

# GICON®



## Wind Farm Planning

### Complete Services

Site Development  
Approval  
General Planning  
Plant Management

GICON Großmann Ingenieur Consult GmbH was founded 1994 as a private and independent company. The corporation is the founding company of the internationally operating GICON group of companies, an association of independent engineering and consulting companies. The group of companies employs 350 permanent and 150 freelance staff members. Subsidiaries all over Germany ensure customer proximity. Moreover, GICON also is represented in several countries in Europe, Asia and North and South America.

Depending on the task, staff members from the group of companies join forces in interdisciplinary teams. In cooperation with research facilities, GICON provides research services in order to guarantee the level of innovation the customer needs and to participate in determining the state of the art. Research partners for the onshore and offshore area in particular are the Freiberg University of Mining and Technology, Rostock University, Wismar University of Applied Sciences and Fraunhofer Institute for Wind Energy and Energy System Technology (IWES).

GICON has long-term experience and comprehensive know-how in the area of wind energy. From the exploration and planning phase to building supervision, the corporation can implement economic complete and special solutions for the investor in an expert and routined manner.

## Experience gained in the planning of 30,000 megawatts

GICON has ample experience from the most diverse planning projects for onshore and offshore wind farms with a total output of 30,000 megawatts.

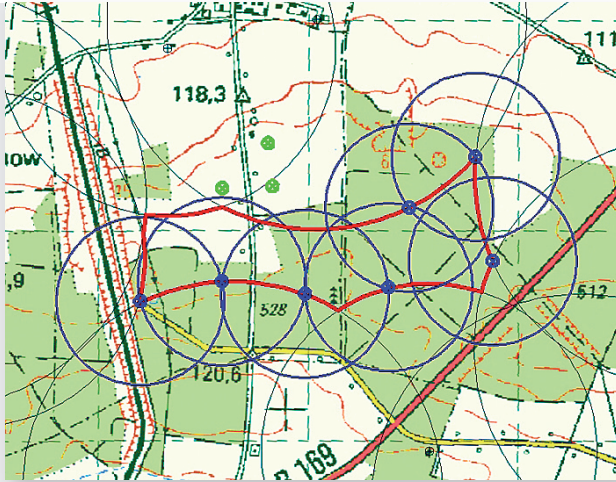
**For the provision of services, the corporation has at its disposal experts from the following areas:**

- Publicly appointed and sworn experts for immission control approval procedures
- Experts in geotechnology approved by the Highest Saxonian Mining Authority
- Experts for slopes and embankments
- Experts for the execution of environmental impact assessments according to article 5 section 2 SächsUVPG (Saxonian Environmental Impact Analysis Act)
- Experts for preventive fire protection
- Health and safety coordinator according to the German Construction Site Ordinance (Baustellenverordnung) RAB 30 (SiGeKo)
- Experts for the assessment of value and construction cost planning
- Experts for the execution of certain safety-related testing and the examination of safety-related documentation on behalf of the authority
- Immission control officer – Specialist Knowledge in compliance with article 53 of the Federal Pollution Control Act (BImSchG)
- Experts for building site surveys, assessment and safety

## Services of the GICON group of companies in the area of wind energy

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# SITE DEVELOPMENT AND APPROVAL PLANNING



## From the idea to the wind farm concept

Based on GICON's extensive experience in the development of wind farm sites in the onshore and offshore area, sites are selected in a target-oriented manner based on currently valid spatial-planning, regional and environmental planning framework conditions. These include the following steps:

- Surface measurement by means of screening methods: Determination of suitable areas, taking into account exclusion and taboo zones
- Determination of potential suitability of the area in a site-specific case-by-case assessment
- Estimation of output situation based on wind statistics data
- Preliminary examination of environment-planning and approval-relevant aspects regarding the area (amongst others, spatial position, shadowing, noise immissions, appearance of the landscape)
- Summary and assessment of the results from the preliminary examination as decision basis for the responsible regional planners
- Draft of wind farm layout
- Preparation of documents for the formally required regional planning procedure in coordination with the competent authorities and the owner of the site
- Determination of repowering potential

Based on wind farm concepts that are approvable and optimally adapted to the specific site, GICON draws up the documentation for the required approval procedure. These are – amongst others – the following:

- Description of the project
- Presentation of environmental impact
- Planning and implementation of compensation and development measures
- Maintaining an eco account
- Building application and object planning
- Development concept

If required, GICON will support its clients with expert know-how during each planning and execution step.

