



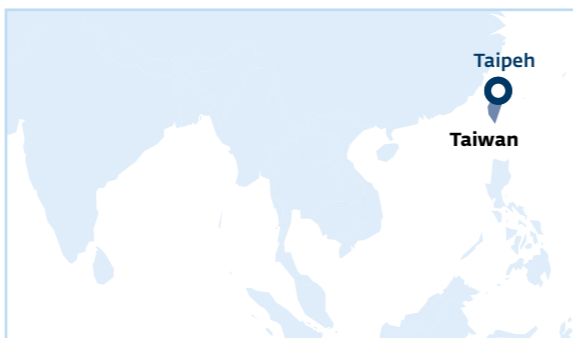
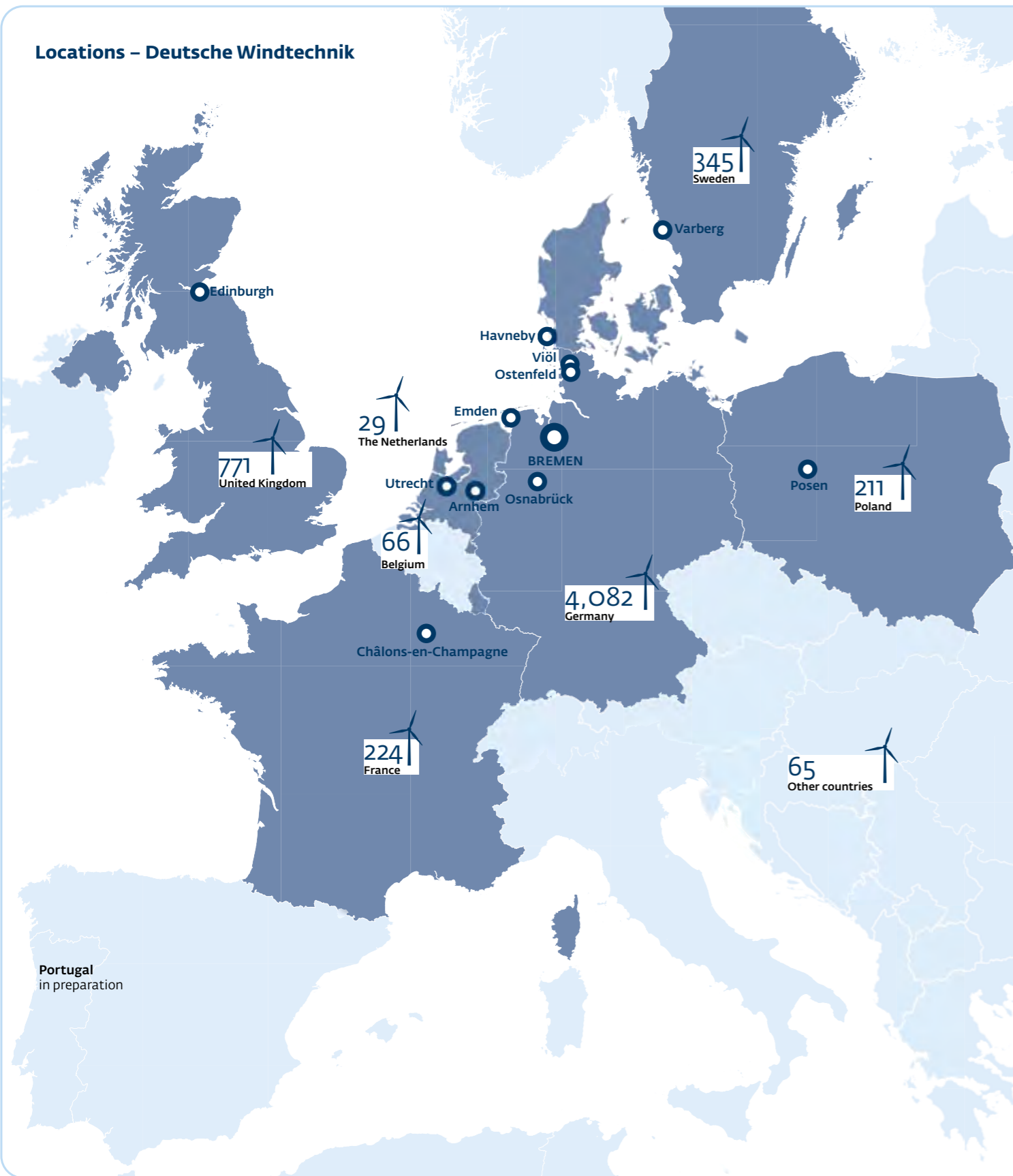
Service Booklet

Uncompromising Competence



**Deutsche
Windtechnik**

Locations – Deutsche Windtechnik



Key Figures – Deutsche Windtechnik

Established	2004
Employees	2,200+
Turnover in 2022	365 million Euro
Service centres worldwide	185+
Service vehicles	645+
Work boats	3
Wind turbines Basic and full maintenance	7,150+
Inspections and surveys	5,000+
Portfolio of wind turbines	Vestas/NEG Micon Siemens/AN Bonus Nordex Senvion Fuhrländer Gamesa Enercon Mitsubishi GE
Spare parts management	Global
Offshore substations Technical operations management	4
Certification	DNV GL in accordance with DIN ISO 9001, ISO 14001 and DIN ISO 45001

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Welcome to our Service Booklet!

The good news first: All scenarios worldwide are pointing to a strong expansion of renewables. And this is particularly true for wind energy. The service and maintenance of wind turbines is a key specialist discipline for the expansion. A study* published in 2019 shows how onshore service markets are developing strategically worldwide in this decade and beyond. According to this study, independent service providers such as Deutsche Windtechnik have established themselves as a fixture in the European service market. At the global scale, more and more operators are weighing their options of service from the turbine manufacturers on the one hand and independent service providers on the other.

The highly dynamic competition, which is being driven by independent service providers, has led to many improvements, innovations and significant price reductions in the service industry. In addition, the trend among the major energy suppliers is to take charge of parts of the maintenance work themselves. These complex developments lead to a multitude of combinations and cooperation opportunities for the individual market players. The advantages of cooperation are particularly profitable in the wind energy sector, as there are many different turbines, many different technical disciplines and a high level of decentrality.

Thinking of maintenance in a modular way

Deutsche Windtechnik has positioned itself well for these tasks: The services presented in this service book cover the complete range of maintenance for wind turbines with various system technologies. All services are designed as individual modules and can be combined in different levels of detail and depth to form individual maintenance concepts. Permanent improvements ensure a constant dialogue with our customers and review of the applied concepts. This is ensured by our continual technical and digital development, our interface management and our high degree of partnership networking at all levels. Our customers appreciate that we share our independent expertise to a great extent with them.

Leading wind energy to success together

Together with our customers, our goal is to be the world's largest, highest quality and most trustworthy independent service provider for wind turbines, both onshore and offshore. We are only capable of this because every one of our staff puts their best effort and passion for their work into an extremely diverse range of tasks on a daily basis. Based on this, the nexus of all stakeholders, including employees, customers, shareholders and others, makes us a special and sustainable company. For this reason, we would like to say a big thank you to everyone.

Overview of services and reference book

The service booklet provides a detailed overview of the entire range of services offered by Deutsche Windtechnik. But that is not all. It also highlights the numerous disciplines that need to be mastered in order to provide competent maintenance and the greatest benefit for the individual wind portfolio.

Do you have questions or would you like to talk to us in person? Please feel free to contact us! Your contact persons, organised by specialist areas, can be found in the appendix.



*Source: The Worldwide Wind Onshore Maintenance Market. Market, competition and perspectives for wind onshore turbines maintenance worldwide, wind:research, February 2019.



From Specialised Discipline to Worldwide Full Service

During the past few decades, we have witnessed a stunning development. Wind energy is the driving force behind the energy turnaround, and it is a key component for a climate-friendly and secure power supply.

Deutsche Windtechnik has been very fortunate to be in the right place at the right time. Together with our customers, who are just as enthusiastic about wind power as we are, we have been able to expand and enhance our system expertise step by step. We now provide a comprehensive range of maintenance services for wind turbines increasingly at the global level. All indicators point to continuing healthy growth.

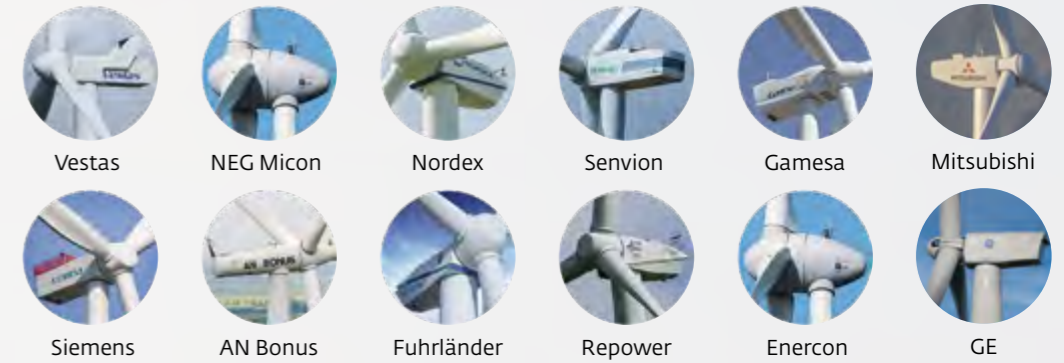
Milestones

- 2004** **Entry into the market**
Begin of service for rotors and towers
- 2006/07** **Establishment of**
Deutsche Windtechnik AG
and Deutsche Windtechnik Service as a special unit for turbine service
- 2010** **Full service**
Everything from a single source
- 2010-2013** **Other specialised units established**
Repowering, Control Technology, Offshore Services, Survey
& Inspections
- 2020** **10 GW rated power**
under maintenance contract

Increasing internationalisation

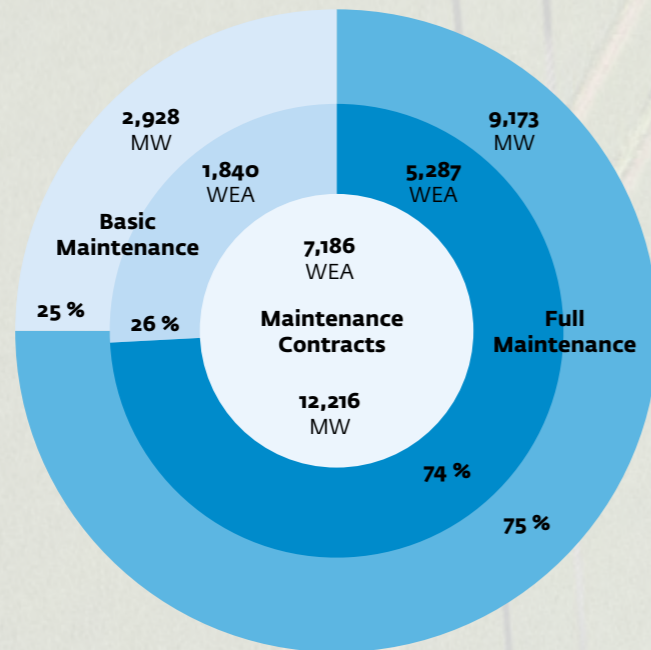
- 2013** Poland (Onshore)
- 2015** UK (Onshore)
The Netherlands
Denmark
- 2016** France
Sweden
- 2017/18** USA
- 2018** Taiwan
- 2021** UK (Offshore)
- 2023** Poland (Offshore)

