services for all aspects relating to electricity supply.

As the first accredited independent certification body, today incorporated in the spin-off FGH Zertifizierungsgesellschaft mbH (established in 2015), we are a pioneer and market leader with respect to certified grid integration of decentralised generating plants. The portfolio includes certification of units and plants according to international grid codes, as well as certification of products and components such as storage solutions, power plant controllers and grid control units.

FGH – Research Association for Power Systems and Power Economics
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 Fax **+49 (0) 621 / 97 68 07 70**
 E-Mail **hanna.johnen@fgh-ma.de**
 Web **www.fgh-ma.de**
 Profile **Technical consultants**
 Category **Experts**
 Turnover **€ 7.3 million (all companies, 2015)**
 – approx. **€ 3.0 million in the field of wind energy (2015)**
 Employees **77 (all companies)**
 Founding year **1921**



GAIA mbH

Your professional partner for planning, development, project coordination, service and management of wind turbines and photovoltaic systems.



The "Gesellschaft für Alternative Ingenieurtechnische Anwendungen", GAIA mbH, is one of the pioneers in renewable energy in Rheinland-Pfalz. Our expertise is the planning and construction of wind and solar power plants as well as the development of individual sustainable energy concepts. Following the successful implementation of a project, we take over the management of wind turbines, wind farms and photovoltaic systems and offer service and maintenance.

The GAIA offices: an old energy-gain-building.



Established in 1999 by Dipl.-Kfm. Torsten Szielasko and Dipl.-Ing. Michael Wahl as an engineering company, GAIA currently employs 38 highly motivated and qualified members of staff. Their work contributes to the transition towards a sustainable energy system, a form of practical environmental protection.

Integrated, sustainable, flexible

"Everything from a single source" – The keystone of GAIA's business philosophy. We cover all processes in the development of wind and solar projects: From initiation to the turnkey handover to the operator, we take care of all aspects of project management. During every step we keep a close eye on the criteria of sustainability.

In addition we offer support to individual project elements or sub-projects. For example, the GAIA team monitors and maintains wind turbines by different manufacturers. They carry out various services, such as periodic inspections, management

of on-site appraisals, cable sheaths and protection checks. We provide these services also for third-party systems.



GAIA mbH

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E-Mail **info@gaia-mbh.de**

Web **www.gaia-mbh.de**

Profile **Planners & project developers**

Category **Planning**

Turnover **€ 7.5 million**

Employees **38**

Founding year **1999**

GEWI AG

INNOVATIVE, ECOLOGICAL, TOGETHER
GEWI AG – YOUR PARTNER FOR DIRECT MARKETING.



01 | Competence and expert knowledge in the energy market.
02 | Working together to come up with innovative energy solutions. Decisive: the quality of the forecasting.

GEWI AG has been operating as a service company in the energy industry since 2009. We are a medium-sized company with 12 employees based in Hanover, and are a subsidiary of GETEC Energie AG, which itself has had more than 10 successful years on the energy market.

It is our philosophy and mission to act as an intermediary between the producers and the consumers on the energy market – always remaining on an equal footing with our partners.

Our core business is currently focused on the direct marketing of renewable energies. The task here is to integrate energies from renewable sources (wind, biomass and solar) into the deregulated energy market. In other words, to trade energy under market- and competition-led conditions with the aim of achieving the energy transition in the most sustainable way possible.

On this basis, we specialise in developing individual supply concepts for and with our customers. We take care to ensure that the optimum supply concept is developed in consideration of the legal framework and that the needs of all parties are met in the best possible way.

In keeping with our medium size, we pride ourselves on our honesty and frankness, as well as our simple and to-the-point contracts.

Do you have power generation capacity that you want to market in a sustainable yet profitable way? Or are you interested in supplying the power you generate locally and using it yourself – all at a competitive price? Please do get in touch.

We will be happy to develop an individual concept with you. And we will of course handle all tasks required for the energy market.



GEWI AG

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E-Mail **info@gewi-ag.de**

Web **www.gewi-ag.de**

Profile **Energy services**

Category **Energy services**

Founding year **2009**



GMA-Werkstoffprüfung GmbH

GMA is your onshore and offshore partner for quality assurance, along all stages of a wind energy project: from planning & development, manufacture & installation to the operation of plants or their components.

GMA-Werkstoffprüfung GmbH supports you in increasing the availability of your onshore and offshore wind farms. Our service portfolio includes quality assurance activities for manufacturers and suppliers of wind turbines and their components, during the transport and assembly process and as continuous monitoring, analysis and optimisation of turbines in operation.

Plant safety and problem-free operation

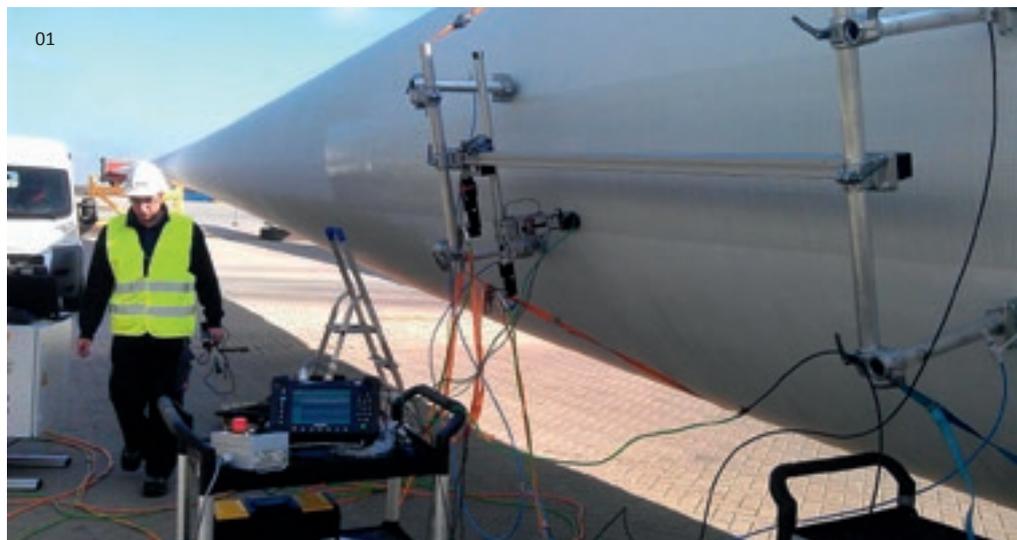
In order to optimise the yield of your wind turbines and increase operational safety, we continuously monitor the condition of your wind turbines and carry out remaining service life analyses, as GMA specialises in testing and inspecting wind turbines. With over 30 years' experience in materials testing and quality assurance, we are a recognised, certified and accredited service provider for the following services:

Non-destructive testing

- All components including rotor blades (ultrasound, surface crack, X-ray and eddy-current testing, phased array, thermography)



02



01

- Training and R&D centre of rotor blades
- Expert know-how for testing all materials including fibre-reinforced plastics

01 | NDT Team with UT Scanner in action.

02 | Inhouse NDT testing of rotor blade on the ground.

Destructive testing and sample preparation

- Development phase
- Material approval
- Verification of production processes
- Damage analysis (mechanical, analytical, metallographic materials testing)

3D Measurement

- Geometry measurement with the accuracy of 0.05 + 0.01 mm/m
- Range of around 80 m

Control unit and controller optimisations

- Remaining service life analyses
- Structural health monitoring (acoustic emission and vibration)



A MEMBER OF MISTRAS

GMA-WERKSTOFFPRÜFUNG.GMBH

GMA-Werkstoffprüfung GmbH

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21684 Stade

Federal state **Lower Saxony / Germany**

Phone **+49 (0) 41414 / 79 44-0**

Fax **+49 (0) 41414 / 79 44-299**

E-Mail **info@gma-group.com**

Web **www.gma-group.com**

Profile **Quality assurance**

Category **Operation & service**

Turnover **€ 51 million (€ 4.5 million**

in the field of wind energy)

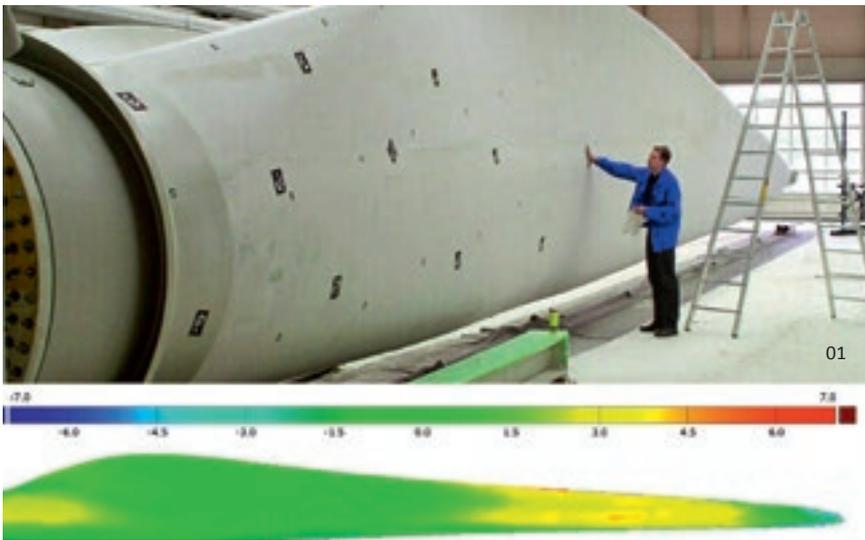
Employees **700 (50 in the field of wind energy)**

Founding year **1984**

GOM – Optical Measuring Techniques

GOM – Precise Industrial 3D Metrology

Quick and flexible component tests and coordinate measurements for the wind industry.



01 | Inspection of very large components with optical 3D coordinate measuring.

02 | Monitoring of movement, stress and deformation.



GOM – Optical Measuring Techniques

Address Mittelweg 7–8

38106 Braunschweig

Federal state Lower Saxony / Germany

Phone +49 (0) 531 / 390 29 - 0

Fax +49 (0) 531 / 390 29 - 15

E-Mail info@gom.com

Web www.gom.com

Profile Quality assurance

Category Operation & service

Employees 400

Founding year 1990

GOM develops, produces and distributes hardware and software for optical 3D coordinate measurements and deformation analysis worldwide. The technology company is headquartered in Germany and has branches in Switzerland, France, the UK, Italy, Belgium and China, as well as 55 partner offices in 36 countries.

Optical 3D measuring technology

Non-contact, optical 3D measuring technology has become a mobile and flexible tool for product development, quality assurance and component testing. It is used to improve and accelerate development, production and maintenance processes.

3D scanning

Production tools and wind turbine components need to be manufactured accurately and to high quality standards. GOM's 3D scanners provide full-field, high-resolution

scans of components. For quality control, the measured data can be compared with a CAD or master data set. Example areas of application include 3D measurement of rotor blade geometry and analysis of gears and hubs.

Coordinate measurement

Optical 3D coordinate measuring by GOM is possible even under difficult conditions and on large components such as towers and nacelles. It allows individual construction components, such as assembly bolts and surfaces, to be quickly inspected and any problems remedied before assembly.

Deformation analysis

The dynamic monitoring of movement, stress and deformation is indispensable for analyzing components. GOM systems provide measurements for wind turbine structures under load, either at specific points or across the entire surface. They replace conventional transducers, strain gauges and accelerometers and can be used for fatigue testing, for investigating the dynamic behavior of rotor blades and for gearbox testing, for example.



Green Energy 3000 GmbH

Project development of renewable energy systems

Development, construction and operation of wind energy and pv projects around the world.



Green Energy 3000 GmbH

The Leipzig-based company Green Energy 3000 GmbH is a specialist in the planning, development and construction of wind power and solar energy projects. Our staff have been working in the field of renewable energies since 1994. Since its foundation in 2004 the company has implemented a wide range of projects nationally and internationally. Already we supply more than 60,000 households with non-polluting electricity, saving more than 110,000 tons of CO₂ every year.

With our tried and tested partners in financing and project realization we stand for profitable projects that benefit the environment.

Focal activities:

- Developing concepts for wind power and solar energy projects
- Technical concepts for wind turbines and photovoltaic systems
- Acquisition of land and roof area
- Planning and approval processes for wind and photovoltaic systems
- Grid connection procedures
- Tenders and submissions
- Construction management and site supervision up to commissioning
- Issue a corporate bond

Green Energy 3000 GmbH –
Project development of renewable energy systems.



Green Energy 3000 GmbH

Address **Torgauer Str. 231**

04347 Leipzig

Federal state **Saxony / Germany**

Phone **+49 (0) 341 / 35 56 04 - 0**

Fax **+49 (0) 341 / 35 56 04 - 70**

E-Mail **info@ge3000.de**

Web **www.ge3000.de**

Profile **Project developers**

Category **Planning**

Employees **50**

Founding year **2004**

GÖRG Partnerschaft von Rechtsanwälten mbB

GÖRG is one of the leading full service corporate law firms and has many years of experience in energy regulation law in the energy industry, in the field of project development and with M&A transactions.



- Drafting, structuring and negotiating project agreements,
- Drafting, structuring and negotiating purchase agreements (SPA and APA),
- Transaction handling and supplementary corporate documentation,
- Providing support with all issues related to energy regulation law (grid connection, grid usage, grid access),
- Drafting and negotiating direct marketing agreements, agreements regarding the supply of emissions allowances and legal consulting, and structuring of trade with proofs of origin.

Our advice in the field of offshore wind energy covers

- Legal consulting and providing support with capacity allocation processes with the German Federal Network Agency,
- Providing support with the approval procedure,
- Structuring and negotiating all supply, installation and other project agreements for the procurement of components of a wind farm and the installation and logistics agreements,
- Corporate and tax structuring of project companies and infrastructure companies,
- Legal advice for financing,
- Support during (Europe wide) tendering procedures and the development of procurement law-related solutions in emergency situations, and
- Ongoing advice during the installation and commissioning phase (contract and claim management).

With over 250 lawyers at its six offices in Berlin, Essen, Frankfurt am Main, Hamburg, Cologne and Munich, as an independent firm GÖRG advises on all core areas of commercial law.

Legal advice on energy law forms a core part of its activities. The energy law team at GÖRG has extensive expertise in the wind industry, both onshore and offshore. We support our clients with planning, financing, acquiring, installing and operating both onshore and offshore wind farms.

Our advice in the field of onshore wind energy covers

- Checking and providing support with approval processes under public law,
- Performing legal and fiscal due diligence,
- Corporate and tax structuring of project companies and infrastructure companies,



**GÖRG Partnerschaft von
Rechtsanwälten mbB**

Address **Kennedyplatz 2
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Federal state **North Rhine-Westphalia / Germany**

Phone **+49 (0) 221 / 336 60-0**

Fax **+49 (0) 221 / 336 60-80**

E-Mail **cologne@goerg.de**

Web **www.goerg.de**

Profile **Lawyers**

Category **Finance & law**

Employees **250 lawyers (22 lawyers in the field
of wind energy)**

Founding year **1996**



GÖRG also provides advice on all aspects of energy regulation law (grid connection, grid access, regulation of grid fees, exceptions of particular infrastructures from the regulation, closed distribution networks/customer systems, framework conditions for energy storage), energy competition law (effectiveness of long-term supply contracts or grid access agreements, price control, compliance advice and cartel fine procedures), energy contract law (creation and negotiation of electricity and gas supply contracts, of grid connection, connection usage and grid usage contracts, of energy trading contracts based on model contracts, e.g. EFET, of contracting models) and energy trading and the legal optimisation of energy procurement (savings of electricity price components, own supply concepts).

Our energy law team also represents its clients at regulatory bodies and (arbitration) courts.

We represent energy companies, banks, financial institutions, suppliers, manufacturers, investors, developers, the public sector, energy traders and large energy consumers.

In addition to specialists in energy industry law, our team also includes experts from the fields of corporate law, taxes, financing, turbine manufacturing, real estate law, public commercial law and energy competition law.

Any questions? We are happy to respond.



green[::]match

smart investment management

green[::]match is your reliable provider for web-based investment software specially designed for renewable energies. Leading investors, developers and banks use our solutions.



green[::]match project overview with cashflow waterfall.

By using extensive analysis and scenarios, you can check your assumptions in order to focus on the right priorities. green[::]match is setting the new standard in efficiency, comparability and reliability.

