Wind Power
Service Portfolio of the IABG Group
High-tech wind energy services

IABG has supported the development, qualification and implementation of advanced technical systems for over 50 years. To implement Germany’s energy transition, we accompany the decommissioning of nuclear power plants and promote the use of renewable energies. Here, we service the entire supply chain: from alternative energy production through its storage, all the way to the end use.

In the wind energy sector, we support our customers and business partners with test concepts and facilities in the development of plants to improve operational safety and to verify functionality, as well as with the purpose of increasing availability and optimising yields in operation. We can thereby ideally resort to the substantial experience gathered across our business segments of Aeronautics, Space, Automotive, InfoCom and railway systems.

The sectors of engineering, materials and process analysis as well as own development of components benefit from the founded expertise in proving (simulation and testing) of the dynamic behaviour of complex mechanical structures and in the construction, implementation and operation of test centres. The comprehensive know-how in the operation of complex plant, drive and aircraft systems, for instance, in structural and condition monitoring as well as consulting expertise on technical plant management gathered throughout decades complete our extensive know-how and broad service spectrum.
Competencies of the IABG group in the wind energy sector

- Fatigue strength
- Design methodology and materials analysis
- Damage analysis
- Testing methods and concepts
- Test stand development
- Test stand operation
- Measurement technology and data acquisition
- Fluid and structural dynamics
- FE analyses
- Rotor blade development
- Quality assurance
- Site assessment
- Monitoring, testing and inspection
- Damage documentation
- IT security
- Stand-alone communication links
Wind energy life cycle support

Development support
With computer-aided analyses and simulations IABG supports customers in the early phases of the development process. This covers, for instance, the forecast of structural characteristics of drive-train components or the production-oriented design of rotor blades, allowing customers to gather vital findings which help to avoid high costs for later improvement measures.

Testing & Qualification
With increasing plant size and complexity, criteria such as functional reliability and service life become increasingly important. Based on the know-how of approx. 300 mechanical and test engineers and by using its unique testing infrastructure, IABG is also a sought-after partner for the verification of complex technical systems in the area of wind energy plants.

Operation optimisation
IABG offers services in the operation phase of wind energy plants and wind parks to optimise yields and increase reliability as well as availability. The spectrum comprises site analyses, structural and condition monitoring, all the way to inspection, damage assessment and documentation.

With its services along the entire life cycle, the IABG group supports manufacturers, operators, maintenance providers, investors, project management companies and insurances and helps to increase yields and operational safety of wind energy plants.
Development support

When developing complete turbines and components, the first step is to determine consistent loads from rotor blades down to the foundation of the wind energy plant. In subsequent development steps, detailed analyses and constructions are implemented from feasibility to manufacturing drawings for the individual components of the wind-power plants.

When optimising components and manufacturing processes both the components’ and/or the complete system’s characteristics as well as cost efficiency factors are considered. For the certification of the individual components (e.g., the rotor blade), development is based on international standards of GL, IEC and DNV.

A risk evaluation for wind energy plants is also performed in the context of the technical consulting process. In the event of damage, repair solutions for individual components are then developed.
Wind energy plants

Fatigue strength test and method development
- Determination of design loads (operation and simulation)
- Experimental and calculated fatigue strength
- Component- and material-related assessment methods
- Static, dynamic, linear and non-linear FE analyses
- Optimisation of individual components
- Examination of local manufacturing conditions, material discontinuities and stress characteristics
- Assessment of production-technological factors (casting, forging, surface treatment)
- Damage calculations with integration of fracture mechanics methods as well as CAE processes
- Consulting and certification support

Computation and simulation of fluid and structural dynamics
- FEM, CFD and software development
- Extreme dynamics (non-linear structural dynamics)
- Fluid-structure interaction
- Operating load simulation
- Simulation of manufacturing, function and abuse events
- Component optimisation (shape and form)
- Experimental validation

Rotor blade development
- Load determination
- Aerodynamic design
- Production-oriented construction of rotor blades in line with current standards (GL, IEC, DNV)
- Assessment and optimisation of rotor blade designs
- Development of own, certified rotor blades
Philosophy

IABG’s testing pyramid

**System verification**
- Interaction of all hardware and software components (mechanical components/control, “hardware in the loop”)
- Verification of models, simulations and component test results
- Integration and interaction
- Environmental simulation, behaviour under operating conditions