Turbine expertise

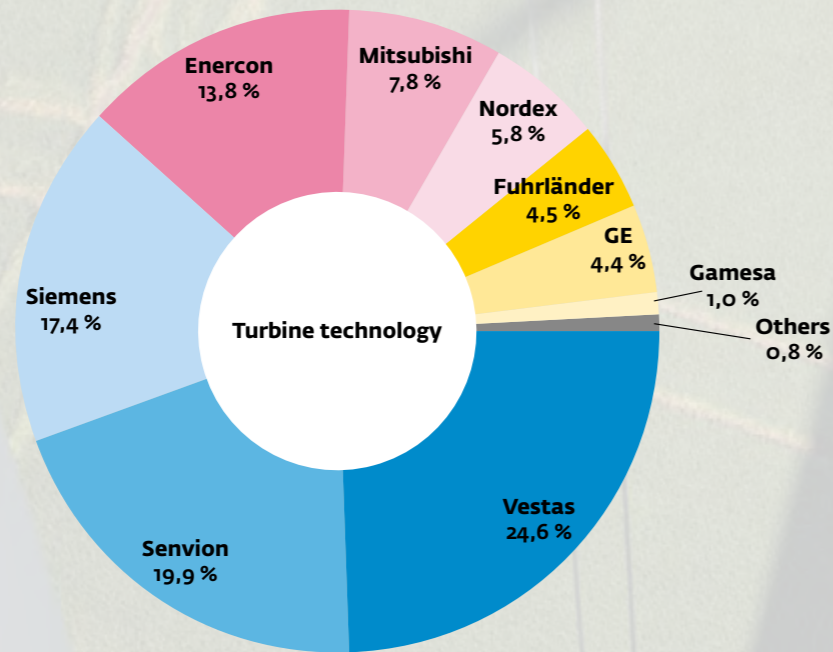


Key Figures

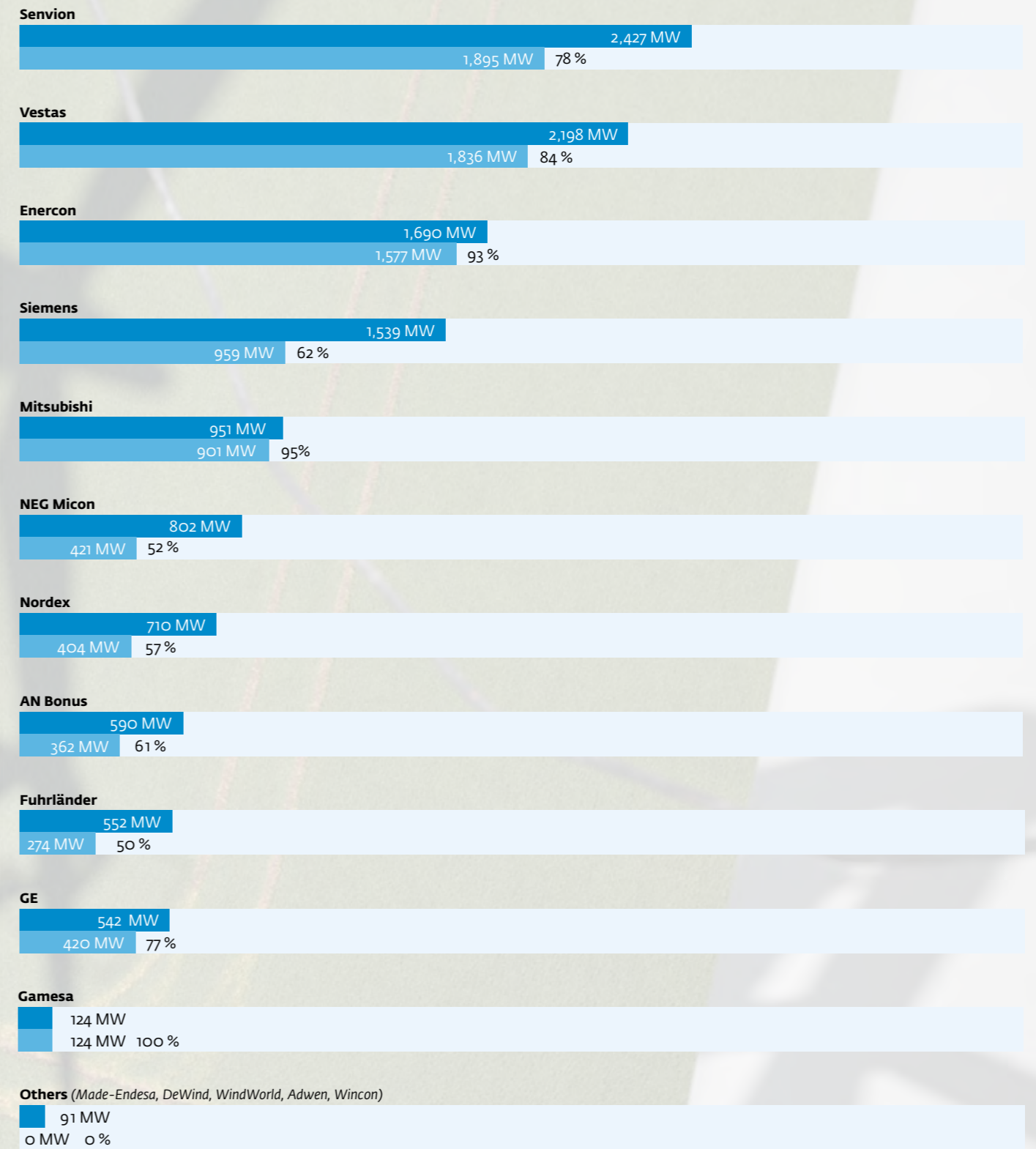
Maintenance contracts (basic and full maintenance)
Shares by wind turbines (WTG), megawatts and in percent



Turbine portfolio multi-brand
Percentage of turbine types under maintenance contract (in megawatt)



Proportion of full maintenance contracts by manufacturer
in megawatt



■ Maintenance contracts
■ thereof full maintenance contracts

Digitisation: On the way to Maintenance 4.0



The digitisation of the working world is one of the biggest changes that businesses have to deal with in our time – and it is also a challenge for the wind industry. The maintenance of wind turbines in particular offers great potential for development. Deutsche Windtechnik has internalised the principles of Industry 4.0 and also participated in the development of many innovations on the market which are appreciated by our customers and other partners.

Our development programs can be found in all areas: mobile service solutions, customer portals, customised ERP environments, numerous tools for remote data monitoring and data analysis, automated tools and databases in the field of recruiting, QHSE systems, modules for e-learning and much more. Our goal is to bring our analogue and digital worlds together in a balanced manner. For us, right means technically and economically reasonable, efficient and resource-saving.

Digitisation creates transparency

In Deutsche Windtechnik's daily business, software supports monitoring, reporting, analysis and much more. Numerous applications have been integrated into our daily activities in the area of service as well as Deutsche Windtechnik's customer portal. This enables us (and, to an extent, the customer as well) to digitally track the location, type and status of the work as well as the qualifications of the service teams. Certificate management, hazardous substance registers, and much more are digitally created and can be shared with the customer via interfaces.

Agile structures give us the ability to act quickly

Our IT roadmap helps us to keep our bearings on the digital journey ahead of us. Our strategy is to divide large goals into small, easy-to-handle individual projects that are transparently managed, constantly monitored and tested as quickly as possible so

that they can be implemented within a short period of time. The more agile the projects are, the more dynamic the overall system becomes and this enables quick feedback. In particular, fast 'live testing' with selected users and lean project structures ensure rapid successes that can be built upon further.

Business processes are going mobile

Mobile applications on smartphones and tablets enable paperless, efficient communication between the office, service technicians and customers. Functions such as checklists, documentation of damage reports and time tracking make it easier for service technicians to carry out their work on-site and ensure that the documentation is easily understandable. Mobile solutions are used for the areas of fault elimination, maintenance, inspection, reporting, production monitoring, and tracking and tracing of serial numbers. All data can be connected to the customer portal, the visualisation of the wind farm and the reporting systems, including all status messages, etc. This gives our customers easily understandable insights into the condition of their wind farms.



1. Onshore

- 1.1** (Full) Maintenance and Additional Maintenance
- 1.2** Remote Data Monitoring
- 1.3** Rotor Blade Service

1.1 (Full) Maintenance and Additional Maintenance

Early on, we recognised the potential in high-quality maintenance and repair of wind parks to ensure economical operation, and we positioned our company accordingly to serve that need. We turned our passion into our profession.

Common maintenance tasks for wind power plants are an integral part of our services: inspection, maintenance, repair, improvement — supported by monitoring, analysis and evaluation. As an independent, multi-brand specialist for system technologies from the manufacturers Vestas, Siemens, Nordex, Senvion, Fuhrlander, Gamesa, Enercon, Mitsubishi and GE, we have detailed knowledge of all turbines made by these manufacturers. Binding norms and standards ensure the high quality of our maintenance services.

Our competence in repair and maintenance is based on the following factors:

- Complete system expertise
- Qualified service engineers
- Sustainable organisational structure with 24/7 remote monitoring, a service network throughout Europe and an increasing number of locations in North America and Taiwan
- Modern, well-equipped service vehicles
- Proven spare parts management and flexible logistics

Service from the first day

Warranty claims are transferable, so it is not necessary to wait until the warranty expires to commission Deutsche Windtechnik with performing maintenance. The maintenance contract that begins with commissioning has a term of up to 20 years and includes all maintenance and service work, upgrades and repairs. We begin providing services as early as the design phase and

during the tender. Our goal as a full service specialist company is to provide competent advice on whether to continue operating a wind turbine beyond the end of its service life and to help you make that decision. Independent service provides excellent options to do business cost-efficiently in the long term.

Flexible contract options

We provide services for over 7,000 wind turbines as part of long-term maintenance agreements. More than two thirds of these are serviced in accordance with full maintenance criteria. However, which maintenance strategy fits the specific needs of an operator depends on many factors: system engineering, wind farm size, age, competencies, risk appetite, structure and also the culture of the company are just some of the variables that determine the right level of maintenance in the desired quality.

We offer six types of maintenance contracts: two basic contracts and four contract options for full maintenance. With Deutsche Windtechnik's full maintenance contracts, operators are on the safe side: All the services required for optimal turbine operation are included in the contract concept.

Depending on the respective requirements and needs, all services can also be ordered individually or combined. The operator can bring in its own competencies or transfer responsibility to Deutsche Windtechnik to the desired extent. Any combination is possible.