Gain a competitive advantage with green[::]match

- Reduce your transaction costs
- Save time and avoid expensive errors
- Quantify the financial risks in a way that is both standardised and reliable
- Assess complex projects regardless of technology, project progress and country specifics
- Efficiently exchange information with the relevant players for the project
- Put green[::]match to use immediately

Sustainable Finance Team (SFT)

As an exclusive consulting partner, SFT offers training sessions and courses on using green[::]match. SFT also assists project buyers and sellers during the transaction process and supports operators with portfolio & asset management.

green[::]match



When investing in renewables, speed, accuracy and standardisation are key factors for success. Thanks to green[::]match you can instantly make informed investment decisions and reduce your transaction costs by a significant amount. The unique platform takes investors, project developers and banks into a new dimension of investment automation.

green[::]match provides project players a standardised way to record their financial project parameters – even with the most complex structures. In addition, centrally managed templates guarantee a high level of both efficiency and compliance. If required, projects can be shared with internal and external stakeholders. For making sound decisions, our tool provides you with all the relevant information that you need.



greenmatch gmbh
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 Phone **+41 (0) 61 / 301 50-00**
 E-Mail **info@greenmatch.ch**
info@sft-basel.ch
 Web **www.greenmatch.ch**
www.sft-basel.ch
 Profile **Software solutions**
 Category **Other services**
 Founding year **2011**

Greenwind

Green Wind Energy GmbH & Green Wind Operations GmbH

With the power of wind: Green Wind Energy GmbH in the field of project development of wind farms and Green Wind Operations GmbH for technical and commercial operational management of wind power plants.



Green Wind Energy GmbH

We develop wind power projects on-site for private and institutional wind farm operators – using strong regional commitment, up-to-date knowledge of wind and enthusiasm for renewable energy.

We support our partners during the entire development process – from financing and land procurement through to planning, building and commissioning – until the plant turns the wind into profit.



Green Wind Operations GmbH

Our technical operational management demonstrates its full power by working with the plant on the basis of detailed analyses and inspections as well as evaluating internal data, using expert appraisals and statutory requirements.

For us, commercial operational management means: a constant flow of finances and problem-free invoicing. We eliminate disruptive factors and unnecessary costs, and optimise contracts in order to obtain the best possible revenues.

We get the very best for our customers – from planning, technologies, contracts – and from ourselves!

With the power of wind

Martin Kühl und Manuel Lasse,
managing directors.



Green Wind Energy GmbH
Green Wind Operations GmbH
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10117 Berlin
Federal state **Berlin / Germany**
Phone **+49 (0) 30 / 351 28 86 30**
E-Mail **berlin@greenwindenergy.de**
Web **www.greenwindenergy.de**
Profile **Project developers**
Technical & commercial
operational management
Category **Planning**
Operation & service
Employees **20**
Founding year **2008**

HUSUM Wind, 12 – 15 September 2017

Trade fair and congress for the German speaking market in Husum –
home of the wind industry

Do Business – Create the Future.



With the most important exhibitors and visitors, HUSUM Wind 2017 (12–15 September) will again have an increased focus on the wind market in Germany and its neighbouring regions, and will once again be the meeting place for the wind industry’s movers and shakers, for old hands and new.

The HUSUM Wind Congress, running parallel to the exhibition, highlights innovations and developments within the industry both on and offshore, and is an important source of information about all the challenges facing the industry.

Husum is known throughout the world as the cradle of the modern wind industry, and for the last twenty-five years, HUSUM Wind has been globally recognised as the international wind industry’s most important trade fair.

One of the great advantages Husum has over its competitors is its location. Situated on Germany’s North Sea coast, the North Frisia region is home to several leading turbine manufacturers and an army of supply businesses, as well as training facilities for service and maintenance engineers. This means that visitors to HUSUM Wind can also visit nearby wind farms, manufacturers and associated industries to see innovation and technology in action.

Attendees also have the opportunity to visit the new wind turbine test fields nearby.

Husum’s attractive peripheral events also guarantee that in 2017 all attendees will be able to enjoy just that right balance of work and play which makes Husum so popular.

With over 60 per cent of the available space already booked (at the time of going to press in February 2016), the future looks good for Husum and the international wind industry as a whole.

www.husumwind.com



The German
Wind Trade Fair
and Congress

12–15 Sept. 2017
Husum, Germany

**HUSUM Wind /
Messe Husum & Congress**

Address **Am Messeplatz 12–18
25813 Husum**

Federal state **Schleswig-Holstein / Germany**

Phone **+49 (0) 4841 / 902-0**

Fax **+49 (0) 4841 / 902-246**

E-Mail **info@husumwind.com**

Web **www.husumwind.com**

Profile **Trade fairs & conferences**

Category **Other services**

Employees **35 (10 in the field of wind energy)**

Founding year **1989**

in.power GmbH

in.power GmbH is an independent specialist for direct marketing and system integration of renewable energies and celebrates its 10th company anniversary in 2016. Affiliates in.power metering and grün.power (green power supplier) complete the offers.

One of the first companies in Germany to do so, in.power GmbH (Mainz) has worked in the direct marketing of renewable and eco-friendly energies since 2006, in particular from fluctuating energy sources such as wind farms and solar power plants. The company's name "in.power" comes from "independent power" and clearly illustrates the group independence of the company. The company currently has a market share of over 1,200 MW in the direct marketing of renewable energies.

In 2016 the innovative company will celebrate its 10th anniversary. It is proud to have promoted the integration of renewables into the market and system, something that is also an important personal concern for both of the founders, Josef Werum and Matthias Roth. Both managing directors have worked intensively in the fields of renewable energies, eco power marketing models, market integration and IT systems for over 20 years.

Remote control solutions, metering points operation and measuring services are offered by the independent subsidiary in.power metering GmbH. An energy data portal allows customers to access metering data, that is updated close to real time,



as well as financial data relevant for controlling and management.

In 2012 the subsidiary grün.power GmbH was founded in order to provide end customers with green power. The company offers high-quality eco power products and demonstrates how a future 100 per cent supply from renewable and eco-friendly energies can work today. What makes grün.power unique is the simultaneous supply from renewable and eco-friendly energies, so that energy demand is met by an appropriate supply.

01 | The company founders Josef Werum (left) and Matthias Roth have plenty of ideas relating to the energy economy.

02 | The in.power team.

in.power

in.power GmbH
Address **An der Fahrt 5**
55124 Mainz
Federal state **Rhineland-Palatinate / Deutschland**
Phone **+49 (0) 6131 / 696 57-0**
Fax **+49 (0) 6131 / 696 57-29**
E-Mail **kontakt@inpower.de**
Web **www.inpower.de**
Profile **Direct marketers**
Category **Direct marketing**
Turnover **approx. € 10 million**
Employees **approx. 10**
Founding year **2006**

ITEC International GmbH

We ensure optimum operation

ITEC International GmbH - professional business administration and technical operational management in the wind power industry. The main business is to manage of erected wind farms throughout Europe.



Performance optimisation

The company uses the latest technology in order to achieve the best possible results and continuously meet customers' growing demands for reliable wind farm operations. Such technology provides for the permanent monitoring of wind farms – the goal is to reduce to a minimum any operating losses which might result from downtimes or decreased performance. Additional benefits are obtained by extensively evaluating all tasks performed. This ensures that service and maintenance agreements, as well as processes and work flows, are continuously adapted and optimised in line with growing demands.

Services

Technical operational management includes remote monitoring with redundant data storage, 24/7 readiness, quick response times provided by local onsite management, performance data analysis, damage management and prevention, monitoring of maintenance, service and inspection deadlines, technical reporting and quality management. Commercial operational management includes financial accounting and contract administration services, controlling and budgeting, liquidity planning strategy and payment transactions, insurance management, direct marketing, load management, general reporting and customer-focused reporting, contract drafting services and energy management.

From its foundation in 2000, ITEC International GmbH has specialized in providing professional business administration and technical operational management services. A key focus has always been the operational management of wind farms. With its main headquarters in Leer, ITEC manages facilities at various locations throughout Europe.

Highly qualified management

With growing investment volumes fed into in the wind energy sector by large-scale domestic and international investors, recent years have seen increasing demands for operational management of wind farms. To ensure this, ITEC is i.a. certified according to DIN EN ISO 9001. Helmut Claassen and Gernot Knipper, the company's executive general managers, have taken on this responsibility. Additional 40 employees have already been hired to assist them in business administration and the technical operational management of about 350 wind turbines (>550 MW) and 16 substations.



ITEC International GmbH

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26789 Leer

Federal state **Lower Saxony / Deutschland**

Phone **+49 (0) 491 / 912 40-600**

Fax **+49 (0) 40 / 912 40-699**

E-Mail **info@itec-international.de**

Web **www.itec-international.de**

Profile **Technical & commercial**
operational management

Category **Operation & service**

Employees **40**

Founding year **2000**

Jetstream Bosse Ing.-Büro für Windenergienutzung

Dipl.-Ing. Peter Bosse

Your partner Jetstream Bosse, with more than 25 years of experience in the wind energy field, is happy to assist you with expert consulting and operational management of wind energy projects.

Service – Expert consulting

Expert consulting in accordance with the latest in technology and many years of professional experience are required for an informed and qualified condition assessment of your wind turbine.

We offer the following services:

1. Expert consulting (wind turbines)
 - Plant, project, commissioning or warranty inspections
 - Periodic inspections according to construction law every 2–4 years
 - Condition-oriented inspections
2. Rotor blade assessment
3. Value reports
4. Damage assessment
5. Vibration control analyses of wind turbines
 - Rotor imbalance measurement
 - Machine diagnostics with mobile 10 channel CMS
6. Gear analysis – video endoscopy, oil and cog shape analysis
7. Inspection of power train alignment – single laser with continuous measuring mode (evidential)



02

8. Expert testing for PPE, ladder and arrester systems, cranes, chain hoists, cable winches
9. Due diligence, technical and economic consulting
10. Construction monitoring of wind energy projects

Service – Management

With approx. 100 wind turbines, we have been assisting operators and investors in managing 600 to 2,500 kW of output since 1999 with modern, 24/7 management. Thanks to Rotorsoft®, our customer-oriented and easy-to-use management software, all processes on the wind turbines are documented and quick reaction times guaranteed. Additional special turbines and manufacturer-related access software in our remote data monitoring allow direct access to the wind turbine for error analysis and targeted resource planning of the service.

Our strength! A highly motivated and well-qualified team available for you around the clock.



03



01

Photo: P. Bosse

- 01 | Appraisal NX 90.
- 02 | Wind farm at dusk.
- 03 | Jetstream-Bladewalker.



Jetstream Bosse Ing.-Büro für Windenergienutzung

Address **Hoepfnerstr. 34**
12101 Berlin

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Phone **+49 (0) 30 / 78 99 15 25**

Fax **+49 (0) 30 / 78 99 15 26**

E-Mail **info@jetstream-bosse.de**

Web **www.jetstream-bosse.de**

Profile **Technical consultants**

Category **Experts**

Employees **6**

Founding year **1999**

juwi Energieprojekte GmbH

Energy is here

We support you from start to finish in planning a successful project: finding the best locations, turnkey erection of turbines, and performing technical and operational management.



02

01 + 03 | juwi as an EPC partner: wind energy projects in collaboration with regional partners and with a high degree of regional participation through such bodies as citizens' energy cooperatives, among others.

02 | juwi wind farm in south western Germany.



juwi Energieprojekte GmbH

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55286 Wörrstadt**

Federal state **Rhineland-Palatinate / Germany**

Phone **+49 (0) 6732 / 96 57-0**

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E-Mail **info@juwi.com**

Web **www.juwi.com**

Profile **Project developers**

Category **Planning**

Turnover **> € 500 million (approx.
€ 300 million in the field of
wind energy)**

Employees **> 1,000 (worldwide)**

Founding year **1996**



03

Competent and experienced partners: We plan and install your wind farm

juwi is one of the leading specialists in wind and solar energy projects, and can provide complete project development and other services related to the construction and management of renewable power plants.

juwi was founded in 1996 in the Rhineland-Palatinate region in Germany. Around the world, the juwi group employs some



01

1,000 staff with projects and subsidiaries on every continent.

Know-how for complex locations

Across Germany, juwi has installed 700 wind turbines with a rated capacity of over 1,500 megawatts – juwi has proven expertise, even in very complex locations with a hilly or forested terrain.

A pioneering partnership

Towards the end of 2014, the juwi group and the Mannheim-based company MVV Energie AG agreed on a pioneering partnership with the aim of creating a high-performance, safe and environmentally-friendly energy system. The result was a sustainable business model that covers the entire energy economy value chain.

Our strengths at a glance

- Long-term' experience: we have been developing and managing wind farms since 1996
- Strong partnership with Mannheim-based MVV Energie, one of the largest German energy suppliers
- Complete range of services: from finding sites to installation
- Cooperation with all major turbine and component suppliers
- Strong regional presence throughout Germany
- Participation of citizens and councils
- Confident business relationships with banks and investors
- High level of customer satisfaction with technical and commercial management
- Concept development and implementation of repowering projects

Kaiserwetter Energy Asset Management GmbH

Kaiserwetter is an independent service provider for the asset, portfolio and risk management of wind and solar parks in Germany, Spain, France and Poland with a total installed capacity of 470 MW.



How can the investments of institutional investors in renewable energy projects be turned into risk adjusted assets? How can an investor monitor and evaluate his pan-European energy assets? How can an investor identify and evaluate any investment and operating risks? By choosing the right partner – Kaiserwetter Energy Asset Management.

Asset management

At Kaiserwetter, we focus on performance. It is the key element of our economic activities and supplemented by the technical and commercial management. Thanks to our long-term expertise, every investor can rest assured that the performance will continue to be maximized and remain in our focus.

Portfolio management

Kaiserwetter offers its customers the opportunity to add an aggregated top level which is able to challenge the current technical and commercial managers to significantly improve the efficiency of wind and solar parks. Long-term contracts with

current managers do not pose a problem for this approach. Thus, Kaiserwetter is able to maximize the performance of the entire portfolio.

Risk management

Our Kaiserwetter Risk Management is a wide-ranging solution for the provision of digital services. The goal is to identify and evaluate risks and to implement measures to minimize the risks of investing in renewable energies. Furthermore, with the help of our Monte-Carlo-Simulation, Kaiserwetter is able to map complex sensitivities.

Our ambition

We provide our customers with profound knowledge regarding the technical and financial management for wind and solar parks on the basis of digital services. Our ambition: To provide maximum control – regardless of location, integration and achievement of returns for the parks in favour of the investors.



Kaiserwetter Energy Asset Management GmbH

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20354 Hamburg
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Phone **+49 (0) 40 / 53 05 66-120**
Fax **+49 (0) 40 / 53 05 66-199**
E-Mail **tbr@kaiserwetter.eu**
Web **www.kaiserwetter.eu**
Profile **Technical & commercial operational management**
Category **Operation & service**
Turnover **€ 2.5 million**
Employees **60**
Founding year **2012**

M.O.E. GmbH

Moeller Operating Engineering GmbH

The certification body for grid integration and system services (SDL).



The M.O.E. team in front of the company's headquarters in Itzehoe.



M.O.E. GmbH

Address **Fraunhoferstr. 3**
25524 Itzehoe

Federal state **Schleswig-Holstein / Germany**

Phone **+49 (0) 4821 / 406 36 - 0**

Fax **+49 (0) 4821 / 406 36 - 40**

E-Mail **info@moe-service.com**

Web **www.moe-service.com**

Profile **Certification**

Category **Experts**

Turnover **€ 4.9 million**

Employees **78**

Founding year **2009**

The integration of local generation plants into the grid is the main field of business of M.O.E. GmbH (Moeller Operating Engineering GmbH). The mid-sized company with sites in Itzehoe, Kiel and Hamburg, Germany, works both across Germany and internationally. M.O.E. has established itself as a highly qualified competence centre, particularly regarding the certification of both generation units and generation plants and their components. Moreover, M.O.E. is among the leading experts for questions about safety checks and harmonic measurements, with its services offered both in Germany and abroad. The portfolio has now been expanded into the fields of regular inspections and acoustics, load and performance measurements.

