

WE PROVIDE WIND TECHNOLOGY



Wind turbine design,
component design
and licensing



27 overall turbine developments

Over 40 years of experience



AEROVIDE is the world's only independent full-service provider that supports you in the implementation of your projects from the initial concept idea to the commissioning of the prototype.

We provide wind technology

Since its foundation in 1983, our innovative and experienced development team has supported numerous global wind turbine manufacturers in the realisation of 27 complete turbine developments in the power range from 5 kW to 10 MW. During the implementation of these projects, AEROVIDE was able to build up extensive experience with all common drive train concepts such as conventional high-speed, hybrid drive (medium speed) and direct drive technology. Given that we have developed 5 Multi-MW offshore wind turbines, you will benefit from our outstanding experience in the field of offshore wind energy when implementing your ideas. AEROVIDE is thus the most experienced Engineering Consultancy for wind energy technology and it supports its customers in all aspects from concept development, detail engineering, design evaluation, type certification to support during manufacturing and commissioning of the turbines.

Our customers include world's leading wind turbine manufacturers, operators and component suppliers. We offer manufacturing licences for existing designs for wind turbines and rotor blades in various power ranges as well as customised developments of wind turbines and rotor blades. In addition to development services, we also support you directly on site in your production facility during manufacturing, assembly, prototype commissioning up to support during series production. For long-term successful cooperation, we also offer training and know-how transfer programmes for the experts in your development department.

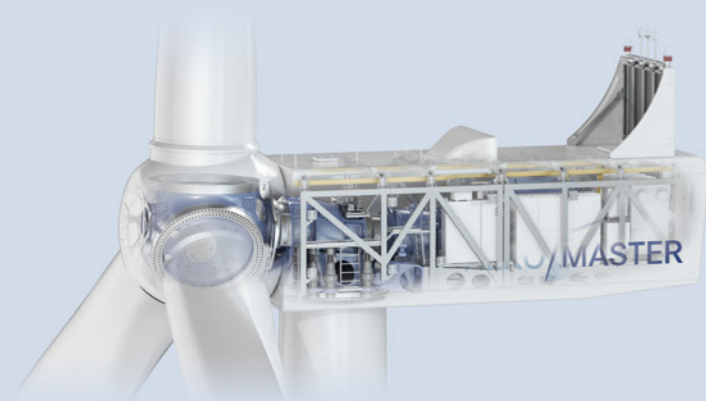
Our range of services covers all relevant areas of wind energy technology:

- Concept studies
- Technical Due Diligence, Expert Opinion
- Retrofits, upgrades and integration of new component suppliers
- Load calculation for onshore, offshore and floating offshore
- Rotor blade design
- Aero-elastic stability analysis
- Tower design
- Generator design / hybrid drive unit design
- Mechanical engineering
- FEM structure calculation
- 3D CAD Design
- Documentation for manufacturing and certification
- Supplier qualification and localisation
- Electrical engineering
- Control software
- Offshore technology
- Certification support
- Manufacturing supervision
- Commissioning
- Training and know-how transfer
- Development software
- Support in series operation
- Calculation of floating foundations by integrated load calculations

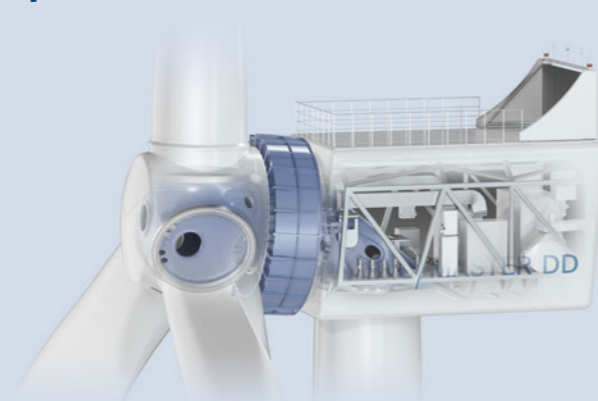


aeroMaster Turbine platform as license

Available turbine platforms

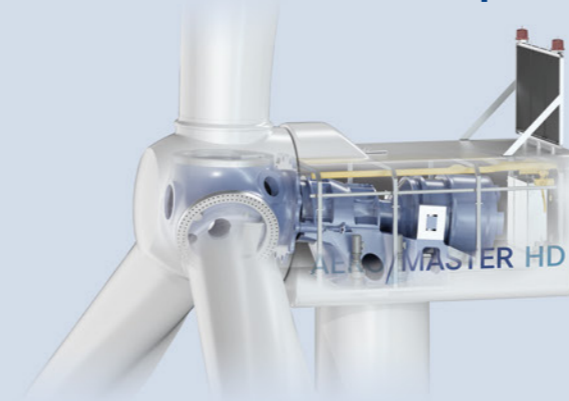


aeroMaster (Standard Drive)