Repairs and spare parts management

Our flexible spare parts management system ensures that our technicians have the necessary spare parts and special tools at the wind turbine installation site on short notice. If components are heavily damaged or spare parts procurement requires complex logistics, our custom repair solutions enable us to ensure continued functionality of the system. This minimises the downtime of wind turbines.

We have all of the essential components necessary for comprehensive maintenance at our large logistics centers in Germany (Büdelndorf and Osnabrück), the USA and Taiwan as well as the numerous intermediate warehouses at the service stations throughout Europe. In addition to large components such as gearboxes, generators, main bearings and transformers, we also keep sufficient quantities of other critical parts for control units, computer circuit boards, brakes and hydraulic systems. Our specialists for control electronics ensure the supply of discontinued parts.

Repair of large components

When disruptions occur in turbine operation that require repairs, we react immediately: Our internal structures, monitoring and analysis of turbine data as well as our flexible spare parts management enable us to take appropriate measures on short notice. This also applies to the repair of large components, such as

- yaw gearbox
- gearbox
- generator
- main bearing
- pitch cylinder
- rotor blades
- transformer

As part of our Full Maintenance Plus approach, we repair all damage regardless of its cause. This includes damage to large components, such as the rotor, as well as a write-off of the entire wind turbine. Even damage caused by external influences such as lightning, fire or hail is repaired within the scope of the full service contract.

Maintenance Contracts

Services	Basic	Full maintenance		Full maintenance Plus	
		without large components	incl. large components	incl. large components + rotor blades	incl. large components + damage caused by natural forces
Maintenance work according to manufacturer specifications, including working materials and lubricants	○	○	○	○	○
Upgrades		○	○	○	○
Remote data monitoring 24/7	○	○	○	○	○
Technical consulting	○	○	○	○	○
Availability guarantee up to 97%		○	○	○	○
Wear parts, small parts		○	○	○	○
Repairs without spare parts		○	○	○	○
Repairs incl. spare parts without large components		○	○	○	○
Repairs incl. spare parts incl. large components			○	○	○
Repair of write-offs			○	○	○
Repair of the rotor				○	○
Repair of damage caused by natural forces					○
Foundation Package		○	○	○	○

● included ○ optional

Large components: Main gearbox, transformers within the wind turbine, swing bearing, generator, main bearing and shaft, cast parts hub/tower

From basic to full maintenance – our contract options at a glance: All services can be ordered individually or combined flexibly to meet the requirements and needs of the operator. In addition, various other options are available, including CMS, transmission endoscopy or the complete range of mandatory inspections.

Cost Check of a Wind Turbine over its Life Cycle



Life cycle costs for a wind farm: Identifying and leveraging savings potential and/or achieving higher yields are key objectives during the service life of a wind turbine.

1.2

Remote Data Monitoring (RDM)

It is important to continuously monitor the operating status of all technical systems. Regardless whether the system is a wind turbine or a corresponding sub-system, our First, Second and Third Level experts at the service control centre reliably monitor and manage them.



Our RDM teams manage all systems 24 hours a day, 365 days a year. A range of levels of involvement and intensity as well as a distribution of tasks between us and the customer are possible. Our fundamental objective is to ensure that the wind turbine is continuously monitored by experts. Onshore as well as offshore.

RDM and fault analysis

All operating conditions and alarms that are triggered are immediately analysed and processed. Evaluation of an error message is carried out using all available data (service reports, maintenance records, statistics and other data). Our statistics show that we are able to remedy 60 to 70 percent of incoming error messages through first level support. This means that turbine downtime is significantly minimised. Downtime for a wind turbine should not exceed two hours – usually significantly less. The operator is informed continuously of measures that are carried out.

Data basis for improvement

RDM is far more than just a monitoring instrument: It serves as a basis for numerous optimisation processes. All relevant system data is prepared and stored long-term. By assessing the data using intelligent systems and analysis methods, it becomes a valuable indicator of improvement in system operations. Whether performance improvement, reduction of wear or improvement of availability and work processes are the goal: The collected data is often the basis for a targeted analysis and finding individual solutions.

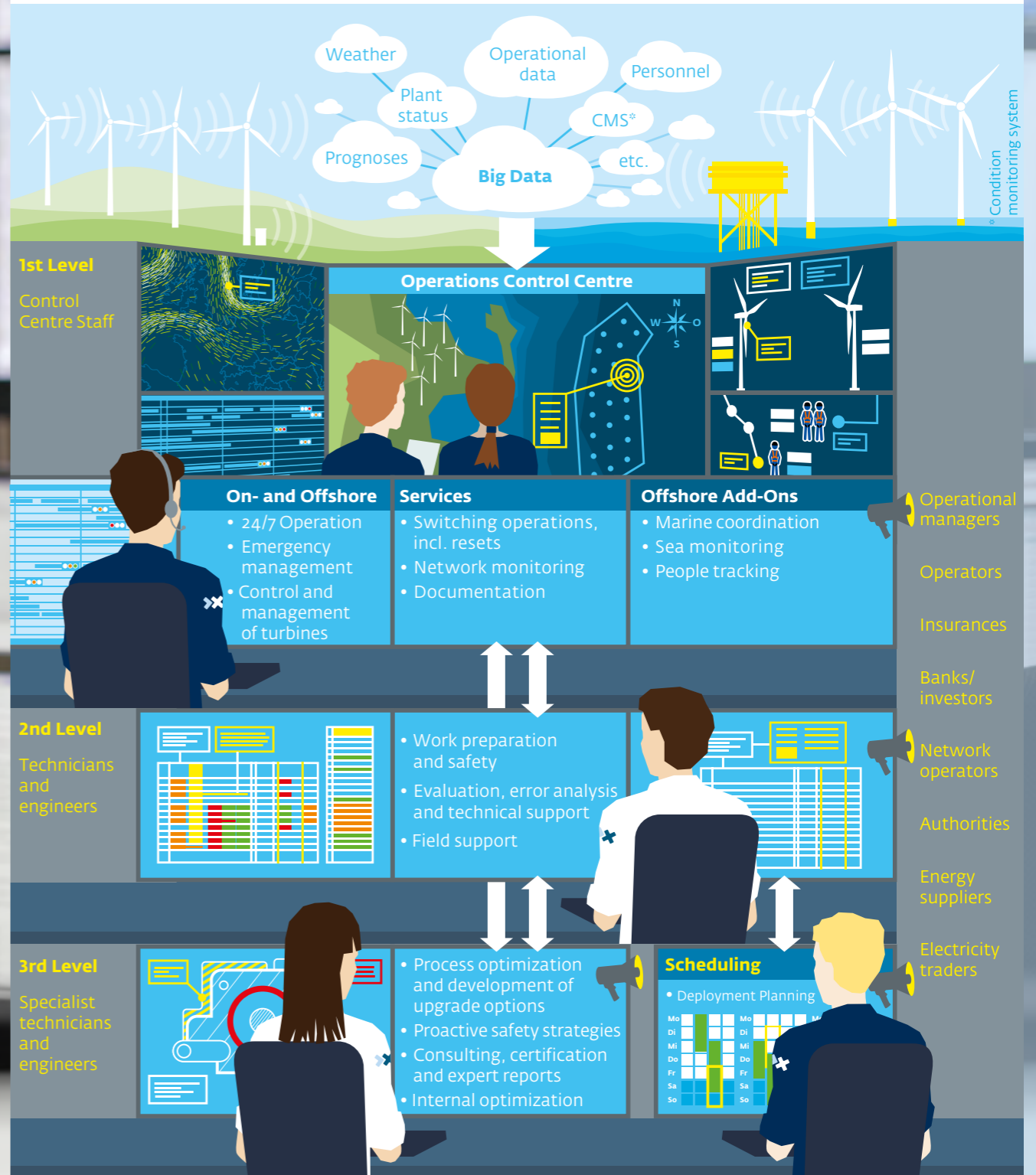
RDM for customer information

RDM is also the basis for our extensive information management for our customers. In addition to raw data, all documents, reports, events, and histories are continuously filed and updated in the RDM system. This provides us with a wide range of individual reporting options. Our customers are increasingly seeking our advice to ensure that they can efficiently manage the growing requirements that operators must fulfil. Direct marketing of electricity, supply management, quality and safety management are just some of the key areas that demonstrate that close cooperation and coordination. This is the best way to prevent redundant work and nonetheless ensure responsible, cost-efficient completion.

Managing Big Data

With the further development of wind energy technology, the amount of electrical, electronic, control, IT and sensor technology being installed (Condition Monitoring Systems are a good example) is increasing, and the amount of available data is increasing proportionately. Parameters such as power, temperature, wind speed, pressures and many more - on different components - reflect the individual condition of the turbine and the environment. Deutsche Windtechnik monitors more than 7,000 wind turbines from its control room, and several gigabytes of Big Data accumulate every day. Special analysis software used in combination with turbine and component data supplies us with automated, compressed information that allows us to determine and plan the necessary maintenance measures. For this reason, Big Data is part of everyday work at Deutsche Windtechnik, but it is also a challenge and an opportunity. Staff at Deutsche Windtechnik have looked into this issue in detail with various partners, including system manufacturers, manufacturers of original parts, research institutes, specialised analysts, and others.

Service Control Room Onshore and Offshore



Remote data monitoring in the service control room: This is where all the relevant data for the smooth operation of the wind farm is collected.

1.3

Rotor Blade Service

Rotor blades have to withstand heavier loads than almost any other component of a wind energy system. Depending on the intensity of the load as well as the type and quality of the manufacturing process, defects caused by wear will occur sooner or later. Design and manufacturing defects may also become apparent. Correspondingly, the amount of maintenance that is optimal is different in each case.

Regular inspection and maintenance of the rotor blades combined with preventive repairs and, if needed, immediate repair measures are therefore necessary to reliably ensure safe system operation. Deutsche Windtechnik has been active in maintenance and repair work for rotors on a daily basis for more than thirteen years. Expertise, the flexibility needed to work on rotor blades and a lot of routine characterise the work of our rotor blade service teams.

Inspections by experts

During the service life of a wind turbine, there are a variety of reasons that make it necessary for an authorised expert to perform an inspection of the rotor blades. Deutsche Windtechnik generates expert assessments using independent accredited experts in the following situations:

- Commissioning
- Warranty expiry
- Periodic inspections
- Condition-oriented inspection in accordance with insurance agreement
- Safeguarding or enforcing liability claims

Maintenance

In addition to qualified appraisals, regular maintenance and all necessary repairs of damaged rotor blades, we also implement preventive measures to protect rotor blades. Several factors have helped us to achieve this: focusing on the essentials, operational flexibility and our ability to identify and utilise synergies. We use rope access technology and special working platforms. Even severe damage can be repaired after disassembly directly at the wind turbine installation site or in a workshop.

An important role in determining the proper amount of maintenance for rotor blades is played by the type of rotor blade, site-specific factors and the length of the period of operation.

In the beginning, we focus mainly on identifying and repairing damage covered by warranty. In subsequent years, it is important to identify increasing wear damage as well as special damage to the rotor blade structure as early as possible. This is the only way to prevent consequential damage or even total damage. Towards the end of the period of operation, minor surface damage is no longer of any importance and a technical condition commensurate with the remaining operating time is acceptable.