- Clarification of planning and approval-specific legal issues
- Creation of the planning and approval basis (regional planning procedure)
- Preliminary draft or optimisation of the wind farm concept (flow modelling)
- Assessment of economic efficiency at the site
- Identification of possible issues under private law
- Development planning (media and access routing, foundation)
- Preparation of an immission-specific approval application with overview map and site plans
- Support in presenting the project to the public

# GENERAL PLANNING / EXPERT PLANNING

GICON offers competent, independent and individual planning of wind farm projects. This ranges from individual plants to whole wind farms and comprises partial planning as well as general planning activities.

## General planning – complete and from one hand

As an experienced general planner, GICON takes over the entire planning as well as the construction supervision and start-up supervision for wind farm projects. GICON's sufficiently large employee base with its competent experts will perform these services complete from one hand. This minimises interfaces and reduces the planning risk.

## Special planning – independent and competent

GICON offers the following technical expert planning:

- Building site surveys, expert building site opinions
- Foundation base planning, verifications of stability
- Foundation planning
- Structural framing
- Planning of access roads and crane sites
- Electrical planning  
(cable ducts, transformer stations)
- Compensation methods
- Special expert opinions (noise opinions, expert opinions regarding issues under nature and species protection law, appearance of the landscape)

GICON provides all services as an independent technical service provider and is partner for project developers, investors and plant engineers.



*Creation of a crane erection site*



*Connection of a transformer station*



*Road construction – flattening out the entry into a depression*

# OWNER'S ENGINEER (OE)



*As an Owner's Engineer, GICON operates on one of Europe's largest wind farm construction sites in Klettwitz*

Wind farm projects are extremely complex and risky. For wind farm project management, clients need an extensive team of experts – often only for a limited period of time.

As an Owner's Engineer, GICON assumes the independent and comprehensive coordination and control of the project for the client – from the planning and approval up to construction. The targets are to ensure project execution is in line with schedule, cost and approval requirements.

Specifically, the Owner's Engineers tasks are:

- Superordinate coordination and control of all construction services
- Contract monitoring and risk management
- Information of and communication with the principal and all parties involved in the project (reporting system, information platform)
- Cost monitoring, follow-up management
- Ensuring realisation in due time (tracking, management and control of schedules)
- Process management (building capacities and logistics)

GICON offers services as Owner's Engineer in various and project-specific ways:

- Delegation of specialists in different areas of expertise
- Delegation of experts to support the client's project teams
- Delegation of a complete OE team, which assumes certain areas or overall project management

GICON's extensive pool of employees ranges from the experienced project manager and expert planner for all trades to specialists for the most diverse disciplines and thus always ensures the optimal team composition for the specific task at hand.

All stated services can be performed in the context of a service agreement or by way of personnel leasing.

# FOUNDATION CONSULTANCY AND PLANNING

From exploration to building supervision



## Exploration

As standard, a combination of cone penetration test/dynamic probing and core drilling is used for a building site survey. In case of difficult building site conditions, seismic measurements are carried out in order to determine dynamic rigidity in situ. Normally, these can be used to demonstrate higher dynamic rigidities, which subsequently results in economic optimisation of foundations.



## Foundation

In General, building sites with low load-bearing capacity should be reinforced, so that the standard foundation established by means of type statics can be used for surface foundation. If this is not possible, additional measures (starting with application of a foundation pad) for the improvement of load-bearing capacity are developed.

Depending on the type of explored building ground and ground water situation, a deep foundation with piles (e.g. driven piles or cast-in-place piles) might be required. If necessary, the advantages or disadvantages of technical solutions are already discussed and assessed during the foundation consultancy phase with regard to risks and costs.

## Increasing demands on building grounds

The ever increasing size of wind turbines also places increasing demands on the building ground. If requirements from type statics cannot be met for larger plant types, additional and specific measures are necessary in order to improve the building site so that it meets specifications.

In the field of foundation consultancy and planning, GICON possesses many years of experience. From exploration to building supervision, we are able to implement economic complete and special solutions.