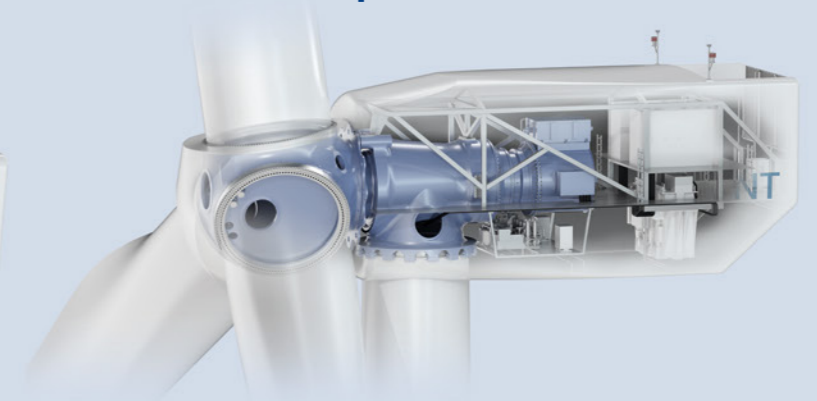


aeroMaster DD (Direct Drive)

Turbine platforms under development



aeroMaster HD (Hybrid Drive)



aeroMaster NT (New Technology)

The fully developed aeroMaster turbine platforms are ready for licensing and ensure a fast and low risk market entrance. With our reliable and flexible turbine platforms we can realize a local supply chain, manufacturing and maintenance which is nowadays a requirement in many markets and the key for long-term successful projects.

Our turbine models can be further optimized to specific customer requirements and can be adapted to different local market requirements by e.g. applying special wind conditions, different climate conditions, variation in rotor diameter and rated power or alternative generator technologies. The aeroMaster turbine models are available for onshore application in the range from 1 MW up to 4.5 MW and for offshore application in the range from 5.7 MW up to 11 MW. Further models are under development to extend the model range even more to cover the future requirement for onshore and offshore markets as well.

For our direct drive models and hybrid-drive models the license includes detailed design and manufacturing documentation of the direct drive generator and the hybrid-drive unit (gearbox and generator). Our customers are therefore able to produce these important turbine components locally to improve the competitiveness.

aero Master platform	Leistung
aeroMaster 1.X	1.0 MW – 1.5 MW
aeroMaster 2.X	2.0 MW – 2.5 MW
aeroMaster 3.X	3.0 MW – 3.2 MW
aeroMaster 4.X	3.6 MW – 4.5 MW
aeroMaster 6.X	5.7 MW – 6.0 MW
aeroMaster 10 DD	9.0 MW – 11.0 MW