Optimisation

Rotor imbalances and incorrect blade positioning not only cause yield losses but also a faster rate of wear of important components (such as damage to pitch drives, blade bearings or yaw systems). Some of the first signs of rotor-related faults include increased rotor noise, typical surface cracks or triggering vibration monitoring units. We use targeted measuring technology to detect faults and initiate corrective measures. For analysing blade angles, we work with laser-based processes (dynamic geometry measurement = DGM).

Enclosed platform technology enables year-round repairs

Thanks to the completely enclosed Terra work platform, we can work largely independently of the weather on rotor blades that are still attached. The 'floating workshop', which is aligned to the attached rotor blade, enables the work platform to be completely enclosed at the repair site. This means that work can be carried out at height regardless of the weather, thereby reducing downtimes due to bad weather and extending the whole rotor blade work season.





2. Offshore

- 2.1 Full Service Above as well as Under Water
- 2.2 Offshore References

2.1 Full Service Above as well as Under Water

Maintenance work on offshore wind farms can be a significant cost factor for operators. As the only independent service provider for offshore full service, our company has taken on this task and successfully established itself in the offshore market.

Several factors have helped us to achieve this: focusing on the essentials, operational flexibility and our ability to identify and utilise synergies. It is more important than ever to question old strategies and develop new ones. Due to the enormous pressure on investment and operating costs, a service strategy that begins with commissioning plays an essential role in utilising savings potential. Logistic costs account for approximately 70 percent of the costs for standard maintenance in the offshore sector, and we see potential savings of 20 to 30 percent in this area alone. Our goal is to find the right balance between standardised, cluster-wide service and optimal adaptation to individual customer requirements.

Maintenance for the whole offshore wind farm

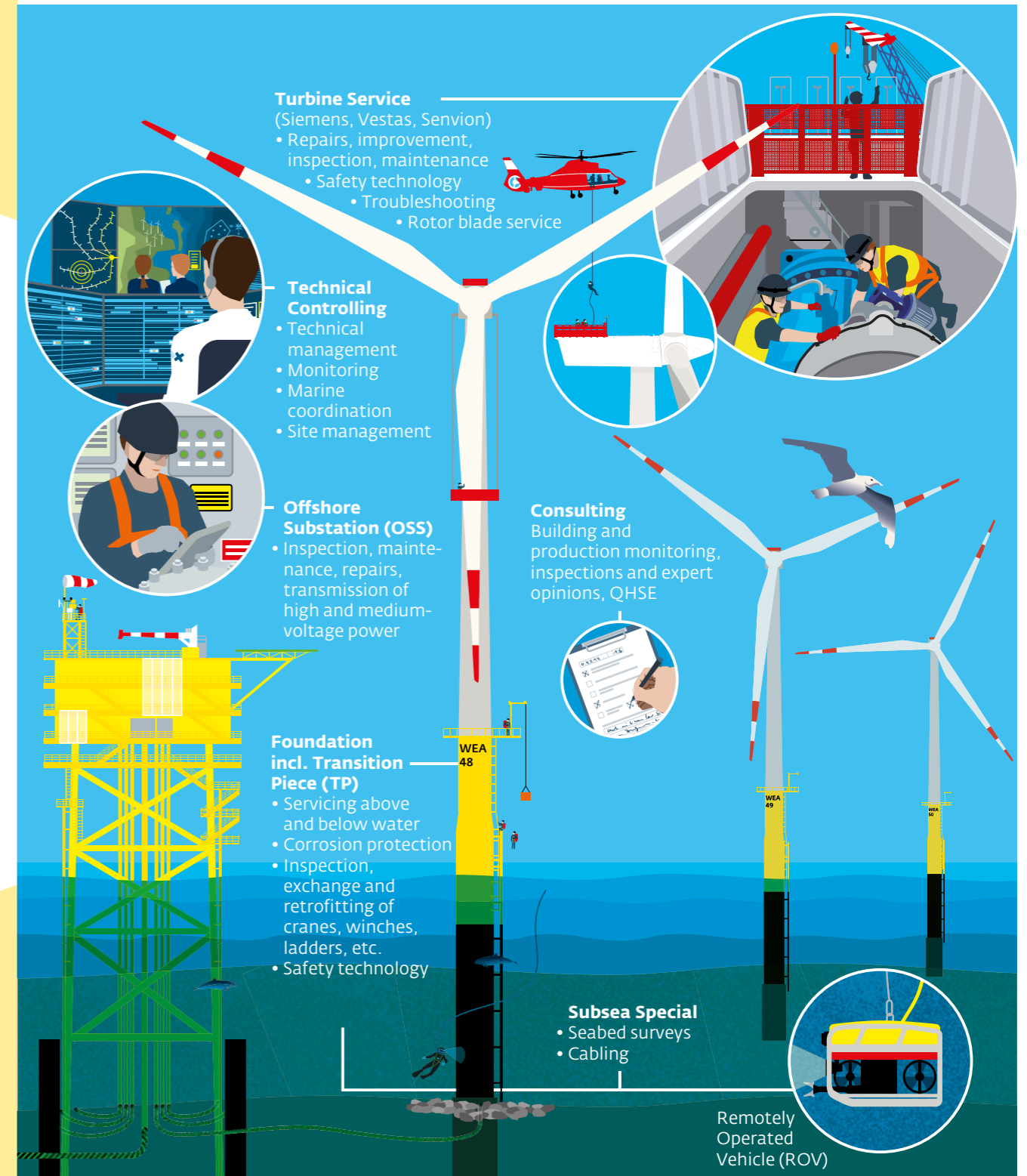
Deutsche Windtechnik was one of the first offshore service providers on the market. For more than a decade, we have been working on a wide range of tasks at sea and have continuously expanded this area to cover the entire infrastructure of offshore wind farms. Our cumulative experience, versatile staff and network of maritime partners enable us to provide comprehensive service for offshore wind farms, including foundations, turbines, rotor blades and even offshore substations (OSS). This makes us the only company that provides maintenance from a single source for complete offshore wind farms and substations.

Manage interfaces – reduce costs

Our customers can select from a range of individual service packages all the way up to the maintenance of complete wind farms above and under water. In addition to the complete system environment, this also includes technical operations management and monitoring, coordination in the wind farm or monitoring tasks during the manufacturing of components and their installation. We rely on synergies and flexible teams that use their training to perform a variety of tasks during deployments, and this minimises the amount of work required. In addition, our wind farm-spanning cluster concept includes wind farms in the Dutch North Sea, the Lower Saxony Wadden Sea and the German Bight as far as Heligoland to form three regional clusters, enabling us to coordinate all service deployments in those regions. Interface management is our leverage to reduce costs. In addition, we work together very closely with suppliers and obtain certification from them. This has advantages for everyone involved.



Full-Service Offshore



Full service above and below water: In addition to servicing, Deutsche Windtechnik is also responsible for services such as operational management and technical controlling of wind farms.

2.2 Offshore References



Offshore Wind Farm	Wind Farm Management	Turbine Service	TP Service	Subsea Service	Substation Service	Manufacturing and Quality Surveillance	Main Components	Further Service
Germany								
(1) alpha ventus	-	●	●	●	●	-	●	●
(2) Amrumbank West	-	-	●	●	●	-	-	●
(3) Arkona Becken SO	-	-	-	●	●	-	-	-
(4) Baltic I	-	-	-	-	-	-	-	●
(5) Baltic II	-	-	●	-	-	-	-	●
(6) Trianel Windpark Borkum I+II	-	●	●	-	-	●	-	●
(7) Butendiek	●	-	●	●	●	●	-	●
(8) DanTysk	-	-	●	●	●	●	-	●
(9) Gode Wind I + II	-	-	-	-	-	-	-	●
(10) Meerwind	-	-	-	-	-	-	-	●
(11) Kaskasi	-	-	-	●	-	-	-	-
(12) Merkur	-	-	-	●	●	-	-	●
(13) Nordergründe	●	●	●	●	●	●	-	●
(14) Nordsee Ost	-	●	●	-	-	-	●	●
(15) Riffgat	●	●	-	●	●	-	-	●
(16) Sandbank	-	-	●	●	●	●	-	-
Denmark								
(17) Anholt	-	-	-	-	-	●	-	●
(18) Horns Rev III	-	-	-	●	-	●	-	-
(19) Danish Kriegers Flak	-	-	-	-	-	●	-	-
(20) Vesterhav Nord/Syd	-	-	-	-	-	●	-	-



Offshore Wind Farm	Wind Farm Management	Turbine Service	TP Service	Subsea Service	Substation Service	Manufacturing and Quality Surveillance	Main Components	Further Service
United Kingdom								
(21) Aberdeen	-	-	-	-	-	●	-	-
(22) Westermost Rough	-	-	-	-	-	-	-	●
(23) Lincs	-	-	-	-	-	-	-	●
(24) Sheringham Shoal	-	-	-	-	-	●	-	-
(25) Greater Gabbard	-	-	-	-	-	-	●	-
(26) London Array	-	-	-	-	-	-	●	●
(27) Gunfleet Sands	-	-	-	-	-	-	●	-
(28) Rhyl Flats	-	-	-	-	-	-	●	-
(29) Kincardine	-	-	-	-	-	-	●	-
The Netherlands								
(30) Egmond aan Zee	-	-	-	-	-	-	-	●
(31) Prinses Amaliawindpark	-	-	●	●	-	-	-	●
(32) Eneco Luchterduinen	-	-	●	●	-	-	-	●
(33) Westermeerwind	-	-	●	●	-	-	-	●
(34) Gemini	●	-	-	-	-	-	-	●
(35) Borssele III + IV	-	-	●	-	-	-	-	-
(36) Fryslân	-	-	●	●	-	-	-	●
(37) Hollandse Kust Zuid	-	-	●	-	-	●	-	●
Taiwan								
(38) Yunlin	●	-	●	●	●	●	-	●
(39) Changhua Demo	-	-	-	-	-	-	-	●
(40) Formosa 1	-	-	●	-	-	-	-	●

3. Additional Services

- 3.1 Research and Development
- 3.2 Control Electronics
- 3.3 Survey and Inspection Body
- 3.4 Quality Management and Occupational Health and Safety
- 3.5 Repowering

3.1

Research and Development

Our objective is not only to ensure that systems operate safely and securely, but also to facilitate continuous improvement. To strengthen and enhance our innovative skills, technicians and engineers in all divisions work daily on the further development of our services.

Our analyses are based on a stable and growing data pool of currently over 7,800 wind turbines. This data is complemented by many years of expertise coupled with technical calculations, careful selection of materials and finally by detailed evaluation of the prototype 150 engineers, foremen, technicians and staff with practical experience. An expert team with a focus on system software and programming takes care of corresponding special tasks. We want our overall range of services to convince our clients. All divisions must fit together perfectly to ensure harmonised services.

Improvements/Upgrade system technology

Servicing will continue to be a dynamic field of activity. This is reflected by the wide range of creative, innovative upgrades that Deutsche Windtechnik has developed to optimise system operations. In order to redesign existing parts, electrical and mechanical components and tools, we also work with 3D scanners. Each upgrade is the result of an extensive research and development process that is driven by our enthusiasm for servicing and our entrepreneurial agility.