M.O.E. GmbH's fields of competence

- Wind energy/photovoltaics/combustion engines/storage systems/hydroelectric power
- Grid integration
- Requirements for local energy generation plants
- Certification
- Guidelines and standards

Types of certification

- Unit certification for wind turbines, photovoltaic and battery inverters, combustion engines and hydroelectric power stations
- Plant certification for wind farms, solar parks, battery storage systems and other power generation plants such as cogeneration and hydroelectric plants
- Component certification/e.g. park control units, LVRT units
- Certifications according to international grid codes
- Low-voltage certification

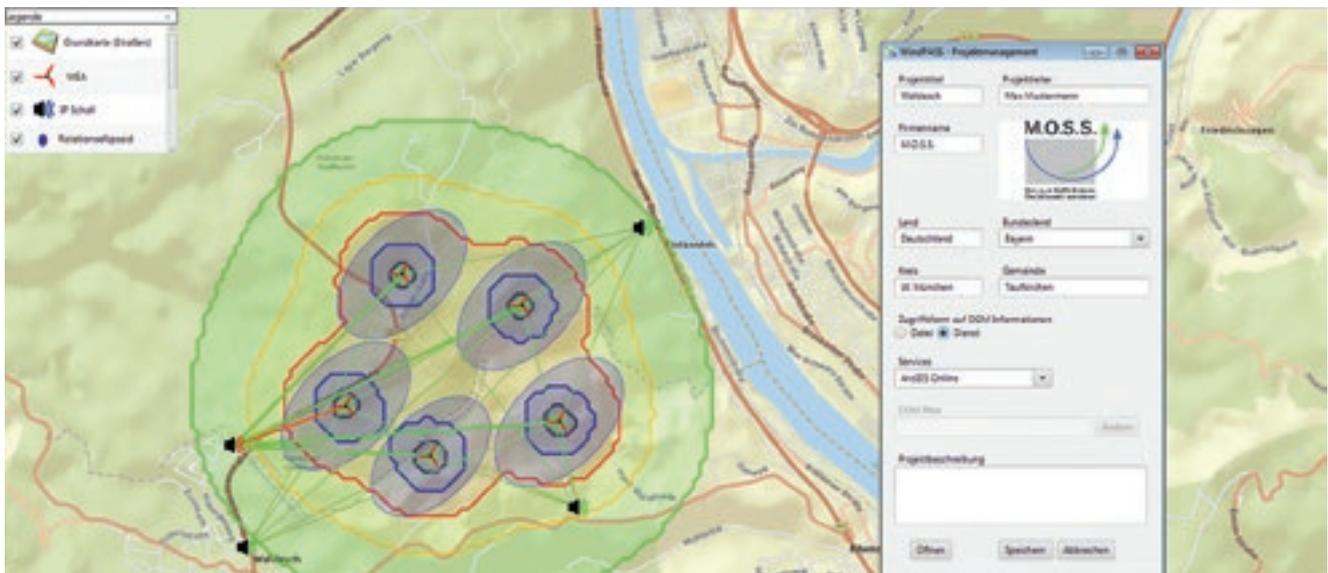
Other services

- Power generation plant declarations of conformity (inspection of parks)
- Power Quality measurement
- Grid protection tests on generation units, substations and transmission stations
- Regular inspections on wind turbines
- Acoustics, load and performance measurements on wind turbines
- Training and talks on the subject of grid integration

M.O.S.S. Computer Grafik Systeme GmbH

Domain specific planning application and GIS based optimization of wind farm planning

M.O.S.S. offers planning application services, as well as integration solutions and consulting services with respect to optimizing the processes of planning wind farms.



WindPASS: Efficient domain targeted applications for planning wind farms based on ArcGIS

WindPASS comprises a set of domain specific solutions fine tuned to support the planning process of wind farms. Each WindPASS application runs on the desktop. It is targeted to a specific subject, tuned for fast startup, efficient execution of computations, and intuitive usability. The results comply with standards and approval regulations. The currently released WindPASS applications include project management, noise, shadowing and yield. Further applications are under development. When using multiple WindPASS applications at the same time changes at different wind power plants, locations of immissions and receptors will be immediately mirrored in all open WindPASS applications. This allows for evaluating diverse subject topics both separately as well as simultaneously.

Analysis of Wind Farm Projects and Processes (WPPA)

Wind farm planning is an iterative process. Intermediate results that have been considered reliable may have to be reevaluated. This reinforces the need for the project developer to use structured, standardized and closely interlocked workflows. A WPPA provides a standardized exchange of GIS and other data which renders the wind farm planning process more efficient. To achieve an optimized planning process the WPPA identifies and removes technical, structural and organizational hurdles by reducing redundant work, eliminating data conversions and avoiding local or duplicated provisioning of data. This yields an up to 20 per cent efficiency gain in the planning processes for wind farms.

The WindPASS domain specific applications noise, project management and shadow.



M.O.S.S. Computer Grafik Systeme GmbH
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Fax **+49 (0) 89 / 666 75-180**
E-Mail **info@moss.de**
Web **www.moss.de**
Profile **Software solutions**
Category **Other services**
Employees **65 (10 in the field of wind energy)**
Founding year **1987**

more energy GmbH

WE OPTIMIZE YOUR WIND ENERGY YIELDS



more energy GmbH
Windpark Management

more energy GmbH
Address **Breitscheidstr. 6**
34119 Kassel
Federal state **Hesse / Germany**
Phone **+49 (0) 561 / 475 19 - 50**
Fax **+49 (0) 561 / 475 19 - 52**
E-Mail **info@more-energy.de**
Web **www.more-energy.de**
Profile **Technical & commercial**
operational management
Category **Operation & service**
Turnover **€ 170,000**
Employees **2**
Founding year **2004**

Effective, professional management is the key factor for achieving long-term, efficient operation of a wind farm. To reach this end, an intelligent coordination between ongoing operational monitoring and the necessary maintenance and inspection activities is essential to ensure the reliable functioning of the facility and thus a consistently high level of output.

At more energy, experts work in the operation of onshore wind farms who have been active as independent and objective service providers to the wind energy industry since the company's foundation in 2004. All work processes and procedures at more energy are based on a strict and detailed system of quality management.

With an expected investment life of 20 to 25 years for wind turbines, the typical manufacturer's guarantee of three years clearly does not provide a sufficient basis for the service and maintenance of a wind energy facility. The support of independent experts is needed who offer customized services to meet individual customer requirements and are always available to provide immediate assistance. As time goes on, the need for service and maintenance activities to ensure the continued profitable operation of wind energy projects will likely increase.

- 01 | Optimization of wind energy yields.
- 02 | Support services – 24 hours / 365 days a year.
- 03 | Periodic inspection.

Muehlhan Deutschland GmbH



Renewables

From inspection and advice via steel construction to surface manufacture and protection. We make use of new technologies and developments to offer professional service for wind turbines and structures.

Muehlhan Deutschland GmbH, a 100 per cent affiliated company of Muehlhan AG, combines strong technical know-how in the wind energy sector and long-standing experience both on- and offshore. Muehlhan Deutschland GmbH is mainly responsible for production whilst Muehlhan Renewables is responsible for service. We offer a full service package for wind farm operators comprising inspection and consulting as well as repair and maintenance work for all surfaces (on- and offshore).

Our Service

Inspection and advice – onshore and offshore

Our inspectors determine the current condition of the surface protection of your wind turbines. They draw up a qualified report and, if requested, also plan the resulting repair and maintenance plan.

Surface protection – onshore and offshore

With our R&D department we develop customer-specific solutions in surface protection for all components, whether it's the foundation, the tower, the nacelle or the rotor blades of the turbine.

Our highly experienced staff carry out all required preparations for subsurface treatment and coating tasks to a high quality standard.

Specially developed beam and coating robots ensure increased economic efficiency in the production process.

Metal construction and welding work – onshore and offshore

In cooperation with our sister company we also carry out complex blasting and welding work according to the current standard. Here we can rely on our own production area which is equipped with the latest technology.

Access technology and industrial climbers – onshore and offshore

We work with the Muehlhan scaffolding company to resolve questions of access technology, or rely on our own division of "Industrial climbers".

Leasing of employees – onshore and offshore

Our qualified personnel is at your disposal for existing or planned projects.

With continuous education and training, we ensure that you can rely on the quality of our teams.

Our workforce includes:

- Metalworkers and welders with all certificates
- Experts in corrosion protection
- Industrial climbers assessed to IRATA and FISAT standard
- Experienced project managers

All employees have a current offshore approval.



Muehlhan
RENEWABLES



Muehlhan Deutschland GmbH

Address **Zur Westpier 40**
28755 Bremen

Federal state **Bremen / Germany**

Phone **+49 (0) 421 / 69 32 69**

E-Mail **renewables@muehlhan.com**

Web **www.muehlhan.com**

Profile **Service, maintenance & repair**

Category **Operation & service**

Turnover **€ 218 million (2014)**

Employees **2,675 (2014)**

Founding year **1881**

N.T.E.S. GmbH Windkraftservice

Maintenance · Repair · Inspection · Optimization

Wind turbine service since 2000. Independent maintenance and repair across Germany using the latest technology and skilled employees.



N.T.E.S. GmbH Windkraftservice is a service provider in the fields of REPAIR, INSPECTION, OPTIMIZATION, THERMOGRAPHY and MEASUREMENT primarily for "Bonus" and "Siemens" wind turbines with capacities between 150kW and 2.3 MW.



N.T.E.S. GmbH Windkraftservice

Address **Handelshof 8**

27432 Bremervörde

Federal state **Lower Saxony / Germany**

Phone **+49 (0) 47 61 / 926 12 - 0**

Fax **+49 (0) 47 61 / 926 12 - 99**

E-Mail **wkas@ntes-service.de**

Web **www.ntes-service.de**

Profile **Service, maintenance & repair**

Category **Operation & service**

Employees **30 (26 in the field of wind energy)**

Founding year **2000**

Working right across Germany, our highly skilled teams operate from four service stations at Bremervörde, Stedum/Hohenhameln, Stelle/Winsen an der Luhe/Erkelenz) in order to ensure flexibility and a fast response rate.

Over 15 years experience in wind turbine service form an ideal basis for achieving optimum results both in case of repair work and prevention through servicing or inspection. In a survey of operators by the German Wind Energy Association (BWE) we achieved an overall rating of GOOD (1.68) for the categories "regular service", "unscheduled repair" and "extraordinary service".

An overview of our services:

Maintenance

- Carrying out annual/biannual maintenance work on wind turbines
- Transformer maintenance
- Blade maintenance
- 24-hour remote data monitoring and maintenance ...



Repairs

- 24-hour fault elimination service with remote data monitoring and maintenance
- Quick response time for repair work
- Large stock of replacement parts
- Inexpensive repairs thanks to our large stock of exchange parts

Inspections

- Blade inspection
- Blade reports
- Gearbox inspection+repair
- Failure analysis ...

Optimisation

- Suggestions and implementation

Thermography

- Troubleshooting and prevention of breakdowns
- Documentation of the current condition

Measurements

- Laser-supported generator alignment
- Earthing measurement
- Bearing condition check

Other

Component repairs:

- Electronic components
- Small yaw gearboxes
- Our own engineering

Development of new components:

- Compensation systems
- Hydraulics

Neas Energy GmbH

Neas Energy is an independent, international energy-trading company focusing in particular on the trade and management of power from renewable energies and decentralised combined heat and power.

Our goal is to offer project developers and operators in these fields the best possible marketing services. Neas Energy operates in the electricity, natural gas & CO₂ markets across Europe and offers numerous services to producers, consumers and wholesale partners.

At Neas Energy, all processes of the value chain are taken care of by our in-house staff. The company has its own trading floor, so that it can respond to all the changes in the various markets as quickly as possible. What is more, we have in-house meteorologists who provide accurate weather forecasts. The software for monitoring and controlling the asset portfolio has been developed and updated by our experienced programmers for over 10 years. In order to implement special technical requirements, we have German-speaking contacts at all levels who can provide our customers with professional help at all times.

In close collaboration with the transmission grid operator and the Danish network agency, Neas Energy is heavily involved in the development of concepts (e. g. virtual power plant, control energy from wind tur-



bines, etc.) that will secure the transition of the Danish energy market from conventional energy production to power from renewable production plants. The Danish energy market is one of the most innovative in the world.

Across Europe, Neas Energy markets more than 6,100 MW of installed capacity from wind, solar, hydro and biogas power facilities across Europe. The majority of these installations can already be managed from our 24-hour control room.

NEAS
ENERGY

Neas Energy GmbH

Address **Schillerstr. 7
40721 Hilden**

State **North Rhine-Westphalia / Germany**

Phone **+49 (0) 2103 / 33 99 00**

E-Mail **ace@neasenergy.com**

Web **www.neasenergy.com**

Profile **Direct marketers**

Category **Direct marketing**

Employees **236**

Founding year **1998**

NOTUS energy

Power on your side

NOTUS initiates and implements wind energy projects, offering a complete portfolio of specialist services. The company's highly diverse team stands for certified service and creative solutions.



01 | NOTUS turbine.

02 | Construction with certified service.



**NOTUS energy Service GmbH & Co. KG /
NOTUS Operations GmbH & Co. KG**

Address **Gregor-Mendel-Str. 24a
14469 Potsdam**

Federal state **Brandenburg / Germany**

Phone **+49 (0) 331 / 620 43-40**

Fax **+49 (0) 331 / 620 43-44**

E-Mail **windkraft@notus.de**

Web **www.notus.de**

Profile **Technical & commercial
operational management**

Category **Operation & service**

Employees **about 120**

Founding year **2001**

NOTUS has planned and built more than 450 wind turbines to date. Since its foundation in 2001 NOTUS has moved a lot. 12,000 tons of steel have been installed, 1,400 kilometers cable have been laid and wind farms built with a size equivalent to 140 football fields. Company founder Heiner Röger owes this success to a highly qualified team of more than 100 experts.

Service

Site acquisition

- locating and securing suitable wind priority areas
- site suitability surveys
- preparation of detailed location concepts including wind farm layout and configuration

Planning

- approval procedures/building permit application processes
- reports and studies on sound emission, shadow flicker effect, turbulence, visualization, environmental compatibility and nature and species conservation
- planning of quantities and arrangement of wind turbines, access roads, grid connection and compensation measures

Construction management

- construction management and supervision of own and third-party projects
- takeover of full construction management for projects at any stage and component tasks
- regular quality control, comprehensive construction documentation, compilation of service specifications
- certified according to DIN EN ISO 9001

General contractors services

- turnkey solutions for wind farms and their infrastructure worldwide
- Notus energy network ensures high quality, competitive prices and reliable construction of wind turbines

Operations management

- technical and commercial operational management of wind turbines
- innovative solutions
- direct marketing with premium income
- our own service apps for operation managers and operators (Wingmaster-App/Sitemaster-App)



OSTWIND Group

Winning energy together

OSTWIND has successfully developed, installed and run wind farms for over 20 years.



We give Europe wings

From 1994 to 2016, the medium-sized company has developed, built and connected up over 500 turbines with a total capacity of approximately 800 MW. OSTWIND, with offices in Germany, France and the Czech Republic, sets highest standards in the wind power industry throughout Europe.

A fair wind for the energy transition

In addition to classic project management, this independent family business offers in-house operational management, innovative project services and attractive public investment schemes.



OSTWIND Repowering replaces existing turbines with modern and higher performing units.

Energy from a single source

Whether as a project developer, implementation partner, service provider, general contractor or operator, whether in individual phases or across an entire project – the OSTWIND Group offers you the complete spectrum of value-creation through wind energy.

Wind is what we do

This is the reason why today the company group, with offices in Regensburg, Strasbourg and Prague, is a preferred partner for citizen-owned wind farms, municipal utilities, energy companies, public service providers, and regional energy suppliers, i. e. for private as well as institutional investments for the future.



The OSTWIND Group plans, constructs and repowers wind farms. The company also provides customer-optimised management services.

Wind makes profits

OSTWIND is the first choice for those seeking new energy for the future and the right choice when it comes to:

- securing suitable sites,
- developing successful projects,
- realising high-yield wind farms and
- securing your investment in wind power over the long term.

Wind is our strength – why not make it yours too?

OSTWIND

Winning energy

OSTWIND Group

Address **Gesandtenstr. 3**
93047 Regensburg
Federal state **Bavaria / Germany**
Phone **+49 (0) 941 / 595 89-0**
Fax **+49 (0) 941 / 595 89-90**
E-Mail **info@ostwind.de**
Web **www.ostwind.de**
Profile **Project developers**
Category **Planning**
Employees **100**
Founding year **1994**

OutSmart Group

Independent wind asset experts

As an independent operational manager of wind farms and advisory company, we help owners to ensure 24/7 high performance and equipment integrity over a 25+ years lifetime. Onshore and offshore. Specifically in northwestern Europe.