Stable natural building ground:

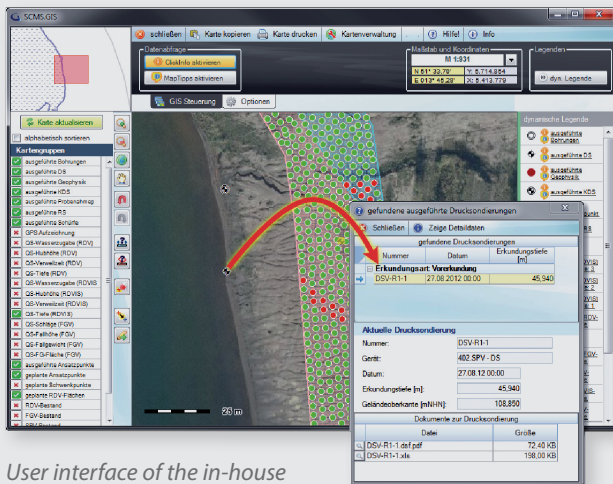
- Conventional exploration
- Surface foundation with standard foundation, if necessary foundation pad

Building ground with low load-bearing capacity:

- Conventional exploration and seismic measurements for foundation optimisation
- Deep building ground improvements
- Surface foundation in conjunction with foundation pad
- Deep foundation for standard foundation



Installation of foundation reinforcement at the wind farm building site in Klettwitz



User interface of the in-house SCMS data base

- Larger special-purpose foundation
- Site-specific foundation solutions such as combined pile raft foundations

## Building site survey and optimised site-specific foundation consultancy

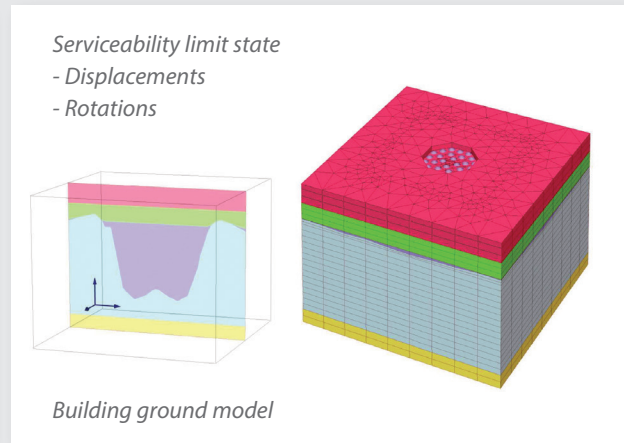
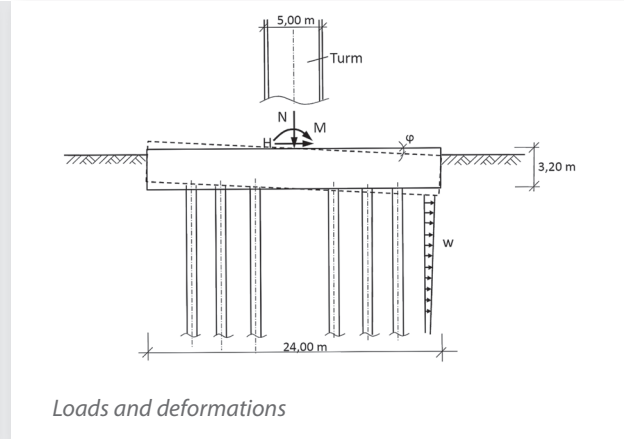
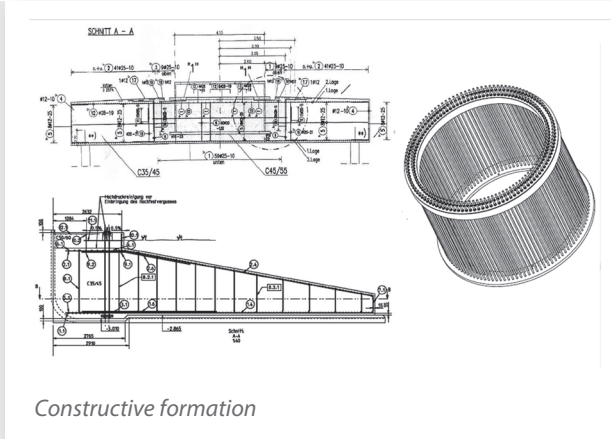
- Special seismic building site surveys
- Planning of special solutions up to the implementation phase
- Preparation of the tender documents
- Site management and building supervision
- Geotechnical construction management
- Evaluation of inventory data on deep compaction with in-house database (SCMS – Soil Compaction Management System) as a tool for performance monitoring
- Proof of compaction
- Inventory documentation

## Refills, dumps, underground mining areas and landfill sites

- Conventional exploration and geophysical measurements
- Deep building ground improvements amongst others against liquefaction of loosely dumped, water-saturated and rolling dump soils

# PLANNING OF STRUCTURAL FRAMING

Statics and construction



## Solutions for special building ground conditions

Sufficient stability of the wind power plant is not always achieved through comprehensive subsoil improvement measures. A special solution for the foundation is required in these cases. GICON has extensive experience in the development of innovative structural framing solutions for onshore and offshore wind power plants.