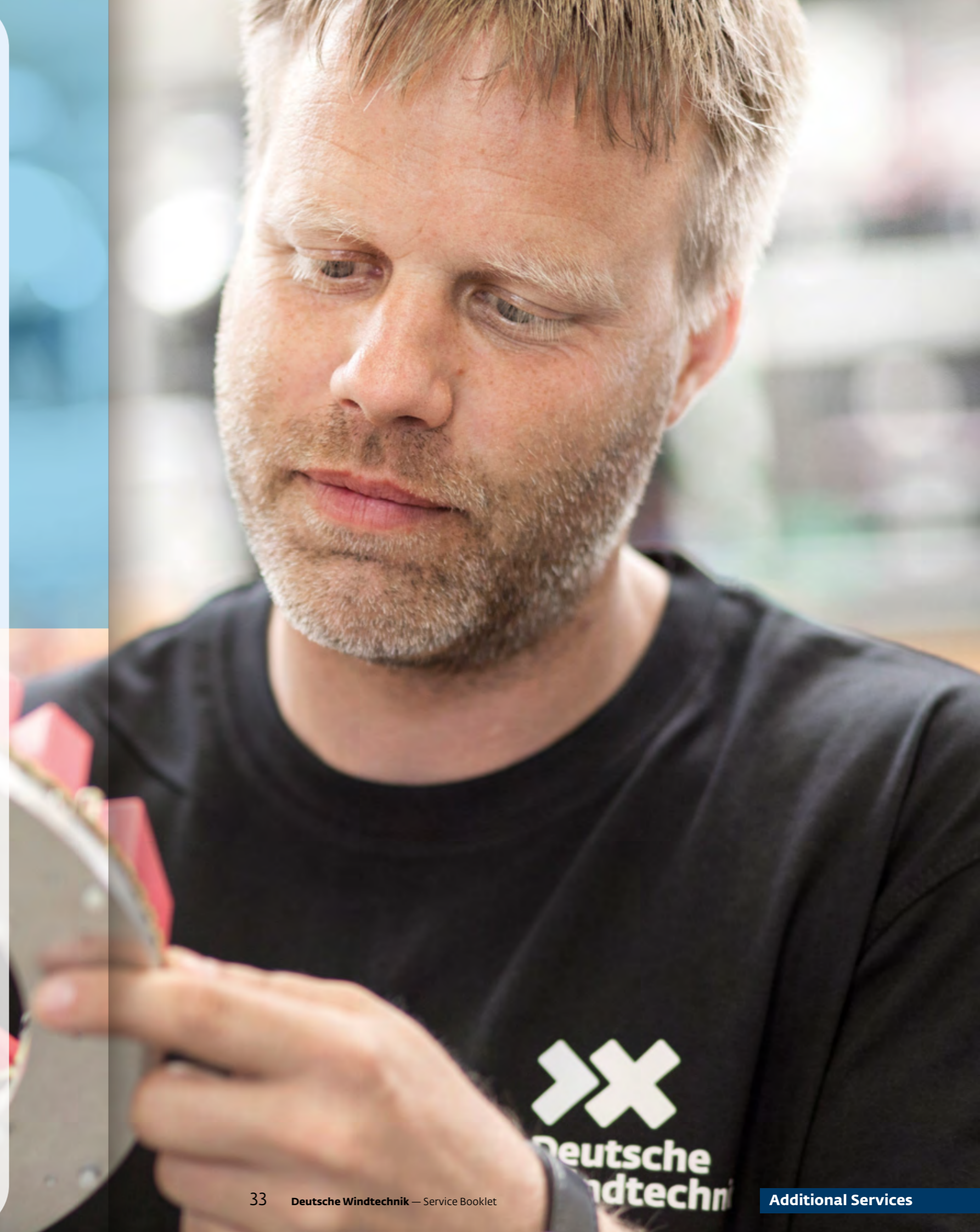
With regard to new designs and further developments, our engineers apply state of the art concepts and work in line with the latest developments. Personal exchange between specialist departments within Deutsche Windtechnik and with research facilities, partners and customers ensures that improvements are developed and applied in the right context. To achieve the desired economic effects, our engineers coordinate their work closely with sales and management.

Independence is necessary

A comparison of available upgrades from manufacturers and independent service providers shows that independent service in particular is the driving force behind retrofits and improvement of overall servicing. We are convinced that independence from the manufacturer is in fact essential to be able to successfully manage improvement of system operations. The manufacturer of original parts or systems is often trapped within its own responsibility for design shortcomings. Independent companies can focus exclusively on maintenance and look very closely at system performance. They possess key competencies because independent companies have qualified service personnel for a wide range of system generations.

Developing new things together with customers

It is important to us to involve our customers as partners in the maintenance processes and the development potential of their own turbines: We maintain a personal dialogue and rely on the direct exchange of information with our customers. Together, we ensure that our engineers develop exactly what you need to sustainably improve system operation.



Improvements/Upgrades

AN Bonus/Siemens

Bearing cover NDE for bearing on the generator	AN Bonus 600 kW MK4 / AN Bonus 1.0 MW
Backup battery WTC3 main computer	AN Bonus <1.3 with WTC3 Controller
Battery modification WTC2 board	AN Bonus 600 kW - 2 MW
Burglar alarm for wind turbines	AN Bonus
Central lubrication of main bearing	AN Bonus 2 MW/76
Discharge circuit board for phase compensation	AN Bonus 450 kW - 2 MW/76
Power supply mainboard	Controller WTC1, AN Bonus 150 kW - 600 kW
SMART UPS 750	AN Bonus - WTC2
Temperature monitoring of main bearing	AN Bonus 600 kW/44-3 - 2 MW/76
UF70	AN Bonus > 1.0 MW with WTC2 and WTC3 controller

Enercon

Frequency measurement via the CMS of the main bearing	all
Generator cleaning using dry ice	E48 to E115
High-quality batteries	E-48 to E-92
Optimisation of control components	E48 to E115
Retrofit of additional lubrication for the main bearing	E48 to E92

Fuhrländer

Automatic central lubrication of main bearing	MD
Control concept Mita WP 3100 MKII	MD
Decoupling of self-supply to protect the power supply units	FL2500
Icing detection	FL2500
Increase in yield through rotor blade optimisation	FL2500
Obstacle lights / Obstruction lights (Hindernisfeuer)	all
Rebuilding LVU - Installation of two fans in the roof of the control cabinet	FL2500
Replacement frequency inverter	MD
Rotor blade optimization	all
Stabilisation Mita ArcNet	MD
Upgrade lightning protection / Lightning protection obstacle lights and sensors	all
Wear and tear prevention rotor blade gear meshing S70/77	MD

Gamesa

Transformer cover	G52
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NEG Micon

Automatic central lubrication main and azimuth bearings	NM64c / NM72c / NM82
Automatic central lubrication of main bearing	M1500 / M1800 / NM48 / NM52 / NM60
Carbon brush holder ASR EVO I/II + PRVS	NM72c / NM80 / NM82 / V82 / NM92
Fill level monitor for main gearbox	NM48 - NM82
Gearbox torque arms	NM64c / NM72c / NM82 / V82
Generator torque arm	NM60 / NM64c / NM72c / NM82 / V82
Hub frame pitch cross-beam	NM72c EVO I Po2
Main frame	NM60 / NM64c / NM72c / NM82
Main gearbox oil pressure monitoring	NM48 - NM52
Offline bypass filtration main gearbox	NM48 / NM52 / NM60
Pitch hydraulic cylinders	NM72 / NM82 / EVO I
Pressure storage / pitch accumulators	NM72c EVO II / NM82 EVO II / V82-1.5
Retrofit of compensation	NM43 / NM48 / NM60
Rotational speed-controlled pressure lubrication main gearbox	NM48
Stall stripes setup	NM82
Temperature monitoring generator bearings	M1500 / M1800 / NM48 / NM52
Temperature monitoring of main bearing	M1500 / M1800 / NM48 / NM52 / NM60 / NM64c / NM72c / NM82
Yaw brake system	NM72c - NM82

Nordex

Amplification of the BUS signal into the hub	all
Automatic central lubrication of main bearing	S70/77
Control concept Mita WP 3100 MKII	S70/77
Cooling top and bottom box	N80/N90
CSC3 to CSC4 Woodward inverter upgrade for non-isolated turbines	N80/N90
Interbus booster	N80-N117
LPC Retrofit	N60/62/N80/N90
Mains contactor upgrade (converter) / Netzschütz Upgrade	N80/N90
Obstacle lights / Obstruction lights (Hindernisfeuer)	all
Pitch controller upgrade / Upgrade UDS35 pitch system on PitchMaster II	N80/N90
Replacement frequency inverter	S70/77
Rotor blade optimization	all
Stabilisation Mita ArcNet	S70/77
Upgrade IDS converter - controller and power hardware	N80/N90
Upgrade lightning protection / Lightning protection obstacle lights and sensors (all)	N80/N90
Wear and tear prevention rotor blade gear meshing S70/77	S70/77

Senvion

Automatic central lubrication of main bearing	MD
Control concept Mita WP 3100 MKII	MD/MM
CSC3 to CSC4 Woodward inverter upgrade for non-isolated turbines	MD/MM
Grid protection test at wind turbine level	MD/MM/3XM
Increase in yield through rotor blade optimisation	MM92
Installation of additional grid filters	3XM with NES converter
Monitoring of blade bearings by monitoring system with active crack monitoring (BBG+R)	MM/3XM
Obstacle lights / Obstruction lights (Hindernisfeuer)	all
Replacement frequency inverter	MD
Rotor blade optimization	all
Stabilisation Mita ArcNet	MD
Upgrade lightning protection / Lightning protection obstacle lights and sensors	all
Upgrade of the lubrication pump for pitch	3XM
Upgrade PCH sensor for vibration monitoring	MM
Wear and tear prevention rotor blade gear meshing S70/77	MD
Wireless connection fos4X-WLAN Bridge	3XM

Vestas

Automatic central lubrication of main bearing	V66 - V80/V90-2.0
Automatic central lubrication of rotor blade bearing	V66 - V80/90-2.0
Climate package nacelle	V66 - V80/90-2.0
Cooling for inverter control unit	V52-850 / V66 - V80/90-2.0
Coupling gearbox to generator	V47-660
Earthing and grease line on the pitch cylinder	V90-2MW Mk8
Gearbox torque arms	V66-1.65 RCC / V66-1.75 VCS
Gearbox torque arms	V80/90-2.0
High voltage transformer	V66 - V80/90-2.0
Temperature monitoring of main bearing	V66 - V80/90-2.0
Tower vibration damper	V80/90-2.0
Upgrade fan board converter control	V9-2MW Mk8
Yaw brake system	V66 - V80/90-2.0
Yaw lubrication system / slewing ring system	V66-1.75 / V80/90-2.0

Other manufacturers on request

Communication conversion from ISDN to DSL (IP Box)	
Ground-based winch system (GBWS) for all turbines up to a hub height of 145 m and up to a blade length of 60 m	
Installation of fire extinguishing system	
Lightning protection obstacle lights and sensors (all)	
Measurement of the blade angle – relative measurement working position under load	
Monitoring of blade bearing using a blade bearing monitoring system	
Obstacle lights – conversion to LED technology	

3.2

Control Electronics

When wind turbines suffer failures, it is often due to problems with the electronics. To get them running again, it is often necessary to replace electronic components. We offer an economical, reliable alternative to new spare parts with refurbished electronic components.