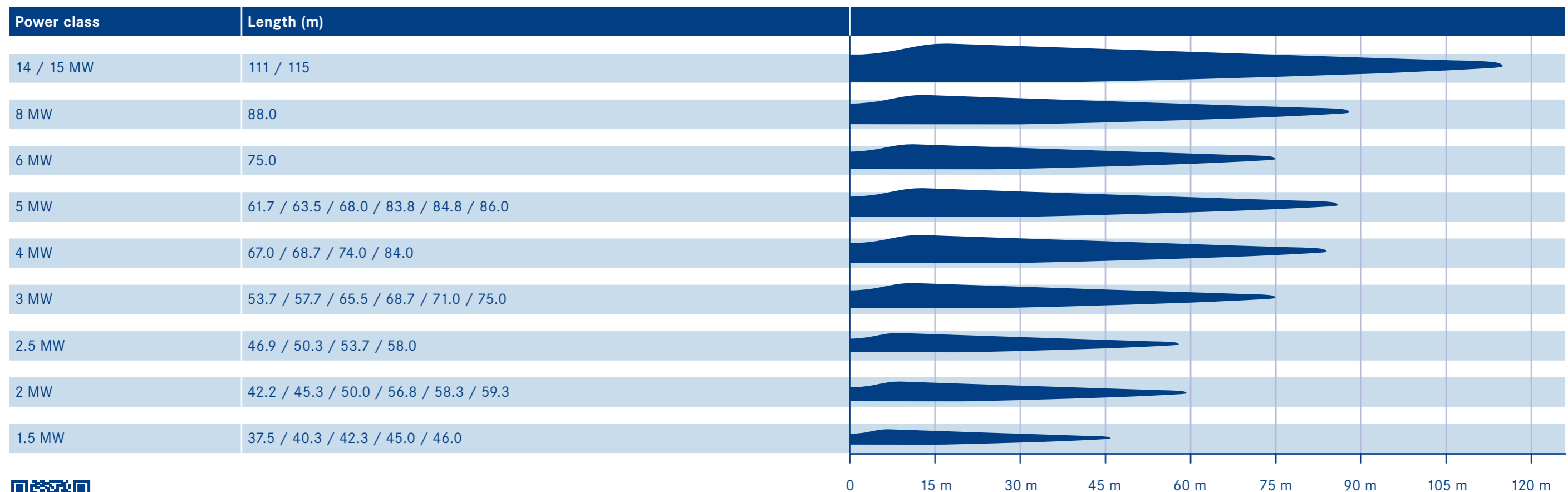
For more details regarding available turbine platforms and license conditions, please contact our head office in Rendsburg

AEblade

Rotor blade models as license

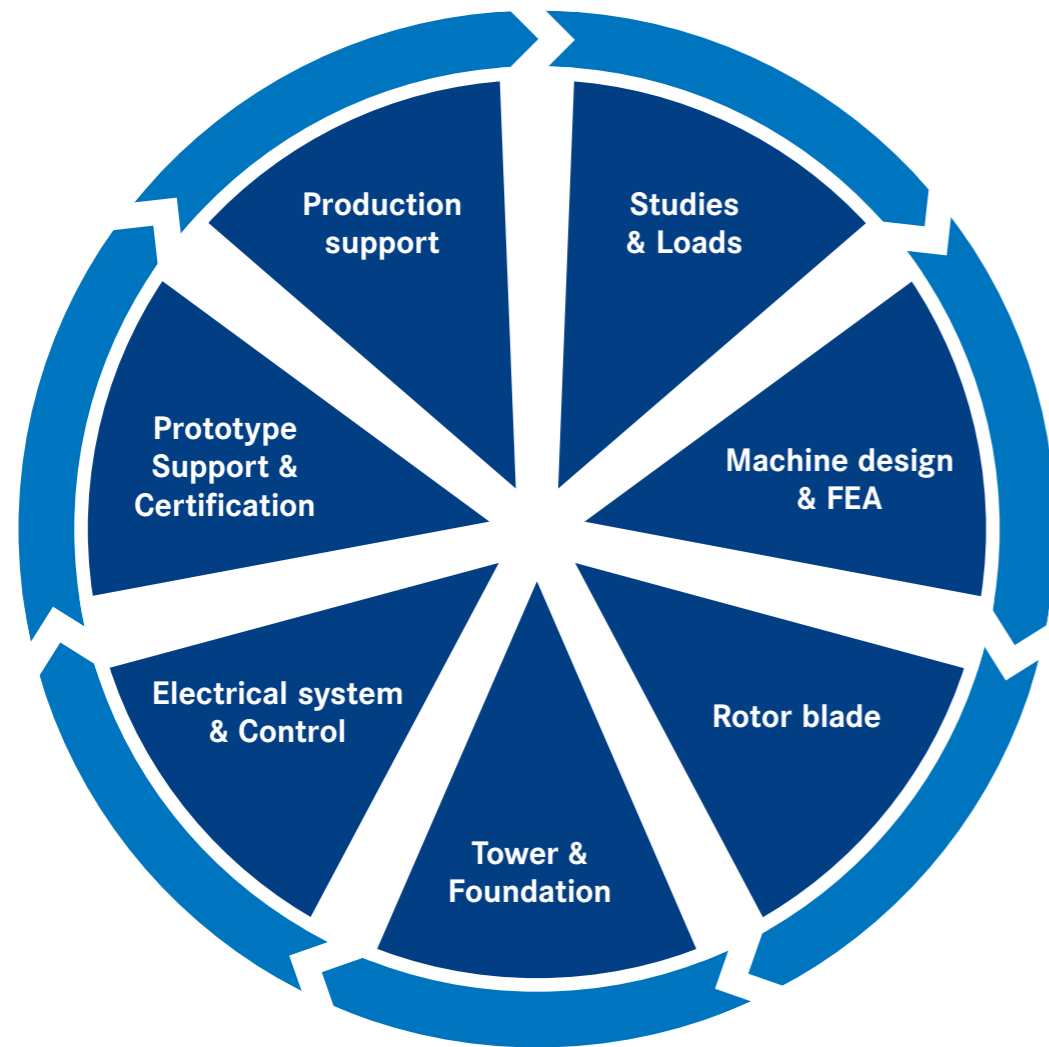
On the basis of its experience with over 50 different rotor blade designs in the power range of 5 kW to 14 MW, AEROVIDE has developed AEblade, the rotor blade series which are suitable for local production due to the proven structural layout and T-bolt blade root connection. The blades are suitable for operation on different turbine types and under different environmental conditions.