OutSmart operations management is based on:

- ISO 55000 (Principles of asset management)
- ISO 9001 (Requirements for Quality Management Systems)
- ISO 27001 (Specification for ISMS)
- OSHAS 18001 (internationally recognized occupational, health and safety management system series standard)
- Industry Standards (ISO, EN, BS, DIN, NEN) and Regulations
- Project Concessions and Permits
- National Legislation (with focus on EU countries)
- Legislation European Electricity Market

Our core business is the technical and commercial operational management of wind farms. Services range from 24/7 full operations take-over to tailored participation in concept engineering and strategy modelling.

We manage your wind farm operations.

With our independent solutions we offer interesting alternatives ranging from full operations take-over to tailor-made participation in existing organisations and the setup of a future-proof organisation. These customer-specific solutions specifically target turbine owners who are in search of operational excellence and cost reduction. OutSmart enables you to realize your business case!

Our proven concepts and methodologies will enable you to improve on ROI.

OutSmart supports onshore and offshore wind energy developers, investors, portfolio managers and lenders to structure wind assets, contracts and concepts in great detail compliant to national legislation. Our knowhow and experience accelerates

the entire process in the compilation of concepts and documentation for your HSE Framework (policy, procedures and work instructions), marine coordination, risk management and emergency response.

We help you to challenge your business model to make it flawless.

Managing profitable wind farms requires sound planning and robust forecasting, respecting the business policy and (commercial) objectives. We are experienced in both cross-checking existing models as well as the elaboration from scratch. The input of our models are based on benchmark figures, best practices and lessons learned from the young wind industry. All inputs are based on detailed assumptions books, auditable by business planners (accountants).



OutSmart Group
 Address **Mattentwiete 5**
20457 Hamburg
 Federal state **Hamburg / Germany**
 Phone **+49 (0) 40 / 375 02-458**
 Fax **+49 (0) 40 / 375 02-443**
 E-Mail **deutschland@out-smart.eu**
 Web **www.out-smart.eu**
 Profile **Technical & commercial**
operational management
 Category **Operation & service**
 Employees **>45**
 Founding year **2006**

PNE WIND AG

Passion for energy

Development, planning, implementation, financing and operation of wind farms in Germany and internationally, onshore and offshore.



At a glance

PNE WIND AG develops onshore and offshore wind farms. Its range of services covers all stages of wind farm development beginning with the initial site investigation and extending through the authorization and financing processes. After constructing and completing the wind farms on a turnkey basis, we offer operation services and repowering solutions at the end of the project life. We value reliability and transparency with all stakeholders. Offshore, PNE WIND AG has also developed wind farms with great success since 1999.

Project development

The first phase of wind farm development is the selection and acquisition of suitable sites. Our experienced experts analyze the wind conditions, manage the authorization process and match the appropriate wind turbine to each site.

Project financing

Wind farms are investments and securing financing is an essential element of project development. PNE WIND AG arranges financing models that are tailored to the requirements of the future owners, who for the most part are institutional or private investors.

Construction

During the construction phase, PNE WIND AG oversees the construction of the necessary infrastructure and electricity grid connection. After the turbines are installed and tested the wind farm is commissioned.

Operational management

After installation and commissioning of the wind farm, PNE WIND AG offers technical and commercial operational management of the wind farm. The goal is to detect errors early and to minimize damage and costly downtime.

01 | Altenbruch wind farm, Lower Saxony.

02 | Calau wind farm, Brandenburg.

03 | Offshore wind energy is an important pillar in the energy mix of the future.



PNE WIND AG

Address **Peter-Henlein-Str. 2–4
27472 Cuxhaven**

Federal state **Lower Saxony / Germany**

Phone **+49 (0) 4721 / 718-06**

Fax **+49 (0) 4721 / 718-200**

E-Mail **info@pnewind.com**

Web **www.pnewind.com**

Profile **Planners & project developers**

Category **Planning**

Employees **approx. 190**

Founding year **1995**

ProfEC Ventus GmbH

closer, committed, competitive

Accredited consulting firm specialized on wind measurement (155 m masts/LIDAR), power curve measurement, site specific assessment of turbulence & energy yield (CFD), anemometer & wind vane calibration.



01

01 | Installation of calibrated measurement equipment during the power curve measurement as per IEC 61400-12-2.

02 | Calibration of anemometers and wind vanes.

03 | 120 wind measurement mast in a class IA location.



ProfEC Ventus GmbH

Address Im Ofenerfeld 23
26127 Oldenburg

Federal state Lower Saxony / Germany

Phone +49 (0) 4421 / 20 90 89-0

Fax +49 (0) 4421 / 20 90 89-9

E-Mail info@profec-ventus.com

Web www.profec-ventus.com

Profile Wind resource evaluators

Category Experts

Founding year 2011

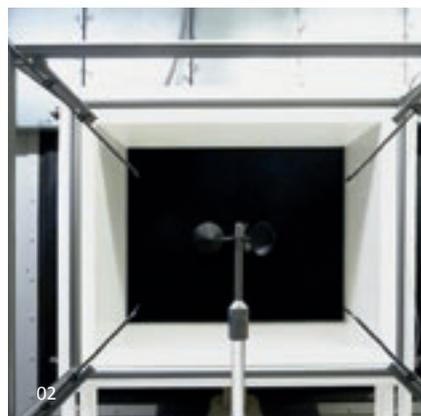
We aim to increase planning safety; and identify, minimise and quantify risks, and determine residual uncertainties and possible losses.

In addition to **wind masts, measuring equipment and sensor calibrations**, ProfEC Ventus offers a wide ranging portfolio of services to collect valuable information that can be used to reliably support essential project-related investment and planning decisions.

Our procedures and processes are founded on the latest findings and are in line with internationally recognised best practices.

Our DAkkS accreditations as a testing and calibration laboratory as per ISO 17025 demonstrate the acceptance of our work by banks and investors worldwide.

Our top-class services help us to serve international requirements and meet the expectations of project developers, governments, public institutions, banks, investors and manufacturers.



02

Our expertise has already been employed **in over 30 countries**, including leading wind industries and markets (Denmark, Germany, etc.), as well as in countries with extreme climatic or social challenges (Mongolia, Honduras, Afghanistan, Papua New Guinea).

We support wind projects from the initial idea and finding an optimal site, to the calibration of complete measuring sections, energy yield assessments, measurement of power curves, optimisation of operation, performance increases, and analysis of problems in existing wind power projects.

ProfEC Ventus offers worldwide **bankable, accredited services and the setting up of accredited wind measurements**.

Our experts are happy to advise you in the role of owner or lender/bank engineer, as well as independent experts and authorities.



03

psm Nature Power Service & Management GmbH & Co. KG

Manufacturer-independent full-service provider: We offer you every aspect of technical and commercial management, plus servicing for wind turbines and solar plants.

Your full-service provider – for full success

At psm you have access to every service you require during the lifetime of your wind turbine or solar plant – from both a technical and a commercial perspective. As a manufacturer-independent company we always have both sides in mind. Because we know what makes sense from a technical perspective, we can always develop the most cost-effective solution for you. Benefit from our long years of experience as an independent service provider for renewable energies.

We offer:

Wind power

- Technical management
- Maintenance and repair
- Repowering
- Replacement of large components
- Service for frequency converters
- Gear endoscopy
- Servicing transformer stations
- Commercial management
- Consulting

Photovoltaics

- Technical management
- Commercial management



Fully dedicated with a fair approach

The psm team – now around 110 strong – are genuinely enthusiastic about every project and give 100 per cent, whether the task is replacing a gear unit or creating a profit forecast. What is particularly important to us? Open and honest communication with our customers: we say what we think. And we act when others are still talking.

Locally across Europe

The focus of our business is in Germany. We are represented here by an extensive network of locations and look after both wind turbines and solar plants in North Rhine-Westphalia, Saxony, Saxony-Anhalt, Rhineland-Palatinate and Schleswig-Holstein. We do, however, also have a local presence in southern Europe – with service locations in Italy and Portugal.



psm Nature Power Service & Management GmbH & Co. KG

Address Jülicher Str. 10–12
41812 Erkelenz

Federal state North Rhine-Westphalia / Germany

Phone +49 (0) 2431 / 97 33 - 6

Fax +49 (0) 2431 / 97 33 - 777

E-Mail service@psm-service.com

Web www.psm-service.com

Profile Technical & commercial
operational management

Category Operation & service

Turnover € 10 million

Employees 110 (90 in the field of wind energy)

Founding year 1998

R+V Versicherung AG

R+V offers comprehensive insurance cover for wind turbines

From planning and installation through to the operational phase, wind turbines require comprehensive insurance cover. This is now available all under one roof with R+V's new insurance concept especially for wind energy.



R+V adviser Jan Kehnapfel (left) is a competent contact for Mr Petersen, an onshore wind farm operator.



R+V Versicherung AG

Address **Raiffeisenplatz 1**
65189 Wiesbaden

Federal state **Hesse / Germany**

Phone **+49 (0) 611 / 533-98751**

E-Mail **G_KompetenzZentrumEE@ruv.de**

Web **www.kompetenzzentrumee.de**

Profile **Insurance companies**

Category **Finance & law**

Turnover **€ 14 billion**

Employees **14,800**

Founding year **1922**

R+V is part of the German cooperative banking group Volksbanken Raiffeisenbanken (VR), making it part of a strong alliance. What we offer our customers, in addition to the latest products and extensive knowledge, is our local presence. Across the 1,100 VR banks and their 13,000 branches, our customers find a named contact for all their insurance matters. You can be sure that we are always there for you.

First-hand knowledge all under one roof – Competence Centre for Renewable Energies

As one of the largest insurers for renewable energy plants, R+V has over 30 years' experience in this field. To strengthen our position in the rapidly growing renewables market, we have bundled our knowledge

and expertise in the Competence Centre for Renewable Energies. Our team of experts implements new product ideas across all areas and continuously develops the existing product offer.

Our staff are always identifying the latest trends in the fields of wind power, solar energy and biogas in cooperation with leading companies and associations. Helping you make sustainable use of our solutions well into the future.

R+V insurance solutions for your wind turbines

Wind turbine operators are making an important contribution to the success of the energy transition. This way of generating power is especially climate-friendly and particularly lucrative – provided you are sufficiently well insured.

From planning and installation to the operational phase, R+V offers comprehensive cover all under one roof with its new insurance concept especially for wind energy.

Let us join forces at the early stages of your project so we can offer you the very best support and advice.



Roever Broenner Susat Mazars

When it comes to the auditing and consulting of wind energy companies, we are your contact with comprehensive industry expertise.

Roever Broenner Susat Mazars is one of Germany's leading independent medium-sized auditing and tax consulting firms. Roever Broenner Susat Mazars Rechtsanwalts-gesellschaft mbH, a medium-sized law firm, is also a member of our group. 68 partners and more than 1,000 employees support clients in the areas of auditing, tax advice, accounting, legal advice, as well as financial advisory services.

We are active in all regions of Germany with our twelve locations in Berlin, Dresden, Düsseldorf, Frankfurt am Main, Greifswald, Hamburg, Cologne, Leipzig, Munich, Nuremberg, Potsdam und Stuttgart, thus in your vicinity.

We have particular industry expertise relating to companies in the energy industry and renewable energy sector.

Our main activities in this area are:

- Preparation of annual financial statements and audits according to the HGB (German Commercial Code) as well as IFRS
- Tax consulting and planning
- Structuring of funds/asset investments
- Drawing up and evaluating of prospectuses
- Due diligence audits
- Contract composition and review
- Financial modelling
- Reference yield reviews
- Output certificates
- Financial structuring



As a member of the international integrated Mazars partnership as well as of Praxity Global Alliance Ltd, an association of independent auditing and advisory firms, we offer audits in accordance with international standards, consulting in international teams, international tax law and cross-border transactions (restructuring, the purchase and sale of companies, the outsourcing of activities).



Roever Broenner Susat Mazars

**Roever Broenner Susat Mazars
GmbH & Co. KG
Wirtschaftsprüfungsgesellschaft
Steuerberatungsgesellschaft**

Address **Rankestr. 21
10789 Berlin**

Federal state **Berlin / Germany**

Phone **+49 (0) 30 / 208 88-0**

E-Mail **gerhard.schmitt@mazars.de**

Web **www.mazars.de**

Profile **Tax accountants**

Category **Finance & law**

Turnover **€ 111 million**

Employees **1,000**

Founding year **1919**

RoSch Industrieservice GmbH

RoSch Industrieservice GmbH with headquarters in Lingen (Ems) is your competent wind energy partner, onshore and offshore. With passion, innovation, know-how and vision.



01 | RoSch service vehicle in action.
02 | Tower renovation in Greece.

In all that we do we take our inspiration from the attributes associated with wind energy: sustainability, durability, confidence, performance and innovation. In this context our corporate philosophy is characterised by progress, flexibility and vision.

We offer the whole gamut of services from a single source ranging from inspections, report production, and repairing dynamically loaded components to servicing and maintenance tasks. Competent, flexible, international.

Prevention rather than cure

We will let you know in advance whenever any maintenance or repair work needs to be carried out. In our capacity as a manufacturer partner we take on, and conscientiously complete, all servicing and maintenance tasks. Our specialists have a thorough knowledge of almost every type of wind energy plant and have been providing high-quality services throughout Europe and internationally for many years. It goes without saying that any and all maintenance and/or repair work that we carry out complies fully with the manufacturers' maintenance guidelines and maintenance specifications.



RoSch Industrieservice GmbH

Address **Bernardstr. 29**
49809 Lingen

Federal state **Lower Saxony / Germany**

Phone **+49 (0) 591 / 80 09 90 - 0**

Fax **+49 (0) 591 / 80 09 90 - 19**

E-Mail **info@rosch-industrieservice.de**

Web **www.rosch-industrieservice.de**

Profile **Service, maintenance & repair**

Category **Operation & service**

Turnover **approx. € 5.6 million**

Founding year **2008**

As specialists in the fields of service provision, maintenance, repairs and servicing in industry, crafts and renewable energy sources, all coordinated from our headquarters in Lingen (Ems Region, Germany), our core mission is not only the implementation of a multitude of professional tasks to the highest possible standards of quality, but also to continuously innovate, improve and develop our potential.

Standstill is not part of our vocabulary. Our team consists exclusively of highly qualified, well-trained personnel who put their know-how to good use throughout Europe.

We know what wind can achieve. More than just a slogan, this is our guiding principle for carrying out our allotted tasks. We see ourselves as partners driven by know-how, passion and quality. For we are well aware of the fact that only innovators can set the benchmarks.



SAXOVENT-GROUP

Cleaner energy, sustainable values!

We have turned our beliefs into a mission, and help you in the financing of wind turbines, in project management, sales and commercial management so you don't have to.

Wind farms are both our business and our passion

The SAXOVENT group has been installing onshore wind farms since 1997. Our passion for this sustainable method of power generation is complemented by our decades of experience. With our turnkey wind farms we offer our customers attractive and environmentally-friendly investment options. In addition we buy project rights, develop wind farms and support the projects of our customers through all project stages. Skilled experts at our sister company Saxoplus carry out all tasks to ensure proper commercial management.

Local roots, international projects

Germany is the core market for Saxovent. Moreover, in the past few years we have developed from a regional player into an internationally recognised company. We have worked in Poland and France since 2011. We have also carried out various projects in Bulgaria.



A lot to be proud of

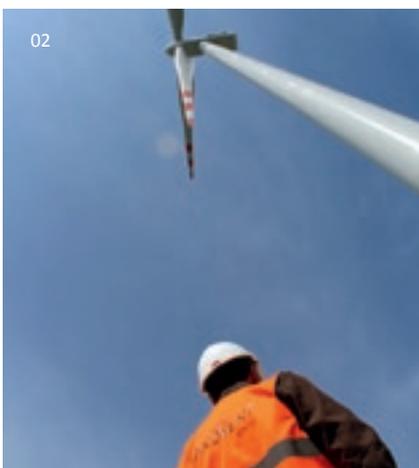
We've done so much already! Since Saxovent was founded, we have installed over 360 wind turbines with a total rated capacity of over 685 megawatts. The turbines produce enough energy to be able to supply around 330,000 three-person households with environmentally-friendly power.