Our experts for control electronics are specialised in the repair of electronics in wind turbines. Since we carry out repairs on an industrial scale, we have committed ourselves to continuous documentation of the work steps and results for each individual assembly.

General overhaul, optimisation and testing

Our technicians and engineers with a focus on control electronics concentrate on the development and implementation of detailed procedures for the general overhaul and testing of selected electronic assemblies. The replicated component is initially identical to the original in terms of properties and use. In the second step, the data we collect and evaluate as part of the product analysis enable us to further develop and improve the component. For example, the installed assemblies are often no longer up-to-date regarding performance and durability. We proactively replace the affected components with higher-performance components. This preventive repair approach with the aim of improving performance clearly distinguishes us from other repair service providers.

After repair, each individual assembly is tested in a simulation environment under real conditions in order to ensure the functionality of the overhauled components. We give a two-year warranty on all refurbished components.

Reverse engineering

The electronics used in wind energy systems are often a 'black box' because in many cases the documentation for the components is kept under lock and key by the manufacturer. In order to keep our delivery times short and to be independent of third parties, we have redesigned some components and manufacture them ourselves.

But our reverse engineering department not only allows us to catalogue the design details of the various components and replicate them. Our overriding goal is to significantly increase the service life of these components by using improved designs and more modern technologies. These measures enable us to act independently and reduce our costs.

Delivery plus support

In addition to refurbishing electronic components, we also use our expertise in wind turbine electronics to support our customers during commissioning and operation of electronic assemblies. We would be very happy to help you and answer any questions you may have!

Proprietary Development and manufacturing

In addition to conventional repair, we also develop our own solutions. This gives us increasing independence from the parts manufacturer in terms of product availability and price. Our customers can rely on the quality, longevity, efficiency and economic viability of our innovative product developments in the areas of converters, measuring and tool technology. Development work is characterised by a practical exchange of knowledge within the Deutsche Windtechnik Group and our discussions with customers and partners.

Virtual wind turbine

We have developed a virtual wind turbine system that allows us to simulate the environmental signals that a real wind turbine is subject to. In addition to the wind, this includes voltages and currents in the energy grid. The virtual wind turbine also simulates the rotational speed, which is calculated using pitch angle and wind speed, as well as the voltages and currents of the generator. We use the virtual wind turbine primarily for the purpose of examining converter control components (VCP boards). This development makes us the first manufacturer-independent service provider to be able to check and repair the entire range of Vestas control electronics from the V29 to the V90 MK5.

RPM Simulator

The RPM (Rotations per Minute) Simulator that we have developed is needed to check overspeed, which is part of the safety shutdown parameters of wind turbines. It allows technicians to verify that the overspeed safety shutdown is functioning correctly without exposing the turbine to mechanical stresses and independently of wind and weather.

SKiiP-Packs for Vestas converter V66-V90 (AGO2)

The inverter of the Vestas V66-V90 is equipped with Semikron SKiiP-Packs on the power side. In cooperation with Semikron, our engineers have developed SKiiP-Packs that can be considered fully compatible, equivalent replacement parts.

IPM-Check

IPM-Check is a further development of the previous inverter testing device SKiiP-Check. This new service case enables a technician to test the IGBT power modules of wind energy converters in an installed or uninstalled condition. Navigating the menu as well as performing the test procedures are both done using a touch display. Measurements are carried out fully automatically. This makes diagnostics more efficient and less time-consuming, thereby reducing costs. The IPM-Check service case is suitable for use with inverter power units from a range of manufacturers, such as Converteam, SEG Woodward and Vestas.

Optical Interface for Vestas-Controller

To provide the service for Vestas wind turbines quickly and efficiently, it is necessary to connect a laptop to the turbine controller. Our Optical Interface has this functionality.

Inverter power unit repairs

Our new power test bench makes it possible to test various inverter power units in accordance with manufacturer standards. Power units from our own repairs as well as used units whose condition is unknown can be tested.

The test sequence is fully automated: First, the reaction times of the power units are tested in the microsecond range. No deviations are permissible. Afterwards, a number of increasing load conditions are tested, all the way up to full load. All parameters are monitored during these tests, in particular the temperature development. This comprehensive test significantly reduces the failure rate of converter power units in the wind turbine.

On-demand Night-time Marking

Using an Aircraft Detection Light System (ADLS for short) will become mandatory on 01.01.2025. In cooperation with f.u.n.k.e. Avionics GmbH, Deutsche Windtechnik has developed an independent transponder-based ADLS system. This was one of the first ADLS systems to be approved in accordance with the new guidelines of the General Administrative Rules for the Identification of Aircraft Obstructions (AVV marking) after type examination.

Our ADLS system is available in configuration options that can be combined with one another. This enables us to offer you a solution that is tailored to your needs and ensures that your wind farm fulfils all ADLS requirements.

Product Overview

Current overhaul products

- Vestas controller V29 – V80/V90 Mk5
- Siemens controller 600kW – 2.3MW
- Semikron SkiiPs
- Vestas RCC
- Several meteorological modules
- Aircraft obstruction lighting
- Enercon Controllers

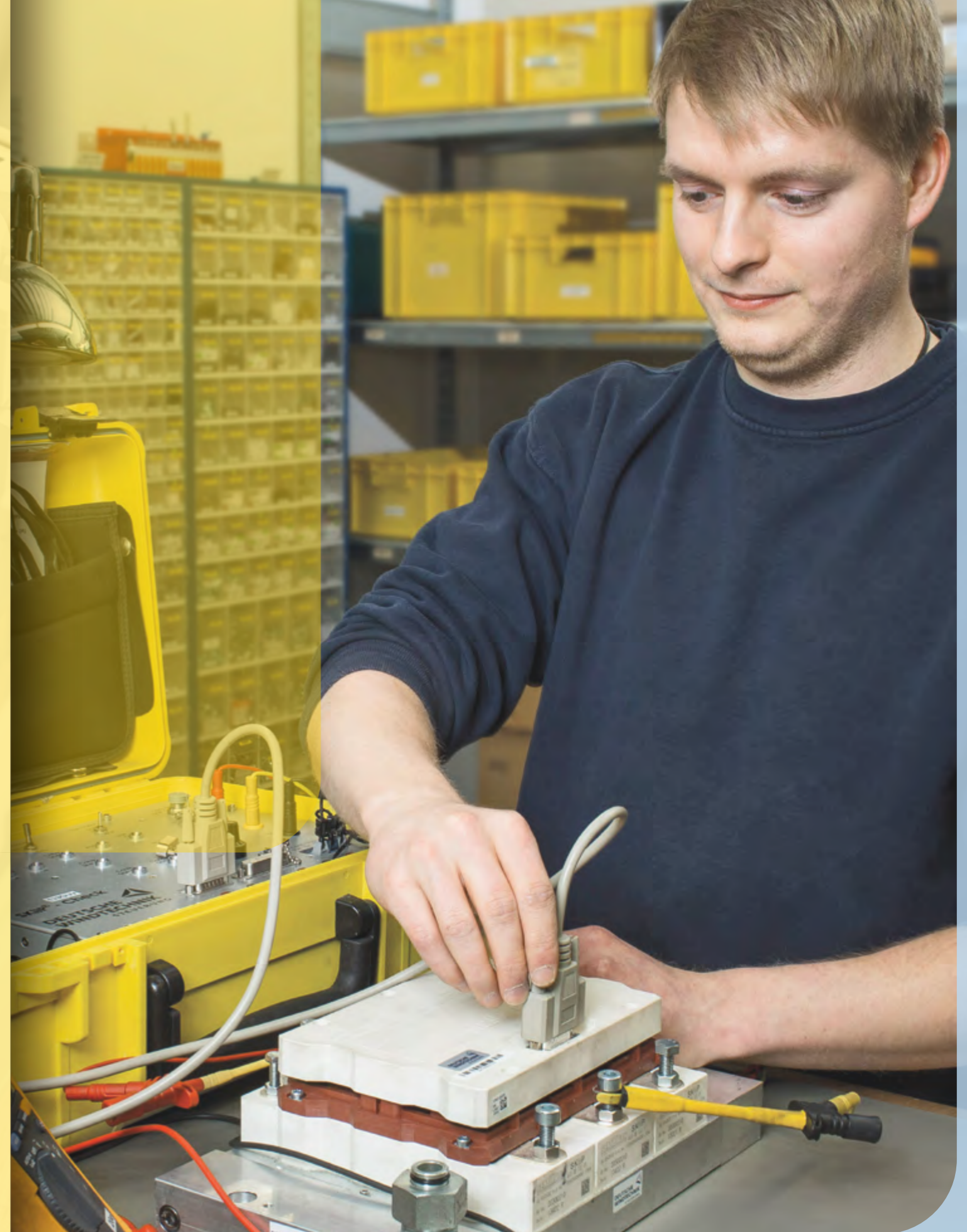
Upgrades

- RCC, several improvements
- VCP Board

Reproductions

- IGBT Driverboards
- RCD Ringsnubber
- SkiiP Check Case
- RPM Simulator
- SkiiP modules for Vestas converters
- Multus PLC
- Scada Internet Communication Solution

All other components from different OEMs can be arranged upon request.



3-3

Survey and Inspection Body



The safe and economical operation of onshore and offshore wind farms requires a wide range of mandatory assessments of the wind turbines and their individual components. Our independent, accredited experts prepare technical reports on turbine safety and occupational safety that fulfil the requirements of national and international laws and standards.

Deutsche Windtechnik's Survey and Inspection Body has been recognised by the German Accreditation Body (DAkks) as a type C Independent Inspection Body in accordance with DIN EN ISO/IEC 17020:2012. It is one of the first in the industry to receive this recognition (certificate attachment under registration number D-IS-20474-01-00).

Expertise and inspection competencies for the entire wind turbine

- Inspections prior to commissioning
- Inspections prior to warranty expiry
- Recurring inspections
- Continued operation of wind turbines after 20 years of calculated service life
- Testing of electrical equipment (IEC 60364, DIN EN 50110, DGUVV3)
- Drive train monitoring (video endoscopy and vibration measurement with a focus on generator, gearbox, main bearing)
- Rotor blade inspection including lightning protection system
- Manufacturing and construction supervision
- 'Client Rep' (client representation, e.g. for repairs)

Manufacturing and construction supervision

Our engineers and technicians systematically document and analyse the quality of the individual project processes, from manufacturing to installation and commissioning of the turbines. This ensures that the construction period and the costs for the project stay within limits. The fulfilment of contractual claims and interests of customers towards suppliers and manufacturers are verified. These monitoring activities form the basis for a safe, sustainable and efficient turbine operation.