Given the wide variety of available blade models for onshore and offshore turbines, our customers can meet all the market demands in a very flexible and efficient way. On demand, AEROVIDE can also modify the blade structure to optimize the blades for one specific turbine application. In addition, the blade structure can also be adapted to specific material properties to customize and optimize the blade structure even more and thus increase profitability for our customers.



For more details regarding available blade models and license conditions, please contact our head office in Rendsburg.

Customized complete turbine developments



Project work packages

Our full range of services covers the complete range of work required for the development of new wind turbines and makes us the only independent “full service provider”. Fewer interfaces and clear responsibilities minimize the development effort and reduce the development risk for our customers.



Design process

The design process at AEROVIDE is well defined and controlled and organized in 5 project phases. This approach enables our customer to track and control the design in every phase of the project.

Scope of supply

The technical documentation and services prepared and carried out in the design process typically include the following topics:

- Load calculation report and detailed results (time series)
- Design reports, drawings and specifications for structural components (special to type equipment)
- Purchase component specifications (general purpose equipment)
- Assembly drawings & parts lists, 3D CAD model
- Single part drawings
- Electrical wiring diagram and control system software
- Manuals for assembly, installation and commissioning
- Supervision of workshop assembly, factory acceptance test, site acceptance test
- Support for prototype operation and measurements



Engineering Services

In addition to our complete developments for wind turbines and rotor blades, we also offer individual engineering services in all relevant areas of wind energy technology. The scope of services is always specifically adapted to the requirements of our customers.

Concept studies

Studies for drive train concepts, entire turbine concepts or also for individual components such as rotor blades, gearboxes, direct-drive generators or hybrid drives. Our concept studies provide our customers with a qualified and reliable basis for making the necessary decisions for the subsequent project phases.

Technical Due Diligence, Expert Opinion

Technical Due Diligence (TDD) of existing wind turbines and individual components as well as technical expert opinions and root cause analysis of damages for operators, insurers, owners and investors. Thanks to our detailed knowledge of the technical interaction of the complex wind turbine system, our experts identify risks at an early stage and can provide valuable information when determining the root cause of damages.

Retrofit, modernisation and supply chain management

For existing turbines, we offer comprehensive support to turbine manufacturers, operators and owners. Our offer includes topics such as life time extension, updating certification to new standards, qualification of new suppliers, use of modern components and implementation of new control functions for energy yield increases and much more.

Load simulation

Load simulation for onshore, offshore and floating offshore turbines according to all common guidelines with our own, modern simulation software **aeroHalo** based on HAWC2 with extended models, e.g. for drivetrain simulation with External Systems (eSys) as well as commercial tools for hydrodynamic model data such as WAMIT® (WAMIT, Inc. developed at MIT) or Ansys AQWA (CADFEM GmbH) for analysis of floating structures.

Rotor blade design

We offer all the necessary steps for the rotor blade design: Airfoil design, aerodynamic design and structural design. All calculations are carried out with our specially developed calculation software **aeroBlade**. In more than 50 rotor blade projects so far, a wide variety of structural concepts, material combinations and blade connection concepts (T-bolt, inserts) have been realised. We offer ready-to-use blade models for licensing as well as customised developments.

Aero-elastic stability analysis

As part of the certification process, aero-elastic stability analyses are required, which we carry out using the HAWCstab2 calculation software.