What we offer

Our goal is to offer large-scale cleanly produced power, and therefore a high-yield investment. We are constantly looking for new partners and projects. Why not invest in a market for the future? We will advise and support you with purchasing a turbine, with financing and sale. Please contact us for more information.

01 | Glasewitz wind farm.

02 | Linowo wind farm.



Saxovent Ökologische Investments
GmbH & Co. KG

Address Fritschestr. 27/28
10585 Berlin

Federal state Berlin / Germany

Phone +49 (0) / 797 42 83 99

Fax +49 (0) 30 / 797 42 83 99

E-Mail saxovent@windkraft.de

Web www.windkraft.de

Profile Banks, financial institutions &
financial service providers

Category Finance & law

Employees 35

Founding year 1997

SSC Wind EMEA GmbH

International services for wind turbines
onshore. offshore. engineering.



provision of cranes, logistical route planning, hybrid towers.

Engineering

Concept creation, installation, commissioning, maintenance and repair of measurement, control and electronic equipment, including underwater sensors, groundwork maintenance, planning and implementation of complex data transmission systems, SCADA monitoring, autonomous power supply.

Transportation of people and materials

to offshore wind farms by boat and helicopter, and offshore rescue concepts.

SSC offers a broad range of services for wind turbines and extensive consulting and engineering services. A selection of the company's extensive service range:

Wind power services

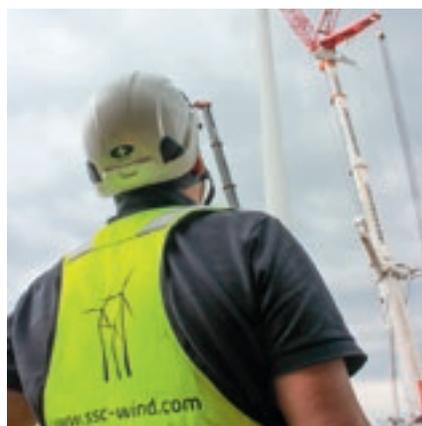
Installation, commissioning, maintenance and repair of onshore and offshore wind turbines, repowering, retrofits, wind farm control, construction site management,

SSC has operated as a successful wind energy service provider throughout Europe for more than 14 years and has a wealth of experience from over 1,000 turbines installed onshore and offshore. With our internal HSE & Quality department, in-house maintenance and calibration of tools on our own test benches and our international joint venture network, we always offer our customers optimal quality of service. The company's quality management is certified according to DIN EN ISO 9001:2008 | BS OHSAS 18001:2007.

In addition SSC is offering a comprehensive range of education and training programs for the wind industry – onshore and offshore – through its subsidiary, the German Wind Academy since 2015. The safety and technical trainings are developed according to the company's operational needs and take place at the "Maritime Campus" site in Elsfleth, Germany.



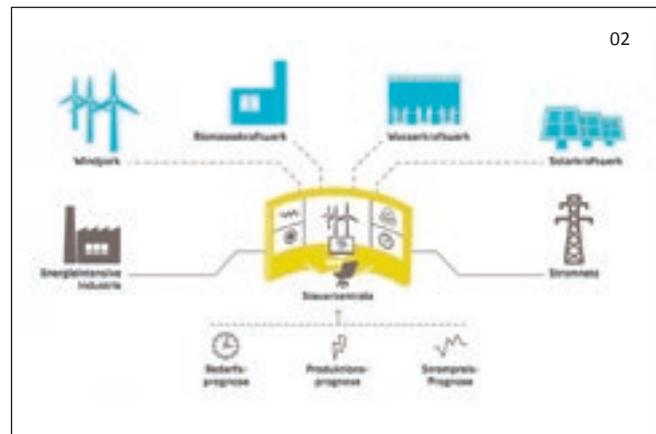
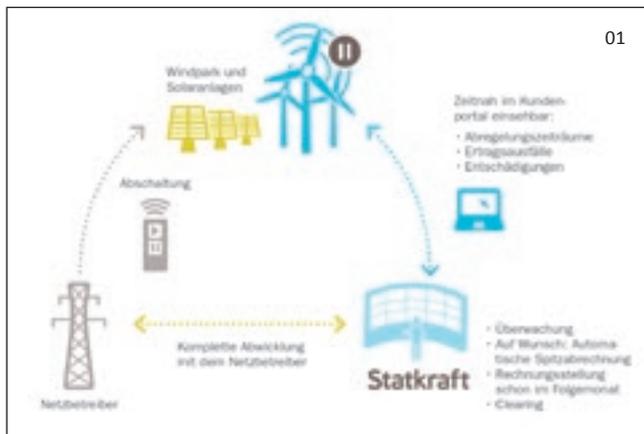
SSC Wind EMEA GmbH
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27793 Wildeshausen
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Phone **+49 (0) 4431 / 738 09 - 0**
Fax **+49 (0) 4431 / 738 09 - 10**
E-Mail **info@ssc-wind.de**
Web **www.ssc-wind.de**
Profile **Service, maintenance & repair**
Category **Operation & service**
Turnover **€ 25 million**
Employees **200**
Founding year **2001**



Statkraft Markets GmbH

Statkraft will sort it!

As the market leader in direct marketing, Statkraft Markets GmbH represents a powerful partner with a comprehensive service offering.



Statkraft stands for technically and economically meaningful integration of renewable energies. With over 120 years' experience as a power plant operator and third-party retailer, we are ideally placed for the direct marketing of renewable energy production capacity for larger and smaller facilities.

In addition to standard services, such as production estimates, electricity marketing in the spot markets and balancing, we also support our customers with a range of services that simplify everyday life in the energy sector. If required, Statkraft will also manage your financial transactions with grid operators. Alternatively, under our Statkraft EisMan package, we can manage any compensation payments following feed-in management interventions – including distribution grid operator invoicing and clearing. Another of our services, Statkraft BezugsStrom, entails the provision of customer plant with electricity from 100 per cent renewable sources under fair conditions.

Via your user account in the Statkraft customer portal you will be able to view all direct marketing services to which you subscribe: power generation and consumption at a glance.

A strong partner on your side

As Europe's biggest producer of renewable energy, Statkraft is an important player in the international energy markets. In addition to conventional electricity and gas, Statkraft also trades in green electricity and CO₂ certificates, third party market access, direct marketing of renewable energies, balancing group management, and flexibility optimisation. As a reliable partner, we support our customers around the clock, 365 days of the year, operating on the basis of solid know-how.

We hope we have piqued your interest. If so, please contact us for first hand information. We would also be glad to explain how you can derive additional value from your plant.

01 | With the Statkraft EisMan package, feed-in management interventions will no longer represent an additional cost.

02 | Statkraft currently interconnects more than 1,500 turbines within a single, virtual and manageable power plant.

Around the clock support for your production facilities!



Statkraft Markets GmbH
 Address **Derendorfer Allee 2a**
40476 Düsseldorf
 Federal state **North Rhine-Westphalia / Germany**
 Phone **+49 (0) 211 / 602 44-000**
 Fax **+49 (0) 211 / 602 44-199**
 E-Mail **info@statkraft.de**
 Web **www.statkraft.de**
 Profile **Direct marketers**
 Category **Direct marketing**
 Turnover **€ 16.43 billion**
 Employees **460**
 Founding year **1999**

THEOLIA Naturenergien GmbH

With fresh energy behind you

We stand out from the crowd - through performance, competency and our fascination with generating power from wind. This fascination is tangibly present in the range of services we offer.



THEOLIA Naturenergien GmbH offers:

- Commercial and technical operational management of your wind turbines
- Accountancy services for your wind farm company

- A modular design principle to put together your personalised operational management package
- Merger & acquisition support, support with real estate and grounds management, and project planning
- Support with direct marketing activities, insurance, communication and repairs

turer and in any performance class in a commercially and technically optimised manner. This is reflected in the 98 per cent availability we achieve for our wind power portfolio.

THEOLIA's proposition to customers is even more attractive. With higher levels of service orientation, quality, and safety, both commercial and private customers will find exactly what they need within our modular operational management package.

Having 89 wind turbines of our own we are familiar with the optimisation potential and the realities of wind farms as well as operational management requirements. This sets us apart from our competitors and we set a high benchmark for ourselves – all in the interests of our customers.

Take us at our word and contact us for a no-obligation quote or come and talk to us. The THEOLIA team look forward to seeing you.



THEOLIA Naturenergien GmbH

Address **Ulmer Str. 4**

70771 Leinfelden-Echterdingen

Federal state **Baden-Württemberg / Deutschland**

Phone **+49 (0) 711 / 238 60 - 0**

Fax **+49 (0) 711 / 238 60 - 99**

E-Mail **kundenservice@theolia.com**

Web **www.windparkbetreuung.de**

Profile **Technical & commercial operational management**

Category **Operation & service**

Employees **36**

Founding year **2000**

With around 420 wind turbines and a combined energy output of 600 MW from third-party and company-owned plant distributed throughout Germany, THEOLIA is one of Germany's leading independent electricity producers and plant management companies.

Both our many years of experience and our comprehensive know-how are critical assets when it comes to commercial and technical operational management. THEOLIA's highly-skilled staff working throughout the entire value-added chain ensure that we are able to operate wind turbines from any manufac-

TÜV NORD SysTec GmbH & Co. KG

Full-service provider for the wind industry

TÜV NORD certifies wind turbines to all international standards and regulations, evaluates specific site conditions and supports operation of wind turbines over their entire lifecycle.

With more than 10,000 employees and experts in nearly all technical disciplines, TÜV NORD Group is one of the world's largest technical service providers. We owe our leading market position to our technical competence and a wide range of services in the field of consulting, testing and certification in our business units of Mobility, Industry Services and International. We operate in over 70 countries worldwide.

Within the field of wind energy TÜV NORD offers services in certification, site assessment and inspection of wind turbines (WTG) and projects. TÜV NORD is one of the leading accredited certification bodies for wind turbines certifying on- and off-shore WTG according to all major guidelines such as IEC, EN, GL, the Danish approval scheme, TAPS and BSH.

Type certification begins with the design assessment of loads, the safety concept and all components of the WTG. Prototype tests then verify the assumptions made during design assessment and measure the power curve. On major components such as gearboxes and rotor blades, separate prototype tests are performed. The third mandatory part of certification is the evaluation of manufacturing with respect to the quality system and the implementation of the design requirements during production. Major components can also be certified individually.

Besides the well known type certification for manufacturers and project certification for project developers, all services for wind energy projects can also be offered as a



one-stop shop. The entire range of project-related assessment services is available to wind farm planners, operators and providers of finance.



TÜV NORD SysTec GmbH & Co. KG

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22525 Hamburg**

Federal state **Hamburg / Germany**

Phone **+49 (0) 40 / 85 57 - 0**

E-Mail **windenergy@tuev-nord.de**

Profile **Wind resource evaluators**

Category **Experts**

TÜV Rheinland Industrie Service GmbH

TÜV Rheinland supports manufacturers, operators and investors with the safety and quality of turbines and projects.



We provide a wide range of services in all project phases to make your wind energy project a success – from choosing a location to planning and production right through to operation.

TÜV Rheinland is both accredited for the type and component certification of wind turbines according to IEC 61400-22 and for certification of power generating units and power generating systems e. g. according to SDLWindV and BDEW MV-guideline by DAkKS.

Further standards such as the DIBt guidelines complete the scope of accreditation.

In addition, we are recognised by BSH as a certifier and registered inspection organisation for the structural design of offshore wind turbines.

Well-trained and qualified employees guarantee high productivity and quality for your wind power project.

Range of onshore and offshore services

- Product, type and component certification
- Project certification
- Certification of power generating units and power generating systems
- Declaration of conformity after and power generating systems certification
- Approval and evaluation of energy generation systems
- Construction supervision and production control
- Commissioning and regular inspection
- Technical due diligence
- Condition Monitoring System (CMS)
- Occupational health and safety
- Risk analysis
- Training
- Expert's report concerning operational life extension after 20 years

Special reports

- Rotor blade inspection
- Site assessment
- Wind yield reports
- Noise and shadow report
- Damage report
- Grid connection and evaluation

Detailed information about all our services can be found at www.tuv.com/wind.



**TÜV Rheinland
Industrie Service GmbH**

Address **Am Grauen Stein
51105 Cologne**

Federal state **North Rhine-Westphalia / Germany**

Phone **+49 (0) 221 / 806 - 5174**

E-Mail **wind@de.tuv.com**

Web **www.tuv.com/wind**

Profile **Technical consultants**

Category **Experts**

Turnover **€ 1.73 billion**

Employees **19,000**

Founding year **1872**

Ventotec GmbH

We create clean energy and new jobs

Ventotec GmbH is one of Germany's leading end-to-end providers in the renewable energy sector. Founded in 1998, Ventotec has successfully established plants with a rated capacity of more than 750 MW in Germany and abroad at an investment volume of more than one billion euros.

United we are strong – Based on this principle, Ventotec GmbH has been working successfully with ITEC International GmbH for over ten years. Together, this corporate alliance is able to cover the entire renewable energy spectrum.

Helmer Stecker and Ralf Heinen have been instrumental in developing this area. In addition to their positions as Executive Directors of Ventotec GmbH, they are also responsible for managing the renewable energy alliance from Leer.

Years of expertise

Ventotec GmbH was founded in 1998. Originally conceived as a traditional project developer, the company provides the whole range of services in the area of project planning. Over the last few years, the company has managed to successfully establish itself on the market as a vendor and marketer of renewable energy projects. Right at the start of this decade, Ventotec was able to skilfully manage foreign investors' growing interest in renewable energy projects, thanks to its many years of experience in project planning for closed-end funds. Now Ventotec is much



in demand as one of the main German providers of wind energy projects and is in constant contact with important institutional investors within Germany and abroad. Ventotec is also responsible for the associated project funding.

In 1998 everything began with Klettwitz wind farm – once again at the top of the agenda. With 62 MW of installed power this was once the largest wind farm in Europe; it is now being repowered. The first phase was completed 2015 with the commissioning of 27 new Vestas V112-3,3 MW turbines. In subsequent stages the number of wind turbines is to be increased to 65.

01 | The Klettwitz wind farm in Brandenburg / Schipkau.

02 | Ventotec GmbH's management team Ralf Heinen and Helmer Stecker.

VENTOTEC

Ventotec GmbH

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26789 Leer

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E-Mail **info@ventotec.de**

Web **www.ventotec.de**

Profile **Project developers**

Category **Planning**

Turnover **€ 1.1 billion**

Employees **80**

Founding year **1998**

Unternehmensgruppe UKA

Umweltgerechte Kraftanlagen

Full solutions for regional energy generation

Since 1999, the UKA Group has been operating as a full developer and implementing wind farms, transformer stations and community wind farms across Germany.



01



02



Umweltgerechte Kraftanlagen

UKA – Umweltgerechte Kraftanlagen GmbH & Co. KG

Address **Dr.-Eberle-Platz 1**
01662 Meissen

Federal state **Saxony /Germany**

Phone **+49 (0) 3521 / 72 80 60**

E-Mail **zentrale@uka-meissen.de**

Web **www.uka-gruppe.de**

Profile **Planners & project developers**

Category **Planning**

Employees **400**

Founding year **1999**

Onshore wind energy

The UKA Group (Environmentally-Friendly Power Stations) provides all services for the construction of onshore wind turbines and transformer stations. UKA covers the whole value chain, from finding and securing suitable locations to project development, obtaining all required permits, financing projects and constructing turn-key wind farms. The company also offers technical monitoring and all-round commercial support during the service life of each wind farm through UKB (Environmentally-Friendly Power Station Management).

Reconciling ecology with economy is one of UKA's missions: Power should be generated in an environmentally friendly and affordable way. As an expert for wind energy in forest areas, UKA has already put into operation several wind farms in commercial forests. UKA also successfully implements repowering projects.

Turnkey completion

The sister company UKA Projektträger GmbH & Co. KG, based in Lohmen (Mecklenburg), is responsible for implementing the construction projects generated by the UKA project development companies. This in-house collaboration ensures seamless transition from planning to construction.



03

Operational management

UKA is a reliable and long-term partner also during the operational phase of a wind farm. The company offers technical monitoring and all-round commercial support during the service life of each wind farm through UKB (Environmentally-Friendly Power Station Management), thus ensuring decades of optimised economic and technical wind turbine performance.

Citizen's wind farms

UKA is actively seeking dialogue and gets local communities and councils involved in the planning processes. Local community members can benefit directly from the proceeds of wind power generation via the UKA-Bürgerwind investment model. UKA also offers local councils the opportunity to invest.