Assessment for lifetime extension after twenty years

Wind turbines are designed for a limited service life. This design service life is usually 20 years. Whether the wind farm project can continue to operate beyond its design life depends most of all on the technical condition of each individual wind turbine. In addition, site-specific meteorological, topographical and orographic parameters are included in the assessment. Practical, analytical assessments are the basis of the individual status report. In the practical part, the entire wind turbine, from the foundation to the tips of the blades, is subjected to a technical inspection. Using this data as a basis, Deutsche Windtechnik works together with specialised analysts to develop options that can enable successful lifetime extension even at complex locations.

Due diligence and consulting

Identifying and evaluating task areas and risks is the main priority of our multidisciplinary consulting team. As part of our due diligence, our experts provide support in all areas with comprehensive expert knowledge and experience from numerous wind farm projects. At the same time, we are at the disposal of all parties involved. As a basis for decision-making, we prepare a sound risk report. The risks are structured and presented according to economical, technical as well as safety-related and environmentally relevant aspects. Depending on the task definition, we offer these services as an audit (due diligence), or as an accompanying consultation service.



Cycles of compulsory tests for wind turbines (WT)

Type of test	Year of operation of the wind turbine																				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Type of test commissioning WT	o																				
Inspection before end of warranty WT			2																		
Periodic inspection WT					4				8				12				16				20
Condition-oriented inspection WT			2				6				10				14				18		
Electrical equipment DIN IEC 60364 / DGUV V3	o				4				8				12				16				20
Service lifts / lift (Züs) / IBN / Z / H	o	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Pressure equipment (Züs)	o											A									A
Winches, hoists and pulling	o	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment lightning (overvoltage) protection	o			3			6			9			12			15			18		
Fire fighting equipment	o		2		4		6		8		10		12		14		16		18		20
Rescue equipment (first aid kit, ...)	o				4				8				12				16				20
Marking / signs continued	o		2		4		6		8		10		12		14		16		18		20
Continued operation WT																					20
Safety technology																					
– Climbing way, anchor points, platforms, fall protection, guided type fall arrester	o	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
– Personal protective equipment (PPE)																					
– Abseiling and rescue equipment																					
– Fire protection system, optional alarm system																					

3.4

Quality Management and Occupational Health and Safety

Deutsche Windtechnik provides consultation services for companies on all aspects of QHSE (Quality, Health, Safety and Environment) both onshore as well as offshore. Our work is based on understanding the QHSE requirements of our customers and jointly implementing measures to fulfil them.

By precisely analysing these requirements in the areas of occupational health and safety, quality and environmental management, we can develop reliable concepts and processes. In addition to consulting services, we will be glad to put our competence and experience at your disposal during operational implementation at your company.

Quality management

The requirements of our customers are the focus of our quality management system. Together with you, we develop tailor-made strategies to achieve or even surpass individual requirements and quality goals.

The tried-and-tested tools of quality management, such as the development of a continuous improvement process (CIP), offer a wide range of opportunities to increase productivity and cost-efficiency. Cooperation with customers and suppliers, internal communication channels as well as the overall success of the company are positively influenced.

Our services include:

- Development of quality management systems
- Consultation for and preparation of certifications (e.g. ISO 9001)
- Consultation and assistance in the implementation of new regulations
- Advice on conducting audits (internal system audits, supplier audits, etc.)

HSE management

Healthy, motivated employees are a key factor for your business. Implementing an effective occupational safety and health management system (SHMS) allows you to control and monitor your occupational safety objectives. A comprehensive understanding of the health and safety of the employees is central to success.

Our services include:

- Development of management systems for occupational safety
- Occupational safety specialist services (SiFa) as well as safety engineering
- Services of the Occupational Safety Coordinator and HSE Manager
- Qualification for carrying out
 - Risk assessments
 - Creation of operating and work instructions

Operational safety (onshore and offshore)

Your projects are at home all over the world? As an international company, we specialise in managing safety projects at home and abroad, on land and at sea. An understanding of the country-specific working conditions of the projects is central to successful operational safety management. For this reason, our specialists perform regular audits for onshore as well as offshore projects and develop advanced solutions that fit your occupational safety management system.

Our services include:

- Auditing and on-site inspection of projects
- Accident investigations and damage assessments (e.g. after fires)
- Services of the Offshore Flight Operations Officer
- Planning and execution of rescue exercises
- Development of protection and safety concepts as well as rescue concepts
- Qualifying employees
 - Support in determining training requirements
 - Safety training

Environmental management

Our certified environmental management system enables us to implement projects in a way that saves resources and is environmentally friendly. We help our customers to develop appropriate indicators and processes to secure the sustainable success for their companies.

Our services include:

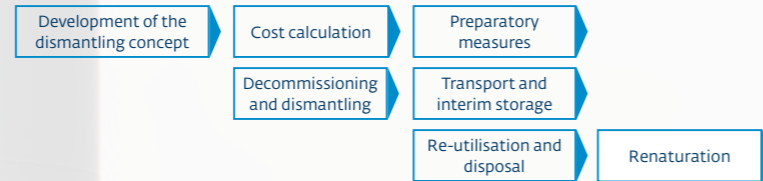
- Development of environmental management systems
- Support for certification in accordance with DIN EN ISO 14001
- Development of performance indicators and processes to improve environmental performance
- Creation of waste concepts and waste balances
- Concepts for the reduction of waste and waste costs



3.5 Repowering

For many years, Deutsche Windtechnik's Repowering department has provided support for operators in dismantling and re-utilising their wind farms. In addition to technical services, we also emphasise advanced project management as well as detailed consultation with regard to the chances of success of the repowering project.

The aim is to achieve maximum added value and planning reliability in relation to the old turbine. The entire responsibility has already been taken over for numerous projects. Below are a selection of examples:



Year	Installation site	Wind turbine details	Work carried out
2019	Blender (Lower Saxony)	4 x DeWind D4/o.6 MW 70 m 1 x Vestas V-47/o.6 MW 78m	Dismantling including tower and foundation Demolition of the lattice mast Purchase and sale of individual components
2018	Eemshaven (Netherlands)	2 x Enercon E-82/3MW Hub height 98 m	Dismantling incl. tower- and foundation demolition Purchase and sale of individual components
2017	Kyritz (Brandenburg)	6 x NEG Micon NM60/1000 Hub height 70 m	Dismantling incl. foundation demolition Purchase and sale of wind turbines and individual components

Project management

Our experience shows that three factors are of central importance for the professional management of dismantling and re-utilisation of systems:

1. The overall project should achieve the best-possible economic performance.
2. The construction stage for new turbines must not be hindered in any manner.
3. It must be ensured that the relevant standards for work safety and environmental protection are adhered to during dismantling, loading and transport.

We provide the following comprehensive measures during the preparation phase to ensure smooth execution of the project:

- Assessment of dismantling cost
- Preparation of a dismantling concept
- Advice on the re-utilisation of old systems
- Contract design
- Administrative processing

Technical services

The Deutsche Windtechnik Group has all of the competencies that are required to successfully handle a variety of dismantling projects. These include professional preparation of the systems, dismantling and logistics for components of a wind farm (rotor blades, tower, foundation, transformer station, substation, cables and trays, paths and roads).

Our extensive services in the field of repowering and dismantling include:

- Planning and coordination of the dismantling process
- Preparation of the wind turbines (removal of hazardous materials, decommissioning, etc.)
- Complete dismantling of the wind turbines and the wind farm infrastructure
- Dismantling or demolition of concrete towers
- Foundation demolition
- Obtaining the necessary permits
- Purchase and sale of wind turbines
- Evaluation, inspection and overhaul of old systems
- Logistics
- Further re-utilisation of wind turbines and individual components
- Renaturation

Utilisation of old systems

After dismantling, three options are available for further re-utilisation of the old system: sale, processing to be sold as spare parts or material recycling and disposal of individual materials. Economic aspects, the technical condition, the system specifications (e.g. tower design) and the demand for the respective types of wind turbines are all important considerations when selecting a re-utilisation strategy. We have many years of experience, and this enables us to offer detailed consulting and project-specific solutions.

Marketing and sale on the secondary market

During the last five years, Deutsche Windtechnik has successfully sold numerous used wind turbines abroad. The countries they were sold to include Northern Ireland, Italy and Kazakhstan. The market is characterised by a high level of volatility and price sensitivity. Tried-and-tested purchase contracts and our finely honed skills in negotiating with potential customers help us to carry out the sale reliably and securely. With the technical support of our specialists and our spare parts warehouse, we ensure the operation of the used turbine after it is reinstalled.

Spare parts sales

In some cases, it may be profitable to sell certain spare parts of a dismantled wind turbine on the secondary market. Large-scale components in particular, such as gearboxes, generators and transformers, can be used again after preparation. Power electronics and parts of the control system can also be reused after being overhauled. It must be ensured that the used parts are checked and are found to be in perfect condition before they are utilised. Repairs must include a guarantee on the respective part to be acceptable for professional service.

Recycling and disposal

In cooperation with proven partners, Deutsche Windtechnik ensures proper and professional recycling of the turbine and individual materials. Depending on the type of system and current market prices, revenues from the recycling of valuable materials from components such as steel towers or copper cables may vary. These revenues reduce the total costs for the dismantling and disposal of the remaining system components.

4. Training Center Deutsche Windtechnik

4.1 Training Center Viöl

4.2 Training Center Bremen

4.1

Training Center Viöl

Main area system technology and occupational health and safety

The growing shortage of skilled workers underscores the important role of a competence centre for system engineering and safety. The rapid development of technology, systems, processes and learning methods means that companies must utilise intelligent, agile methods in their leadership and must inspire their employees. Accordingly, we attach great importance to training and further education because it ensures the work quality and motivation of our employees.



At our Training Center in Viöl, knowledge transfer takes place under unique conditions: Practical training is given under realistic conditions in original nacelles from a range of manufacturers.

Targeted multi-brand training

Original turbines from the manufacturers Vestas, NEG Micon, Siemens, Enercon as well as Senvion form the unique centre-piece of the Training Center. Nacelles installed on the ground represent almost the entire spectrum of technology that service technicians deal with in their daily work. Here, at this one training location, they can simultaneously perform troubleshooting tasks and clarify practical questions regarding electrical engineering, mechanics, hydraulics, control and operation. The training concept includes both basic training and subject-specific training.

Individual training concepts for customers

The competence centre provides training for our own employees, but it also offers customers the opportunity to have their staff trained by trainers with extensive industry experience. In

addition to standardised courses, we also design demand-driven, individual concepts. The training courses gain additional attractiveness through features such as on-the-job training, field support, external experts, state-of-the-art media and much more.

The focus of our training courses is the creation of entrepreneurial added value for the customer. One important principle is the development of solutions by the participants themselves. It contributes to the long-term anchoring of knowledge and provides a sense of achievement. A continuous exchange of ideas and solutions as well as the final analysis ensure lasting further development for participants and trainers alike.