Tower design

Design and calculation of towers with our own calculation software (**aeroTower**) and FEM verifications. On customer request, we realise different tower concepts such as conventional tubular steel towers, lattice towers or hybrid towers. Detailed design of tower internals or electrical units for converters and transformers in the tower round off our range of services.



Engineering Services

Generator design/Hybrid drive design

For direct-drive or hybrid-drive turbines, we offer detailed engineering for the generator or hybrid drive unit in addition to the design of the overall turbine system. In doing so, we cooperate with experienced experts in the field of gearbox development, electromagnetic generator design and cooling design and integrate all sub-areas into the finished product. In this way, our customers receive all the component information necessary for production and are able to manufacture these central components of the wind turbine themselves.

Mechanical engineering

In the area of mechanical engineering, which is important for the realisation of the overall turbine system, we offer all the relevant services: Concept definition for the entire wind turbine system, simulation of pitch and yaw systems with our own calculation software (**aeroComp**), specification and technical clarification with component suppliers for all mechanical components, bolt calculations, integration of the components into the nacelle design, 3D CAD design and the complete documentation for the design evaluation and production.

Supplier qualification

The selection and technical coordination with all component suppliers is of key importance for the successful implementation of wind turbine development. Together with our customers, we also always try to achieve the highest possible localisation with the component suppliers in order to optimise the economic efficiency of the turbine. We also support you in the qualification of new and additional suppliers for existing turbine types.

FEM structure calculation

We carry out extensive FEM calculations and geometry optimisations for all structural components of a wind turbine. The calculations include non-linear stress calculations, fatigue life calculations using our own calculation software **aeroFat**, non-linear bolt calculations and fracture mechanics analyses.

Electrical engineering

AEROVIDE's electrical engineering services include the following features: Specification and technical clarification with component suppliers for all electrical components, preparation of the complete circuit diagram in ePlan, control cabinet layout as a basis for the detailed design, integration of condition monitoring systems or LIDAR systems, determination of the performance level of the electrical system, manuals for factory acceptance test (FAT) and site acceptance test (SAT).

Control software

Our own control software **aeroControl**, which is constantly being developed further, and the user interface **aeroVisu** form the basis for the control software for our **aeroMaster** system platforms and are also the basis for customer-specific developments. **aeroControl** has a modular structure and can be easily adapted to different hardware platforms and turbine components. Interfaces to various SCADA programmes can be implemented easily. It natively contains all required functionality as for example parameter management, operational data storage and a user management.



Engineering Services

Offshore technology

The total of 5 offshore turbine developments illustrate our experience in the field of offshore technology. In the course of these projects, we have realised all drive train concepts: conventional high-speed generator, medium-speed generator and direct drive generator. The coupled load analysis required for offshore turbines, in which wind and wave loads must be taken into account simultaneously in the load analysis, is carried out with our simulation software **aeroHalo**, in which any fixed offshore foundations as well as floating foundations can be taken into account.

Certification support

Through years of intensive cooperation with all leading certification bodies, we enable our customers to obtain a design assessment for their project in the shortest possible time. We accompany the verification of all our calculations until the Design Assessment is obtained and also offer support for obtaining the Type Certificate.

Manufacturing supervision

After completion of the design, our experts supervise and monitor the workshop assembly, the workshop commissioning and the site commissioning of the turbine. This ensures the smooth implementation of our designs in production. We also offer support and supervision for prototype manufacturing for rotor blade projects.

Site Commissioning

For site commissioning, our specialists supervise the entire process in accordance with the specifications in the commissioning protocol, including all safety tests and support for acceptance by the certification body.

Training and know-how transfer

As part of a long-term cooperation with our customers, we offer individual training and education for development engineers in all aspects of turbine design. In addition, training can be given for the use and further development of our control software **aeroControl**. This creates the long-term basis for the independent further development of our products by our customers.

Development software

To complement our development work, we also offer the licensing of our own development software for the establishment of an internal development department. The software developed by AEROVIDE over several years covers the areas of load analysis, blade design, tower design, mechanical engineering and structural calculation.

Support for prototypes and series operation

In addition to our turbine development and prototype support services, we also offer further support for the operation of prototypes or series turbines. This potential offer includes, among other things, troubleshooting during operation, the implementation of new components and functions in the control system, the evaluation of operating data and the optimisation of operation.



AEROVIDE

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