Company sites

With over 400 employees at sites in Meissen, Cottbus, Rostock, Erfurt, Oldenburg, Hanover, Bielefeld and Lohmen (Mecklenburg), UKA has become one of Germany's leading wind power companies. The UKA Group has already set up some 270 wind turbines with more than 650 megawatts of rated capacity.



- 01 | Planning – construction – management: Full service from a single source.
- 02 | UKA has eight conveniently located sites.
- 03 | Göllnitz-Lieskau-Rehain wind farm (Brandenburg).
- 04 | Range of services of the UKA Group.



04

- > Project Development
- > Securing of Sites
- > Obtaining of Permission
- > Turnkey Construction
- > Repowering
- > Technical and Commercial Management
- > Community Wind Energy Projects
- > Communal Participation
- > Purchasing of Project Rights

Umwelt Management AG (UMaAG)

The Principle of Renewable Success

Umwelt Management AG's (UMaAG) aim is to turn renewable energy into sustainable success. To do so, Umwelt Management AG (UMaAG) relies on partnerships based on trust in planning, controlling or supporting our shareholders. Based on its own acquisition and project development the group has initiated wind farms for over 18 years.



“We realise economic success through environmentally sound projects.”



Umwelt Management AG

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27478 Cuxhaven

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E-Mail **info@umwelt-management.de**

Web **www.umwelt-management.de**

Profile **Project developers**

Category **Planning**

Turnover **approx. € 900 million**

Employees **30**

Founding year **1998**

Turning renewable energy to sustainable success: Umwelt Management AG (UMaAG)

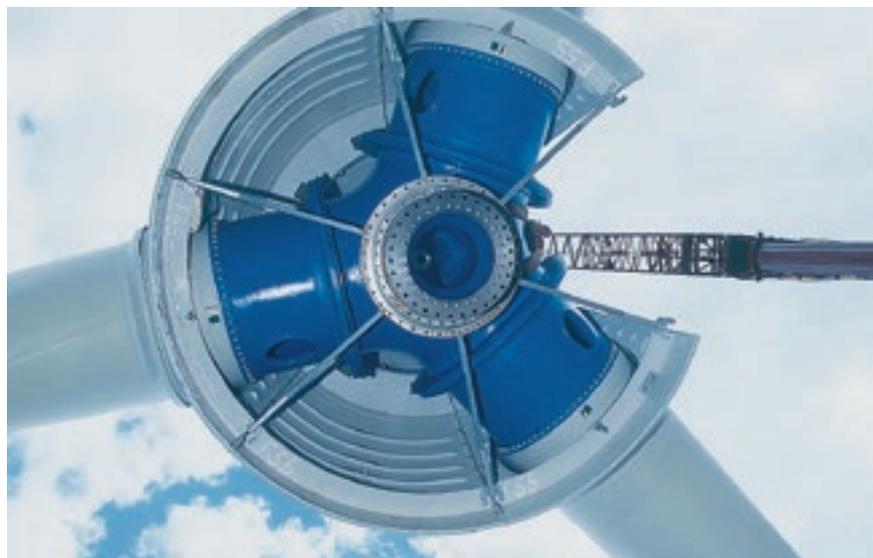
Umwelt Management AG (UMaAG) stands for successful development of Renewable Energy in the context of a more healthy environment and species protection. In the last 18 years, Umwelt Management AG (UMaAG) has grown to one of the leading players in the wind energy arena in Germany with a full service offering. Located in Cuxhaven (North Germany), the team lives and believes in long term and proven relationships with local, national and international partners.

Umwelt Management AG (UMaAG) has developed over 60 wind farm projects all over Germany with almost 600 MW in volume. The business is based on proven experience, solid knowledge and flexibility with a strong drive to success.

Discover potential

Umwelt Management AG (UMaAG) not only focusses on wind energy, but also on the development of solar energy and biomass, which serves as a perfect base for future growth and for long term co-operation with national and international partners.

A straight path with a clear vision, even through stormy times in the wind energy arena, has led Umwelt Management AG (UMaAG) to develop intelligent solutions and quality standards, which were turned into fundamental principles to secure future growth. A total investment volume of around € 1,000 million could be generated within the last few years.





The company provides services as follows:

- operational concepts,
 - financial concepts,
 - procurement of equity and outside capital, capital resources,
 - operation, administration,
 - controlling,
 - shareholder support,
 - project planning, project development and implementation
- commercial and technical services,
 - reliable and transparent project management,
 - project acquisition, assessment, development and management,
 - co-operation with renowned partner companies in planning and implementation

A little extra

Umwelt Management AG (UMaAG) is proud of its many years of experience and know-how on all project levels. The use of the latest technologies provides efficient and targeted project development measures, transparency to investors, banks and project partners and the best possible information level for all. In addition, the service offering includes:

Umwelt Management AG (UMaAG) is always looking for new opportunities in the wind, solar and biomass arena. There are many possibilities for becoming a partner, whether it is through practical competence, project co-operation or investment. In any case, Umwelt Management AG (UMaAG) is looking forward to implementing projects with existing and new partners.

Dipl.-Wi.-Ing. Günther Conrad (left) and Dipl.-Kfm. Uwe Leonhardt (right).



Volkswind GmbH

Clean energy for 1 million people

As one of the leading independent power producers Volkswind delivers clean and renewable onshore wind energy to roughly one million people.



the expansion and diversification of the project portfolio also with regard to regulatory changes in the energy sector. Due to Axpo's strong competence in European wind farm management the strategic partnership also comprises the further expansion of Volkswind's technical management as well as asset management.

Volkswind seeks to achieve highest quality standards in wind farm operation in order to achieve maximum energy output. The daily maintenance routine encompasses a 24/7 maintenance team, long-term service contracts with turbine manufacturers and intranet-based quality reports on the turbines. The investment in R&D and state of the art technology guarantees meeting highest quality standards.

In 1993 Volkswind laid the foundation of today's success as a German pioneer among the Independent Power Producers by installing the first 500 kW turbine. Having realized over 60 wind farms Volkswind nowadays belongs to Europe's leading developers and operators of onshore wind energy with a geographically – as well as regarding clients – diversified portfolio.

With France and Germany being the core markets Volkswind was a first mover in successfully establishing new locations in growing European markets. In France, Volkswind is one of the biggest developers with a market share of 8 per cent. Volkswind has continuously received an independent "A" rating through Euler Hermes (Allianz Group) for its financial solidity.

Through the acquisition by the Swiss Energy Company Axpo in 2015, Volkswind has become even stronger with view to



Volkswind GmbH

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E-Mail **info@volkswind.de**

Web **www.volkswind.de**

Profile **Planners & project developers**

Category **Planning**

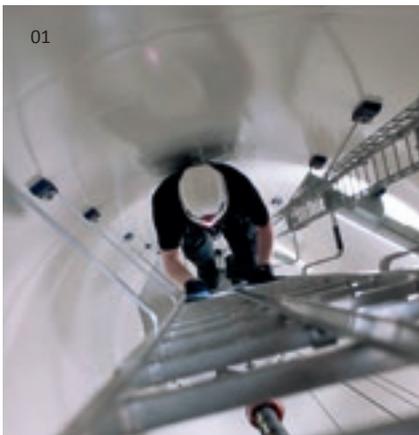
Employees **approx. 80**

Founding year **1993**

vortex energy Holding AG

When know-how and passion go hand-in-hand, you get a dedicated all-rounder

For the last 12 years, the vortex energy group has developed, implemented, operated and marketed wind and PV projects. It is also a licensed service provider for electricity trading as well as balancing and scheduling in Poland.



Holding at eye level

In 2004 Heinrich and Till Jeske founded vortex energy. Father and son together laid the foundations for a constantly growing company that made the leap to a holding company in 2014. In addition to vortex energy Deutschland GmbH and vortex energy Polska Sp. z o.o., cleanenergybond® GmbH, a company offering innovative financing concepts is also part of the group. To date (December 2015), vortex energy has installed over 340 MW of wind capacity in Germany and Poland. The project scopes can extend from 1 to 21 turbines. Since February 2015 vortex energy has been licensed as a balancing and power trading provider in Poland.

From green field to management

After completion of project development, which includes acquisition of suitable sites, analysis of wind conditions, approval procedures and selection of the optimal turbine type, financing concepts have to be developed and own/third-party capital procured. As a general contractor, vortex



energy installs the grid connection with associated infrastructure and implements turnkey wind farms. These farms are either operated by us, or are generally sold to investors. After commissioning, vortex energy offers technical and commercial management, as well as technical inspections.

Respect for nature

vortex energy boasts a flexible team, which approaches complex challenges in an uncomplicated way. Even projects with countless hurdles are possible, according to the vortex motto "There's always a plan B". The team relies on intelligent networking, clear communication and reliable order processing. The eco power generated by vortex energy is 990 GWh, which supplies approximately 300,000 households, and saves 525,038 t CO₂/year.

01 | Best practice: Management that increases efficiency as a result of target-oriented and customised contract optimisation.

02 | Leading expertise: In the top 3 in Poland with 11 Polish wind farms.

Fig. Śniatowo wind farm, 32 MW.



NEUE ENERGIEN – WEIL ES UNSERE NATUR IST.

vortex energy Holding AG

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Phone **+49 (0) 561 / 45 07 98-0**

Fax **+49 (0) 561 / 45 07 98-15**

E-Mail **info@vortex-energy.de**

Web **www.vortex-energy-group.com**

Profile **Planners & project developers**

Category **Planning**

Turnover **€ 20 million**

Employees **65**

Founding year **2004**

WestWind ENERGY

Turning wind into power

We organize the entire process, from consultation and planning to the construction and subsequent operation of a wind turbine. Our company reflects who we are: individual, effective and personal!



It's our personal goal to generate only clean and affordable energy in the future!
Gerard Meindersma & Jörg Osterholz

We at WestWind ENERGY can rely on many years of experience to plan, develop and operate wind farms.

Whether at your doorstep or Down Under, every project we take on is a new challenge. We work with our customers for a common future in which green power is as natural as the wind and the sun.

From start to finish!

Good ideas turn into successful projects. WestWind organizes the entire process, from consulting and planning to the construction and subsequent operation of a wind turbine, whether the project is at home in Germany or elsewhere in the world. Unbureaucratic, fast and in close collaboration with the project partner.

Full service. Of course!

Even after the rotor blades have long begun rotating in the wind, we remain at our customers' side as cooperative contact persons. WestWind Verwaltung takes on the operational management for operators, whilst WestWind Service ensures smooth operations through professional technical and commercial management. As a matter of course, WestWind's full service is provided irrespectively of the turbine manufacturer and separately from our project planning and construction activities.

With a financial safety net!

Our customers look for strong and sound financing for their wind energy projects. WestWind's detailed preparation of all relevant documents guarantees smooth project appraisals that ensure the right financing with banks and investors.



WestWind Entwicklungs GmbH & Co. KG
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E-Mail **Webkontakt@w-wind.de**
Web **www.w-wind.de**
Profile **Planners & project developers**
Service, maintenance & repair
Category **Planning**
Operation & service
Employees **30**
Founding year **1998**



WindEnergy Hamburg

The global on- & offshore expo

The world's leading expo for wind energy.



The global wind industry has a wide range of innovative technologies, products, services and synergies with solutions from other industries – to be presented at WindEnergy Hamburg. The annual conference 2016 of WindEurope will be held at the Congress Center Hamburg in parallel to WindEnergy Hamburg – the world's leading wind expo is teaming up with the number one wind industry conference. That makes Hamburg the global hotspot for business, networking as well as political and scientific dialogue from 27 to 30 September 2016.

More than 33,000 trade visitors from all parts of the world collected information at the first WindEnergy Hamburg in 2014 on the latest products and services of 1,200 exhibitors from 33 nations. One third of visitors came from outside Germany, including 24 delegations from 22 countries. "Hamburg has proved that it is the ideal

location for this leading global fair, both for the companies in the industry and for the trade visitors," said Bernd Aufderheide, President and CEO Hamburg Messe und Congress.

Manufacturers, equipment suppliers, service and energy companies and all other sectors of the value chain will find ideal conditions at the Hamburg Fair site and in the Congress Center in walking distance. The site benefits from outstanding logistics, has direct connections to all transport routes, and is located at the heart of the city of Hamburg, which has established itself as the European wind industry capital.

The list of exhibitors, programme and registration details are available at windenergyhamburg.com/en/



Hamburg Messe und Congress GmbH

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Phone **+49 (0) 40 / 35 69 - 2263**

Fax **+49 (0) 40 / 35 69 - 692263**

E-Mail **andreas.arnheim@hamburg-messe.de**

Web **windenergyhamburg.com**

Profile **Trade fairs & conferences**

Category **Other services**

Turnover **€ 55 – 100 million**

Employees **244**

Founding year **1972**

Windwärts Energie GmbH

A company of the MVV Energie Group

With more than 20 years' experience, Windwärts is one of the pioneers of the wind energy industry. Since 2014, Windwärts has been part of the MVV Energie Group, continuing to make a valuable contribution to the expansion of renewable energies and the restructuring of the energy system.



01

01 | In good hands: Windwärts has been developing, building and operating onshore wind energy projects for more than twenty years.

02 | Key to success: The experience and know-how of our operational managers secure and increase yields.



Windwärts Energie GmbH
A company of the MVV Energie Group

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30449 Hanover

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E-Mail **info@windwaerts.de**

Web **www.windwaerts.de**

Profile **Project developers**

Category **Planning**

Employees **95**

Founding year **1994**

Experience in onshore wind energy

Our areas of business are project development, financing and implementation, as well as technical and commercial management of onshore wind turbines in Germany and France. The prominent focus in Germany is Lower Saxony and Schleswig-Holstein, the country's leading states when it comes to wind power. To date, Windwärts has connected 157 wind turbines to the grid, with a total rated capacity of 289 megawatts. Management takes care of a total rated capacity of 351 MW and ensures the highest possible yields.

Expertise and enthusiasm for the energy transition

Windwärts understands its trade, from locating suitable areas through to planning and the approval process, financing and constructing the wind farm to commercial and technical management over the entire service life of the turbines. The expertise

of the members of staff in all these areas is as much a central feature of Windwärts' work as the company's reputation for care and attention to detail. It helps to assess risks and eliminate the obstacles in complex approval procedures. And our staff always have one objective in mind, which feeds their drive and commitment: they want to make the energy transition a concrete reality at every location.

Strong implementation

In addition to site owners, councils and investors, public utility companies and energy suppliers, for whom Windwärts plans wind turbines and builds them as the general contractor, benefit from this experience and motivation. Since autumn 2014 Windwärts has been part of the MVV Energie group, making it part of one of Germany's leading energy companies. This strengthens the position of the company as one of the leading project developers for wind energy in northern Germany.



02

WKN AG

Renewable energies for today and tomorrow

WKN AG has been one of the leading project developers in Germany, Europe as well as the US for about twenty five years. The German wind experts always keep an eye on new markets.

WKN AG has been planning, developing, financing and building first-class wind farms since 1990. As one of the pioneers of the German wind energy scene the Husum-based company has been one of the leading developers for decades and is also represented on various international markets. The WKN team consists of renowned wind energy experts who consider each project as a new challenge and who strive to find the best possible solution by working closely with the project partners on site.

It was this pronounced pioneering spirit which took WKN to international markets very early on. Since 2007 the fruits of these markets have been harvested: large-scale wind energy projects have been built in the US, Italy, Spain as well as Poland, and many further projects are currently being realized. Needless to say that WKN consistently keeps an eye on new and further markets.

In all projects, WKN relies on long-term strategies and cooperation with local partners. Wind energy projects developed by



WKN are being acquired by renowned major company groups, investment trusts as well as energy providers. WKN's business activities include site evaluation and development, planning, financing, turn-key construction and operation through to commercial and technical management of the wind farm. Up until the end of 2015, WKN AG had realized more than 1,300 megawatts of installed capacity in about 110 projects.

In mid-2013 PNE WIND AG, Cuxhaven/ Germany became the WKN majority shareholder.



- 01 | Wind farm Francofonte, Italy.
- 02 | Local heroes for international challenges.
- 03 | Wind farm Dargies, France.