Transparency that benefits everyone

In contrast to the manufacturer, Deutsche Windtechnik is not obligated to any particular technology. This freedom means that problems and findings can be addressed openly and transparently. The transfer of know-how also promotes technical transparency and quality in the market.

No.	Course	Methode	Duration
1	Occupational safety training in accordance with german DGUV		
1.1	PPE against falls (DGUV) basics	theory, practice	16 h
1.1.1	PPE against falls (DGUV) refresh	theory, practice	8 h
1.2	First aid training for company first aiders (DGUV)	theory, practice	6,5 h
1.3	Fire awareness (DGUV)	theory, practice	4 h
1.5	Deck crane, attachment of loads	theory, practice	4 h
3	User training for service lifts		
3.1	User training on service lifts Avanti Shark, Dolphin, Lift 2000	theory, practice	6 h
3.2	User training for service lifts Powerclimber SP-WMVC, SHERPA	theory, practice	6 h
3.3	User training for service lifts Zarges TBA 600 series	theory, practice	6 h
3.4	User training for service lifts Greifzug Climbing System series (for Enercon WEC)	theory, practice	6 h
4	Basics		
4.1	Energy generation by means of wind turbines	interactive, theory	2 h
4.1.1	Energy generation by means of wind turbines incl. WTG inspection	interactive, theory, practice	8 h
4.2	Basics of wind turbine mechanics	interactive, theory	2 h
4.3	Basics of wind turbine hydraulics	interactive, theory, practice	7 h
4.4	Maintenance activities	interactive, theory	1 h
4.5	Automatic lubricators	interactive, theory	1 h
4.6	Screw connections, torque and clamping tools	interactive, theory, practice	2 h
4.7	Laser alignment tool	theory, practice	6 h
5	Entrance training EFKfTT or extended EuP entrance training		
5.1	Entrance training EFKfTT or extended EuP entrance training (for non-EFK)	interactive, theory, practice	32 h
6 - 9	WTG technology training		
6.1.1	Siemens AN BONUS G-Serie until 2,3 MW CS WTG function/operation – control/operation	interactive, theory, practice	8 h
7.1.1	Vestas V80/V66-V80-MK-7 WTG function/operation – control/operation	interactive, theory, practice	8 h
8.1.1	Enercon E70 E4 WTG function/operation – control/operation (for windturbine types E48-E115)	interactive, theory, practice	8 h
9.1.1	Senvion MD/MM WTG function/operation – control/operation	interactive, theory, practice	8 h
13	Medium voltage switching authorization		
13.2	Medium voltage switching authorization annual instruction	theory, practice	4 h
15	EuP, EFKfTT, EFK annual instruction		
15.2	EuP, EFKfTT, EFK annual instruction	theory	4 h

4.2 Training Center Bremen

Focus on occupational health and safety

Many workplaces, for example at heights, in confined spaces or in places with a firehazard, are associated with risks and dangers. In order to ensure safe working conditions, companies are obliged to train their employees in the field of occupational safety.

Preventive measures and training are essential to prevent accidents. Theoretical and practical knowledge and skills must be learned and regularly refreshed. In addition, employees need to be able to trust the protective equipment and themselves. This is the only way to ensure safe operation.



Training in accordance with GWO, DGUV and FISAT

Our experienced trainers will quickly provide the necessary training in all relevant safety aspects of working at heights, first aid, fire protection and much more in a realistic environment. All content is presented in an interesting and practical way because having fun while learning helps participants to retain that knowledge in the long term. Each successful participant receives a certificate. Courses currently only take place at our training locations in accordance with our corona-compliant hygiene concept.

Rescue operations at heights and in the depths

Our safety training is carried out at a complex climbing tower that we installed in a building at our location in Hüttenstraße in

Bremen. At a total height of 14m, the versatile steel structure provides everything needed for a practical training. This includes various abseiling heights, attachment points, service lifts and fixed ladders with climbing protection. By moving the pedestal railing, exiting a helicopter can also be simulated. Another 9m high steel tower allows participants to train rescue situations as well as operator and user training for service lifts.

Confined Space Training

For Confined Space Training, we built a complex course of narrow rooms and corridors to train safe working as well as rescue from confined spaces. With artificial fog and darkness, the training can be carried out under very authentic conditions, regardless of the weather and season.

First aid

The Training Center is certified by both GWO and DGUV and provides participants of first aid courses comprehensive training by our staff who are qualified in emergency medicine. The double certification enables participants to receive up to four certificates in basic training within three days. Qualifications are now comparable and mutually recognised to a large extent.



No.	Course	Duration	Validity
1	Occupational safety training in accordance with German DGUV		
1.1	PPE against falls (DGUV) basics	2 days	12 months
1.1.1	PPE against falls (DGUV) refresh	1 day	12 months
1.2	First aid training for company first aiders (DGUV)	1 day	24 months
1.2.1	First aid advanced training for company first aiders (DGUV)	1 day	24 months
1.2.6	First aid training for first aiders in wind energy (DGUV)	3 days	24 months
1.2	including first aid training for company first aiders (DGUV)		
1.2.7	First aid refresher training for first aid in wind energy (DGUV)	2 days	24 months
1.2.1	including first aid advanced training for company first aiders (DGUV)		
1.25	First aid combi basics (EH, GWO FA)	2 days	GWO 24 months / DGUV 24 months
1.25.1	First aid combi refresh (EH-R, GWO FA-R)	1 day	GWO 24 months / DGUV 24 months
1.26	First aid DGUV / GWO basic package (EH-R, EH-WE-R, GWO FA-R, GWO EFA)	3 days	GWO 24 months / DGUV 24 months
1.27	First aid DGUV / GWO refresh package (EH-R, EH-WE-R, GWO FA-R, GWO EFA)	2 days	GWO 24 months / DGUV 24 months
1.3	Fire awareness basics (DGUV)	0,5 days	12 months
1.3.1	Fire awareness refresh (DGUV)	0,5 days	12 months
1.40	HSE introduction	1 day	12 months
1.5.2	Instruction on the operation of deck cranes	0,5 days	12 months
1.8.1	Confined space training (DGUV)	1 days	12 months
1.9	Manual handling (DGUV)	0,5 days	12 months
1.9.3	Helicopter underwater escape training including CAEBs	1 day	48 months
2	Occupational safety training in accordance with GWO		
2.1	GWO Working at heights basics	2 days	GWO 24 months / DGUV 12 months
2.1.1	GWO Working at heights refresh	1 day	GWO 24 months / DGUV 12 months
2.2	GWO First aid basics	1 day	GWO 24 months
2.2.2	GWO First aid refresh	0,5 days	GWO 24 months
2.3	GWO Manual handling	0,5 days	GWO 24 months / DGUV 12 months
2.4	GWO Fire awareness	0,5 days	GWO 24 months / DGUV 12 months
2.5	GWO Sea survival	1 day	GWO 24 months
2.7	GWO Enhanced first aid incl. GWO first aid basics	3 days	GWO 24 months
2.7.1	GWO Enhanced first aid incl. GWO first aid refresh	2 days	GWO 24 months
2.8	GWO Advanced Rescue Training combined basics	3 days	GWO 24 months
3	User training for service lifts		
3.1	Avanti Shark, Dolphin, Lift 2000	0,5 days	24 months
3.2	Powerclimber	0,5 days	24 months
3.3	Zarges TBA 600 Serie	0,5 days	24 months
3.4	Greifzug Climbing system series	0,5 days	24 months
3.5	HALLO Servicelift - only practical introduction	0,5 days	24 months
15	Qualified electrician (EFK), qualified Electrician for specific electrical work (EFKfT), Person instructed in working with		
15.3	Person instructed in working with electrical equipment (EuP)	1 day	12 months
22	Training courses using rope access technology in accordance with FISAT		
22.1	Rope access and positioning technique Level 1 - basic training	5 days	12 months
22.2	Rope access and positioning technique Level 2 - basic training	5 days	12 months
22.3	Rope access and positioning technique Level 3 - basic training	5 days	12 months
22.4	Rope access and positioning technique Level 1 - refresh training	1 day	12 months
22.5	Rope access and positioning technique Level 2 - refresh training	1 day	12 months
22.6	Rope access and positioning technique Level 3 - refresh training	1 day	12 months

Dates and more information about each course can be found on our website at deutsche-windtechnik.com/training-center

5. Offshore- Wind Farm Management

5.1 Expertise and Services

5.2 Relevant Offshore References

5.1

Offshore Wind Farm Management



For over a decade, the OutSmart Group, which is a part of Deutsche Windtechnik, has offered a wide range of concepts and services to ensure the optimal long-term operation of wind turbines. Currently, the company operates almost 4 GW of installed onshore and offshore wind energy capacity on behalf of customers. Its current and future focus is the European and Asian offshore market.

Power Plant Management

One of the three main fields of activity is the operational management of renewable energy plants with a focus on wind farm management. Depending on customer requirements, the range of services covers the entire life cycle, including planning and construction, the operational phase and end of service life, either completely autonomously or in close cooperation with the customer. The concentrated expertise that the Deutsche Windtechnik Group brings to the table is a decisive factor for our customers, which include energy suppliers, project developers, wind turbine manufacturers, fund managers and institutional and private investors.

Optimisation of operations management

Our solutions are based on three important trends: the rapid development of the market, the elimination of subsidies (subsidy-free assets) and increasing cost pressure (LCoE). A first-class operating business and a corporate culture based on innovative technology are therefore more necessary than ever.

Our focus is on optimising plant utilisation: We ensure 100 percent compliance with all operating requirements and optimum technical availability. Our 24/7/365 remote data monitoring and close cooperation with service providers enables us to limit technical risks and implement appropriate measures if necessary. The software we use ensures transparent and secure reporting to our customers. Our integrated approach covers the areas of contract management, technical operations management and commercial operations management.



Direct Offtake Agreements

We facilitate Direct Offtake Agreements by negotiating all contracts for producers and offtakers of electricity from renewable energy sources, including the electricity price. In doing so, we take into account the interests and requirements of all parties involved in a transparent and trusting manner. We are an intermediary for renewable energy with a focus on bringing producers and offtakers together directly and, if required, supporting them over the entire term of the contract.

Optimisation of electricity pricing

With our Direct Offtake Agreements, we are responding to three major trends in the power offtake business: the discontinuation of subsidies, the higher cost pressure that results from this and the increasing environmental awareness of companies for their corporate social responsibilities (CSR), which go hand in hand with economic interests.

We have facilitated many large electricity contracts since 2008 and we have contributed in an optimised power price setting for producers and offtakers. This leads to advantages for both: a power price that can be up to 5% higher for the producer and a price for the offtaker that can be up to 10% lower, depending on the requirements of both sides.

Sharing expertise

We also use and share our knowledge with developers, investors, portfolio managers, energy purchasers and lenders in order to advise renewable energy organisations, structure negotiations and projects, and draw up and negotiate contracts. We implement proven, very detailed concepts or work out new concepts as needed.

Our services include:

- Contract strategy
- Contract process management
- Benchmarking
- Quality management plan, HSE plan, O&M plan
- Creation and implementation of a wide variety of operating concepts
- and much more

5.2

Relevant Offshore References



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