**Component testing**
- Simulation of real loads on individual components
- Availability of real loads on individual components and/or the tower mount
- Real interface conditions and interaction, also concerning mounting systems
- Component-related testing concepts
- Avoiding over- and/or under-sizing

**Materials testing & method development**
- Consideration of local manufacturing faults
- Material defects and stress characteristics for material samples
- Assessment of technological influence factors
- Damage calculation with fracture-mechanical methods as well as integration into the CAE process
- Up-scaling of results to component level
Wind energy plants
Service portfolio of the IABG group

Material characterisation and quality assurance
- Materialography and fractography
- Determination of mechanical-technological and physical characteristics
- Materials testing (static, cyclic and fracture-mechanical)
- Examination of manufacturing and assembly qualities, quality assurance
- Support of product and process optimisation processes
- Consulting on test and backup components
- Use and optimisation of non-destructive testing methods

Test stand construction & operation
- Function test stands (including HiL)
- Endurance test stands
- Variable experimental setups
- Special, customer-specific test stands
- Development of component-related testing concepts
- Extensive test infrastructures at several locations

System test stands
- Stands for testing drive-trains of rotor blades and bearings
- Environmental simulation on components and large-scale structures
- Determination load spectra from operating loads
- Fatigue strength testing for components and total systems
Wind energy plants

Infrastructure
- 5,000 m² roofed areas at the headquarters in Ottobrunn
- Guardrail systems for load application
- Central hydraulic, compressed air and oil supply systems
- Over 700 hydraulic cylinders
- Power supply (10 MW available)
- Safety infrastructure (isolation of the item under test)
Optimisation of technical operation management

Wind energy plants, whether in on-shore and particularly in off-shore operation, are affiliated with high investment volumes, which – after a short amortization period – is to enter the profit phase as fast as possible. This succeeds the more sustainably, the higher the yield of the wind energy plant and the shorter and less frequent the unplanned outage as well as scheduled maintenance and repair-related downtimes are.

The foundation for a successful operation is already laid in the site assessment phase. IABG supports this process with wind potential analyses, environmental compatibility investigations, all the way to the risk assessment.

In the operation phase, the early recognition of changing operating conditions or developing damages is of vital importance. For this purpose, IABG developed a generic simulation model for wind energy plants which – based on operator data on the respective type to be monitored – can be adapted. Maintenance and repair measures can be initiated and implemented promptly. In addition to condition monitoring the derived model can also be used to optimise operational processes, for instance, the rotor tracking system or the blade control can immediately be adapted to changing wind conditions.

Other IABG services in the operating phase comprise the execution of inspections on components and the documentation of findings, structural monitoring as well as material investigations and damage analyses.
Site assessment
- Wind potential, topology evaluation, yield prognosis and turbulence analysis
- Support with the approval process, preparation of planning documents
- Environmental compatibility investigations, sound emissions, shadow impact
- Risk analyses, possible endangerment of sensitive neighbouring areas

Damage analysis
- Damage analysis according to VDI 3822
- Determination of active damage mechanisms
- Determination of damage causes
- Preparation of damage appraisals
- Damage prevention consulting
- On-site and laboratory-based component examination

Monitoring, inspection and documentation
- Yield optimisation
- Structural monitoring
- Model-based condition monitoring
- Application and optimisation of diagnostic methods for fibre composites
- Life cycle management
About IABG
IABG is a leading European technology enterprise. We focus on trend-setting high technology and science applications. We plan, implement and operate. With approx. 1,000 experienced and committed employees we provide our customers with solutions in the sectors Automotive • InfoCom • Mobility, Energy & Environment • Aeronautics • Space • Defence & Security.

About ACENTISS
ACENTISS – Approved Center of Engineering, Technology and In Service Support – supports its customers in all product life cycle phases in the business fields of Aviation and Space, Regenerative Energies and Automotive. The know-how of ACENTISS is used to research and develop new technologies – Engineering, Simulation & Optimisation – to analyse and optimise customer processes – System Dynamics Engineering, Engineering – and to establish know-how – Acentiss Academy.

About INTIS
INTIS is specialised in integrated engineering services in the sectors of Mobility, Energy and Environment. It concentrates on the development, implementation and operation of environmentally-friendly and resource-saving infrastructure solutions for future traffic systems, industrial transport and logistics applications and sustainable energy supply.
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