WKN AG
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25813 Husum
Federal state **Schleswig-Holstein / Germany**
Phone **+49 (0) 4841 / 8944 - 100**
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E-Mail **info@wkn-ag.de**
Web **www.wkn-ag.de**
Profile **Planners & project developers**
Category **Planning**
Employees **180**
Founding year **1990**

Wölfel Wind Systems GmbH

Experts for vibration reduction, structural mechanics and acoustics

Wölfel Wind Systems is focused on the production and installation of SHM and CMS systems as well as systems for the reduction of vibrations and structure-borne noise for onshore and offshore wind turbines.



the related lifetime consumption of your WT. We measure sound emissions and immissions and our certified rotor blade inspectors assist you in all matters related to rotor blades.

In addition, the experiences gained from R&D and consulting and engineering service projects are taken into account and incorporated in the development of specific products. The systems **IDD.Blade®** (for ice detection), **SHM.Blade®** (for condition monitoring of rotor blades) – both certified by DNV GL – and the active damper system **ADD.Sound®** (for the reduction of the tonal components in airborne noise) are impressive examples for the development of application-oriented solutions. Our latest technological innovation is **TMD. Tower** – this damping system reduces tower vibrations and thus increases the lifetime of your WT.

We cooperate with many operators and manufacturers – onshore and offshore – and can support you with our know-how and extensive experience for a successful and profitable operation of your WT.

From ice detection or reduction of tonalities to structural health monitoring (SHM) of blades or foundations through to rotor blade inspections – our services focus on engineering in the field of structural mechanics, on simulation and experimental testing of components, and in particular on the dynamics of your individual wind turbine (WT).

In the signal analysis, we combine our findings from Third Party Inspection and recurrent check of rotor blades with the data obtained from the wind turbine. In the past decades, Wölfel has built up and extended a unique core competence in this field. We extract the really relevant technical information from the masses of data. We provide information about structural damage on the blade, the tower or the foundation, about fatigue loading and



Wölfel Wind Systems GmbH

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E-Mail **info@woelfel.de**

Web **www.woelfel.de**

Profile **Technical consultants**

Category **Experts**

Founding year **1971**

wpd windmanager GmbH & Co. KG

Germany's top provider in wind farm management

All services from a single source – that's efficient wind farm management. Optimized operation of wind farms, guaranteed through our long-term experience and comprehensive market knowledge.

Since 1998, wpd windmanager have been managing all tasks relating to the commercial and technical operation of wind farms. All our clients benefit from a customised selection of wind farm services optimised for profitability. We currently employ more than 300 staff in around 320 wind farms at home and abroad, encompassing 1,750 individual turbines producing a total output of 3,400 megawatts.

Technical management

Considering that rapid response times are key to minimising profit losses, our service entails a complete technical support package, the core of which is 24/7 monitoring directed from our central control room. Among other things, our technical operational management team is responsible for operational monitoring, documentation and the management of contracts and warranty agreements. Our certified specialists deal with all other technical wind farm issues. Experienced wind farm managers ensure the optimum operation of turbines on site and the implementation of all necessary measures.

Commercial management

We have extensive knowledge of all matters relating to taxation, legislation, and accountancy. In conjunction with central contact persons, our comprehensive information management system quickly provides our customers with information tailored to their specific requirements. We also monitor deadlines and produce annual reports.



Additional services

Our optional additional services, which are also available outside of a plant management contract, are designed to increase productivity and profitability even more. These cover such areas as information technology, Quality, Health, Safety, Environment (QHSE), wind turbine components, wind farm infrastructure, electrical engineering and consulting.



wpd windmanager GmbH & Co. KG
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E-Mail **windmanager@wpd.de**
Web **www.windmanager.de**
Profile **Technical & commercial operational management**
Category **Operation & service**
Turnover **€ 10 million**
Employees **> 300**
Founding year **1998**

WSB Neue Energien Holding GmbH

Customized solutions from a single source

For 20 years, we have been developing environmentally friendly and profitable solutions throughout the entire life cycle of wind energy projects for our customers and partners.



01 | Regional Value Added: Wind farm Wölkisch (Saxony, 20,5 MW).

02 | Wind energy in accordance with nature and environment.



WSB Neue Energien Holding GmbH

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E-Mail **kontakt@wsb.de**

Web **www.wsb.de**

Profile **Planners & project developers**

Category **Planning**

Employees **more than 200**

Founding year **1996**

The future of our energy supply is in renewables. This has been WSB Neue Energien Group's guiding principle since 1996. And it's been successful, too. From its head office in Dresden, the consultancy has become an international provider of wind energy and photovoltaic solutions. WSB Neue Energien adds value throughout the entire project life cycle, from securing land through approval planning and implementation to operations.

We also offer our clients and investors a full range of specialized services and operate as a general contractor. We aim to provide quality, optimal project management, high-value components and excellent partners.

WSB Neue Energien implements environmentally-friendly projects, reducing CO₂ emissions by several thousand tonnes. With our partners, we help municipal councils and mayors to develop and implement energy- and climate-driven concepts. Our common goal is to create a reliable energy supply, use energy consciously and efficiently and at low cost. This enables us to involve citizens comprehensively at an early stage, build acceptance and develop individual participation models.

A 200-strong team in Germany, Europe and worldwide works hard to make our vision of 100 per cent energy generation from renewables a reality. For example, we have already succeeded in connecting roughly 730 megawatts of wind energy and photovoltaic power to the grid. That is equivalent to the annual energy consumption of roughly 440,000 three-person households. Many other projects are currently in development with cooperation partners, municipalities, citizens and investors.



WTS

Tax, Legal and Consulting from one source

With more than 550 employees in eight offices in Germany and with a worldwide presence, WTS is one of the leading companies in the German consulting sector.

WTS is an international consulting company with the three business units Tax, Legal and Consulting. The focus lies on tax consulting for multinational corporations, national and international medium-sized companies as well as private individuals and non-profit organizations. For any problem we offer our clients the best individual solution also in a cross-sectoral and interdisciplinary way.

Expertise in wind from WTS:

We are experts in the field of wind energy – both on- and offshore. Our customers include international companies operating along the entire value chain. Since we understand the business and the transactions that go along with it, we can provide optimal tax advice that is firmly grounded on practice.

For turbine manufacturers, project developers, investors and service companies, particularly at the international level, we offer efficient tax structure, where our knowledge of foreign law is a decisive factor for success. In addition, we advise operators of wind turbines on all issues of tax law and energy law. Current topics include the obligatory market premium, the auc-



tion model for funding permissions introduced by the Renewable Energies Act (EEG) in 2014, as well as issues of environmental and planning law. In the case of company restructuring (M&A and financing), we provide comprehensive tax and legal consultancy.

We understand the challenges the future will bring and help companies in drawing up the best plan in preparation.



wts TAX LEGAL CONSULTING

WTS

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Federal state Hamburg / Germany

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Fax +49 (0) 40 / 320 86 66 - 29

E-Mail torsten.hopp@wts.de

Web www.wts.de

Profile Tax accountants

Category Finance & law

Employees 550

Founding year 2000

Companies:

Publisher and cooperation partners

Working closely with its cooperation partners, the German Wind Energy Association (BWE) publishes a comprehensive overview of the industry in a publication entitled “Wind Industry in Germany”.





Manufacturer and Supplier Board

The voice of the German wind industry

The Manufacturer and Supplier Board represents the wind industry in Germany. Including Enercon, Vestas, Senvion and Nordex, approximately 97 per cent of manufacturers are members of the Board in terms of market share in Germany.



element since a significant proportion of the added value in this sector of industry is created in these mostly medium-sized enterprises.

In the last few years, the Board has worked intensively on the implementation of the System Service Ordinance (SDLWindV).

Calls for tender and the planned amendment of the German Renewable Energies Act represent central topics for the Board in 2016.

To its members the Board offers an exclusive platform for information exchange. Export strategies, trade fair participation and joint action in the political arena are regularly on the agenda.

In addition to turbine manufacturers, the Board also includes suppliers as they too depend on political framework conditions. The suppliers to the wind sector are a key

To ensure there is a positive political atmosphere, representatives from the manufacturer and supplier sector regularly come together for Board meetings. Representatives from the world of politics are invited to take part in constructive meetings so that decision-makers gain a better understanding of the point of view of the wind industry. Insight into the



German Wind Energy Association

German Wind Energy Association

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Web **www.wind-energie.de**

Profile **Associations**

Category **Associations &
public institutions**

Founding year **1996**





First network meeting of the Manufacturer and Supplier Board in January 2011.

political decision-making process is of key significance to ensure that political requirements can be responded to appropriately in the future. The newly introduced legal requirements for system services and for feed-in management have made this clear. The Board therefore acts as an interface between the wind industry and politicians.

A strong voice for the wind energy sector in the public arena and in politics is fundamental. It is important to give all stakeholders in the industry the opportunity to

represent their interests in an association that comprises nearly 22,000 members.

- Would you like to be actively involved in shaping the political framework for wind power?
- Do you have an interest in the network of wind turbine manufacturers and their suppliers?
- Would you like to organize trade-fair stands and events together with other market participants?
- Do you need information at first hand?

- Do you want to further strengthen the expansion of wind power consumption and thus the German wind energy market?

Then become a member of the Manufacturer and Supplier Board!

Contact:

Bundesverband WindEnergie e.V.

Wolf Stötzel

Phone +49 (0)30 21 23 41 - 130

E-Mail w.stoetzel@wind-energie.de



The expert committees at the German Wind Energy Association (BWE)

Advisory boards – Forums – Working groups

At the BWE, operators, manufacturers, suppliers and service providers are organised into expert committees such as advisory boards, working groups and forums.



The expert committees at the German Wind Energy Association

Address **Neustädtische Kirchstr. 6
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E-Mail **info@wind-energie.de**

Web **www.wind-energie.de**

Profile **Associations**

Category **Organisations &
public institutions**

Founding year **1996**

At the advisory board meetings, companies in the wind energy sector meet to discuss and resolve current issues and to develop long-term strategies concerning the most important issues in the industry. Within their specialist areas, they therefore function as an important exchange of information. The work carried out by these experts leads to position papers and statements; the standards developed then act as a guideline for the entire wind industry. Each advisory board has a chairman who sits on the federal executive board of the BWE, giving them a strong say in the association's policies.



Investors' advisory board

The investors' advisory board is concerned with the quality of investment opportunities in wind farms. It analyses annual financial statements and collects important information on the financial situation and profitability of numerous wind farm projects.



Operators' advisory board

On the seven operator forums at the BWE, members exchange knowledge about each manufacturer's wind turbines. Operators of both individual and multiple wind turbines are organised in such forums. The speakers of the forums meet regularly to discuss their experiences in the operators' advisory board.



Operational managers advisory board

The advisory board of operational managers comprises representatives of the operators of wind turbines. It is the central platform for the exchange of technical information on all important issues affecting operators.



Citizens' wind energy advisory board

The citizens' wind energy advisory board brings together operators of citizen's wind farms. Concerned with implementing the energy transition through citizen's and community-owned energy projects, it represents the interests of citizen's wind farm operators within the BWE.

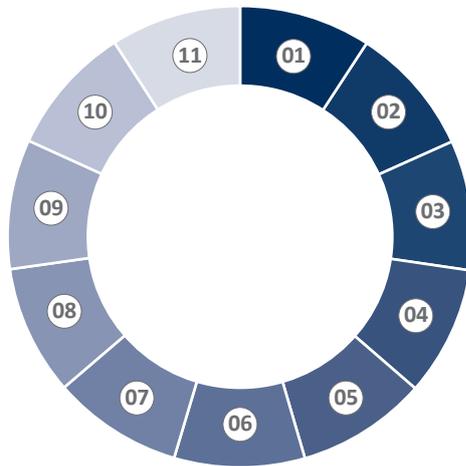


Manufacturer and supplier board

As the committee for the representatives of the wind energy industry, over 97 per cent of German wind turbine manufacturers are represented on the manufacturer and supplier board. For some time the supplier industry has also been working more closely with this board.

Advisory boards:

Experience and knowledge of the expert committees



- 01 Planners
- 02 Operators
- 03 Operators of citizens wind farms
- 04 Investors
- 05 Operational managers
- 06 Legal experts
- 07 Manufacturers and suppliers
- 08 Experts
- 09 Wind consultants
- 10 Scientists
- 11 Financing institutions



Finance advisory board

The finance advisory board is open to all banks and financing companies with activities in the wind energy industry. It acts as a forum of exchange between different companies, for example for the drawing up of rules for the financing of wind energy projects.



Legal advisory board

The legal advisory board comprises over 80 lawyers and in-house legal counsels who together discuss current legal questions relating to wind energy. This involves the exchange of valuable information on current court cases. The latest legal proceedings are also discussed by the legal advisory board and written opinions submitted.



Planning advisory board

The planning advisory board is an important platform for the exchange of information by planning companies. Expert presentations accompany the discussion of major topics such as local and national

planning laws, the future shape of the EEG, and European energy policy. Members support the positioning of the BWE regarding planning questions.



Expert advisory board

The expert advisory board discusses and develops policies and procedural guidelines for the technical examination of wind energy systems.



Wind consultant advisory board

The focus of the wind consultant advisory board is on improving onshore wind forecasts in Germany.



Scientific advisory board

As a forum for BWE members active in research and science, the scientific advisory board deepens current scientific discourses and establishes future research needs.

Working groups are established at short notice to deal with current issues and problems. They are organised across different boards, are able to act quickly, and can also hire external experts if necessary. Representatives from around 100 member companies are currently involved in working groups for public relations work, networks, aviation and radar, obstruction lighting, nature conservation and wind energy, foundations, and continued operation.

All 2,300 operator companies who are members of the BWE are organised in the operators' advisory board via operator forums. Of the 1,100 manufacturers, suppliers and service providers who are members, 220 companies are members of the boards of the BWE. Each board meets between 2 and 4 times a year. For further information on the work of the boards and working groups and to view the lists of members, go to: www.wind-energie.de/verband/fachgremien.

German Wind Energy Association

Events & Corporate Publishing

Knowledge about wind – networking – qualification



“The BWE’s knowledge of the wind industry is second to none. And we are delighted to share the information gained from our political work and wind expert network with you.”

Herrmann Albers, BWE President



German Wind Energy Association

German Wind Energy Association

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E-Mail **seminare@wind-energie.de**

Web **www.wind-energie.de**

Profile **Education & training**

Category **Education & training**

Founding year **1996**

The German Wind Energy Association – a strong partner

With around 22,000 members it is the world’s largest association for renewable energies. For many years the BWE has been campaigning for a sustainable and efficient extension of wind energy in Germany, with ever greater success.

With its ambitious expansion targets, the wind power sector is the main driver behind the switch to renewables. Together with its members, the BWE is fully committed to continuing the success story of German wind energy and to ensuring that the vision of “100 per cent electricity from renewable energy” in Germany becomes a reality soon.

BWE seminars

At our seminars sector experts convey well-founded basics, in-depth knowledge and practice-oriented solutions. Speakers with profound knowledge of the sector give insights from their valuable collected experience. Participants are able to develop their own solutions and transfer these to their own working environment.

BWE conferences

In addition to transferring knowledge, BWE conferences serve as networking platforms for various occupational fields such as project planners, operational managers, finance providers or direkt marketers. Practitioners meet other practitioners to directly exchange experiences; they also receive valuable input from our speakers on important topics of everyday business life. Use this environment to expand your knowledge and make new contacts.

BWE industry days

BWE industry days encourage direct dialogue with policy makers and administrations in the various federal states. Regional networks are supported, and local problems and potentials are discussed. Due to ongoing situations, dates for BWE industry days are often only set a few months in advance – check www.bwe-seminare.de for current dates.

BWE publications

In addition to events, the German Wind Energy Association is also packing its knowledge into countless specialist publications. For example, for the last 22 years it has published the wind energy year-book. Also known for providing a market overview, it offers an excellent overview of the facts, figures and data and the development of both the market and technology in Germany. Furthermore, in it you will also find the operating results of 2,500 German wind power plants.



An overview of all events can be found here: www.bwe-seminare.de

BWE also publishes specialist publications devoted to topics from the fields of law, financing, service, project planning, and recently even small wind turbines. The knowledge gained through them can be utilised in important company decisions, thereby promoting the continued sustainable growth of the industry. You can find an overview of all BWE publications here: www.bwe-shop.de

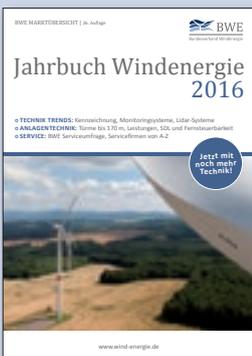
The industry directory

The wind industry sector report in Germany, you are holding in your hands has been published by the BWE since 2010. The economic report is the flagship for the entire sector, in which companies can present their services and products to a broad target group. The comprehensive address section means it is also a real reference book for anyone looking for partners in the wind industry.

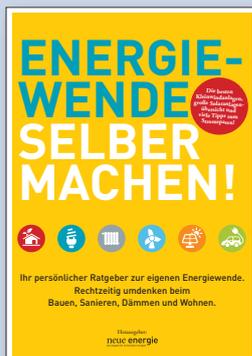
The industry portal

The online platform of the German wind industry provides all market participants with an in-depth insight into the industry. Here, companies present their latest innovations, as well as key reference points for possible partnerships and collaborations – crucial for planning and implementing new projects. The editorial content, consisting of a wide range of specialist articles, goes into great depth and takes a look at technical and administrative aspects from various angles. Written by experts with practical experience, they shed light on the likely supply, demand and requirements of the future wind industry. You also gain an overview of current and older wind turbines. A large archive of high quality publications has been made available in late 2015, offering free downloads ranging from company magazines to expert studies.

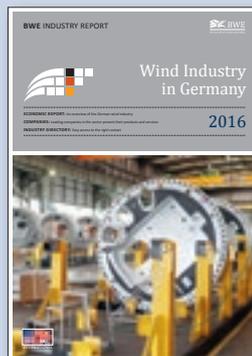
www.windindustrie-in-deutschland.de



Yearbook



Guide



Industry report

new energy

Magazines for renewable energy

neue energie is Germany’s leading specialist magazine for the renewables sector featuring exciting articles and background reports on current politics, business and technology. new energy is our bimonthly sister publication for English speakers. Between 6,000 and 10,000 copies of the magazine are distributed throughout Europe and the world, mainly in Brussels.



The magazine is characterized by well-researched analyses of markets, technology and policy, extensive country reports and portraits of pioneers – individuals, companies, municipalities or entire regions.

A team of around 50 authors from all around the world work with the main editorial office in Berlin.

With a paid circulation of 19,753 (3rd quarter 2015, IVW certified), neue energie achieves the highest sales of any renewable energy title in Germany.

Further information on www.newenergy.info www.neueenergie.net



Every edition of “new energy” has the entire world of energy in its sights. The magazine reports on the use of renewables in generating electricity, heat and mobility, offering readers a monthly account of the latest market trends for wind, solar and bioenergy in Germany and globally. Particular focus is on wind energy.

The magazine regularly covers the latest trends in electromobility and storage, as well as the expansion of energy infrastructure in Germany and Europe. Climate protection and policy are just as much a focus as the traditional energy sources of coal, nuclear power, gas, oil and notable developments in the energy market. Every edition comes with information on new legal acts and bills, regulations and other rules.



Editor-in-Chief Jörg-Rainer Zimmermann

new energy
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 E-Mail **cm@neueenergie.net**
 Web **www.newenergy.info**
 Profile **Media & communication**
 Category **Other services**
 Employees **10**
 Founding year **1998**

Sunbeam Communications

Communication & marketing for the new energy world

#PR #Digitalmarketing #Technicalmarketing #Digitalmedia #Communicationdesign

Renewable energies and the conventional energy industry are merging into the new energy world – which is right up our street. Sunbeam is more than just a communications agency: we bring market and methodological skills together. With our 17 years' experience in renewables, we will help you to become more visible and gain and keep new customers.

We increase your visibility.

Your message needs to be seen, understood and believed. To do this sustainably you need high-quality content precisely tailored to the target group and the right channels. This is no small job, which is why successful communication begins with a coordinated strategy. We develop an individual communication concept for each customer, with the appropriate PR and marketing measures to be taken. We advise you through the entire process and ensure that all measures are implemented competently.

We know the field.

Users expect content that is either relevant or entertaining. That is why only high-



01

quality content that interests users will increase your visibility.

We know the field and your target groups, so we can even create your personalised content single-handedly.

The spectrum is huge – extending from conventional press texts and magazine contributions to white papers and infographics. Thanks to our experts in technical marketing, we can create customised online tools or up-to-date technical documentation.

Tailor-made from a single source.

We don't just want to give you good advice; we want to take the pressure off you. So we can also take on concrete implementation. This might cover the production of print materials or coding websites and mobile apps.

01 | We combine high-quality communications with expertise in markets and technologies in the fields of renewables.

02 | Sunbeam designs and develops your mobile apps.



02

sunbeam
communications | new media | design

Sunbeam Communications

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Web **www.sunbeam-communications.com**

Profile **Media & communication**

Category **Other services**

Employees **16**

Founding year **1998**

Companies:

Industry directory

Around 600 addresses of leading companies in the wind industry.





Direct marketing

Direct marketers



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 Grillparzerstr. 12a, 81675 Munich, Germany
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 Fax: +49 (0)89 383932-5720
 E-Mail: greenenergyproducts@baywa-re.com
 www.baywa-re.com
 EEG direct marketing, marketing of balancing energy services, biomethane trading, portfolio management and balancing group management, sale of green power and green gas.



Energy2market GmbH
 Weißenfels Str. 84, 04229 Leipzig, Germany
 Tel: +49 (0)341 23028-402
 Fax: +49 (0)341 23028-499
 E-Mail: kundencenter@e2m.energy
 www.e2m.energy
 E2m specialises in managing and optimising dynamic portfolios as well as in marketing power and flexibility generated by decentralised generation and consumption plants.



ENERGYA VM GmbH
 Hatzper Str. 30, 45149 Essen, Germany
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 E-Mail: info@energyavm.de
 www.energyavm.de
 Fair direct marketing of renewable energy.



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 EWE TRADING GmbH is a renowned direct marketer for renewable energies in Germany. We support operators of wind farms and solar parks across Germany in marketing their electricity.



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 www.inpower.de
 in.power GmbH is an independent specialist for direct marketing and system integration of renewable energies. Affiliates in.power metering and grün.power (green power supplier) complete the offers.



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 KEHAG Energiehandel GmbH is the partner for the public sector, companies and medium-sized enterprises in particular regarding energy supply, own power generation and direct marketing of renewable power.



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 Fax: +49 (0)4605 18848-20
 E-Mail: tw@nordgröon.de
 www.nordgröon.de
 The mission of the company is to put into practice energy logistical optimisation, synchronisation and integration of renewable energies (keyword: virtual combined power station).



Statkraft Markets GmbH
 Derendorfer Allee 2a, 40476 Düsseldorf, Germany
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 Fax: +49 (0)211 60244-199
 E-Mail: info@statkraft.de
 www.statkraft.de
 Statkraft is a major player in energy trading and a powerful partner in the field of direct marketing standing for technical and economical integration of renewable energy into the power market.

Forecasting services providers



enercast GmbH
 Universitätsplatz 12, 34127 Kassel, Germany
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 Fax: +49 (0)561 4739664-9
 E-Mail: info@enercast.de
 www.enercast.de
 enercast enables the integration of wind and solar energy into electricity grids and energy markets by means of wind and solar power forecasts.



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 E-Mail: mail@energymeteo.com
 www.energymeteo.com
 Diverse range of services for integrating renewable energy: wind and solar power forecasts, software "Virtual Power Plant" for remote control and marketing of decentralized production units.

**EuroWind GmbH**

Robert-Perthel-Str. 19, 50739 Cologne, Germany
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 E-Mail: contact@eurowind.info
www.eurowind.info

State and supply area based wind and solar service forecasts, frequent short-term forecasts, actual data; individual customer portfolios; data access via web portal www.spotrenewables.com.

**HANSA/FLEX****HANSA-FLEX AG**

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 Fax: +49 (0)421 4890748
 E-Mail: m.henke@hansa-flex.com
www.hansa-flex.com

Safety training**DEUTSCHE WINDGUARD****Deutsche WindGuard**

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 Tel: +49 (0)4404 9875-100
 E-Mail: j.wolniakowski@windguard.de
www.windguard.com

Certified GWO Basic Safety Training – all modules incl. refresher & training according to German DGUV. Modules PPE, first aid, fire awareness, sea survival, HUET (incl. STASS or EBS), first responder offshore (DGUV).

SHE Solution
Das Mehr an Sicherheit**SHE Solution Bergmann GmbH & Co. KG**

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 Fax: +49 (0)5224 9393-852
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www.she-solution.de

Abseil and rescue equipment, PSAg, training, health and safety co-ordination, safety concepts, inspections and reports, CTE system (collective escape for ultra-large wind turbines).

Education & training

Education & training**EMD Deutschland GbR**

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Tel: +49 (0)331 62043-40
Fax: +49 (0)331 62043-44
E-Mail: windkraft@notus.de
www.notus.de

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E-Mail: service@psm-service.com
www.psm-service.com

psm is an independent service provider offering complete technical and commercial management for windfarms and solar parks.



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www.voltawind.de

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WSB Service Deutschland GmbH is your quality leader when it comes to technically and commercially managing wind energy systems, photovoltaic systems and transformer stations – 24 hours a day, 365 days a year.

Organisations & public institutions

Associations

American Wind Energy Association (AWEA)

1501 M Street, NW, Suite 1000, 20005 Washington, D.C., United States

Tel: +1 (0)202 383-2500
 Fax: +1 (0)202 383-2505
 E-Mail: windmail@awea.org
 www.awea.org

AWEA promotes wind energy as a clean source of electricity for consumers around the world.

Asociación Empresarial Eólica (AEE)

Serrano, 143, 28006 Madrid, Spain

Tel: +34 (0)917 451-276
 Fax: +34 (0)917 451-277
 E-Mail: comunicacion@aeolica.es
 www.aeolica.es
 AEE is the Spanish wind energy association.

Associazione Nazionale Energia del Vento (ANEV)

Via Piemonte 39, 187 Rome, Italy

Tel: +39 (0)6 4204-701
 Fax: +39 (0)6 4200-4838
 E-Mail: segreteria@anev.org
 www.anev.org
 ANEV is the Italian wind energy association.

Canadian Wind Energy Association (CanWEA)

Suite 710, 1600 Carling Avenue,

K1Z 1G3 Ottawa, Ontario, Canada
 Tel: +1 (0)613 234-8716
 Fax: +1 (0)613 234-5642
 E-Mail: info@canwea.ca
 www.canwea.ca

CanWEA is an association that promotes the appropriate development and application of all aspects of wind energy in Canada.

Danish Wind Industry Association

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Tel: +45 (0)3373 0330
 Fax: +45 (0)3373 0333
 E-Mail: danish@windpower.org
 www.windpower.org
 DWIA is an interest and industry association for wind energy in Denmark.

Danish Wind Turbine Owners Association

Ellemarksvej 47, Bygning 6, 8000 Aarhus C, Denmark

Tel: +45 (0)8611 2-600
 Fax: +45 (0)8611 2-700
 E-Mail: info@dkvind.dk
 www.dkvind.dk
 DWTOA takes care of mutual interests regarding the authorities, political decision-makers, utilities and turbine manufacturers.

European Renewable Energies Federation (EREF)

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 www.eref-europe.org
 EREF is the European interest and lobby group for independent producers of electricity and fuels from all renewable energy sources.



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EWEA is the voice of the wind industry, actively promoting the utilisation of wind power in Europe and worldwide.

France Energie

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 E-Mail: contact@fee.asso.fr
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German Wind Energy Association

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 E-Mail: info@wind-energie.de
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Global Wind Energy Council (GWEC)

Wind Power Housse, 80 Rue d’Arlon, 1040 Brussels, Belgium

Tel: +32 (0)2 213 1897
 E-Mail: info@gwec.net
 www.gwec.net

GWEC is the global wind industry trade association, providing a credible & representative forum for the wind energy sector.

Irish Wind Energy Association (IWEA)

Sycamore House, Millennium Park, Osberstown, Naas Co. Kildare, Ireland

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 Fax: +353 (0)45 854958
 E-Mail: office@iwea.com
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New Zealand Wind Energy Association (NZWEA)

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 Fax: +64 (0)4 4736754
 E-Mail: info@windenergy.org.nz
 www.windenergy.org.nz

NZWEA is a membership-based industry association that works towards the development of wind as a clean energy source.



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Norwegian Wind Energy Association (NORWEA)

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Polish Wind Energy Association

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www.renewableuk.com

RenewableUK is the trade and professional body for the UK wind and marine renewables industries.

**The German Renewable Energy Federation**

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The German Renewable Energy Federation is the umbrella organization of the associations for renewable energies in Germany.

**Wind Energy Network Rostock e. V.**

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E-Mail: info@wind-energy-network.de

www.wind-energy-network.de

Wind energy competence center for the Rostock region (offshore and onshore).

**World Wind Energy Association (WWEA)**

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**Fraunhofer IWES | Kassel**

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 Germany Trade & Invest is the economic development agency of the Federal Republic of Germany.



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 UK Trade & Investment is the British government's organisation that helps UK companies succeed internationally and assists overseas companies to bring high quality investment to the UK's economy.



WTSH – Business Development and Technology Transfer Corporation of Schleswig-Holstein GmbH
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 Schleswig-Holstein offers a positive climate for investing in the wind energy industry. And WTSH provides the service required for founding, expanding or relocating businesses. It's a competent partner.

Ministries

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new energy is the magazine for those interested in energy policy. It is read by the entire renewables sector.



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DrehPunkt has developed ROTORsoft, a management software for wind energy or photovoltaic power plants.



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www.windstrom.de

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WSB Neue Energien Holding GmbH

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www.wsb.de

WSB Neue Energien Group provides solutions in the fields of wind energy and photovoltaics: from project development, design and financing right up to implementation and operational management.



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Categories (prices see top right)

Education & training

- Education & training
- Safety training

Experts

- Avifaunal reports
- Certification
- Technical consultants
- Wind resource evaluators

Finance & law

- Banks, financial institutions & financial service providers
- Consulting & business consulting
- Fund providers
- Insurance companies
- Lawyers
- Patent attorneys
- Tax accountants

Manufacturers

- Small wind turbines (< 100 kW)
- Wind turbines (> 100 kW)

Operation & service

- Quality assurance
- Service, maintenance & repair
- Technical & commercial operational management

Organisations & public institutions

- Associations
- Institutions
- Ministries
- Research, development & analysis

Other services

- Container
- Development & construction
- Human resource services
- Media & communication
- Security services
- Software solutions
- Trade fairs & conferences for the wind energy industry
- Translation

Planning

- Grids & grid connection
- Offshore
- Planners & projects developers
- Recycling of wind turbines
- Repowering

Suppliers of electrical & electronic components

- Aviation obstruction markers & lighting systems
- Condition monitoring systems
- Controlling, cables & switchgear cabinets
- Cooling & climatisation
- Energy & data transmission
- Generators
- Light fittings & emergency light fittings
- Measurement equipment & measuring masts
- Power supply unit
- Safety features & equipment
- Sensors
- Transformers, converters & power resistors

Suppliers of large components

- Casting & heavy engineering
- Foundations & footings

- Rotor blades & rotor blade materials
- Towers

Suppliers of mechanical components

- Access technology
- Bearings
- Bolts & fasteners
- Brakes
- Couplings
- Covering components
- Electric actuator systems
- Gears
- Hydraulic components
- Lubricants & lubrication systems
- Rotor locks
- Seals & vibration control
- Steel components
- Surface technology
- Tools & machine tools

Transport & logistics

- Crane manufacturers, crane hire & special transport
- Lifting technology & crane systems
- Logistics service provider
- Ports
- Ships & shipping companies
- Transport packaging & tarpaulins
- Transport systems

Energy services

- Energy services

Direct marketing

- Direct marketers
- Forecasting services providers

Prices for company profile

	Standard price	BWE member
4 pages, A4, incl. 1 address entry	€ 5,900	€ 4,900
2 pages, A4, incl. 1 address entry	€ 3,650	€ 2,900
1 page, A4, incl. 1 address entry	€ 2,150	€ 1,800

Prices for address entry only

Basic address entry	€ 550	€ 450
Additional address entries per category	€ 200	€ 150

All prices plus 19 % VAT.

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Billing address

Company

Street

Postcode, town, country

Tel.

Internal invoice number

VAT no.

Date, signature

Contact

Surname, first name

Position

Tel.

E-mail

- We are BWE members

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