Based on design-relevant load case combinations, typical time-dependent load scenarios for structural framing and foundation structures are determined under dynamical load changes by means of multiphysical numerical verification models.

In limit condition considerations, GICONs qualified engineers define material use, dimensioning and constructive formation of structural components.

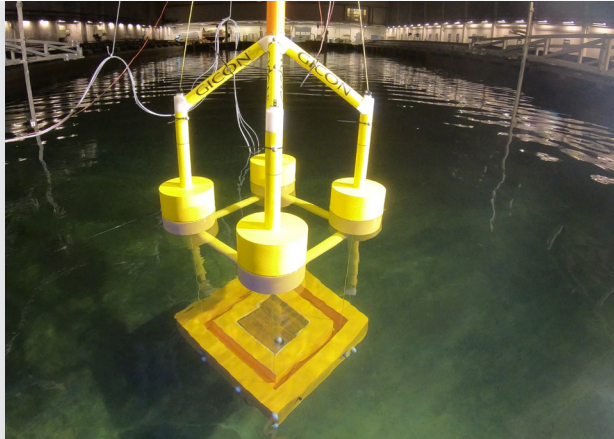
## Statics and construction

- Towers in skeleton, reinforced-concrete and in prestressed concrete construction
- Site-specific foundation solutions
- Special foundations on difficult building ground (dumps)
- Monopile, tripod, jacket and gravitation foundations for offshore wind power plants
- Structural framing concepts and planning for floating foundations

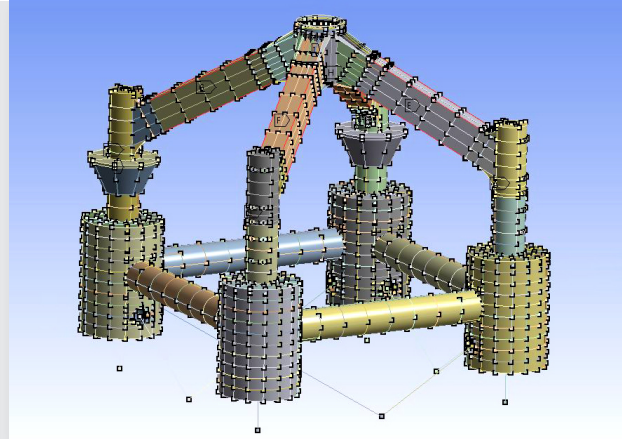


# STRUCTURE DYNAMICAL SIMULATION

Simple, economical and secure



Model trials in wind and wave tunnel



3D finite element calculation model

In cooperation with its partners WPC Wind Power Construction GmbH, the Freiberg University of Mining and Technology and Rostock University, GICON develops innovative solutions for the foundations of wind power plants. Through specialist surveys, analyses and modelling, GICON contributes to the development of new and sometimes unused sites such as landfill sites, waste dumps, post-mining landscapes and forests and to the development of the offshore field.

## Simulation and design

- Wind load under operating conditions and extreme wind conditions
- Application of site-specific and plant-specific characteristics
- Parametrised multiple body simulation models
- Dimensioning of aerodynamically and hydrodynamically loaded support structures
- Analysis of structural framing vibrations and resonance behaviour

The following simulation programs are used:

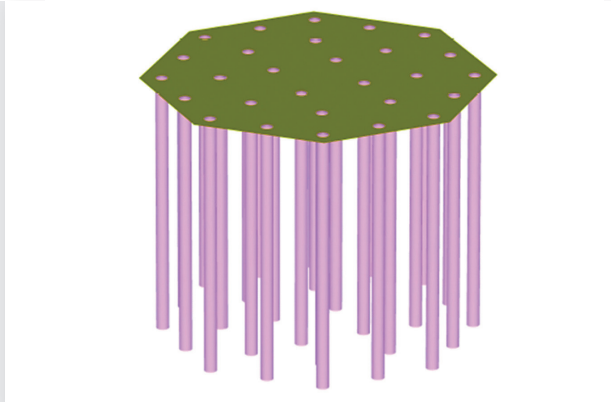
- ANSYS
- ALASKA
- ABAQUS

## Research and Development

- Cooperation with Freiberg University of Mining and Technology and Rostock University
- Development of numerical calculation models
- Complex simulations of aerodynamical and hydrodynamical load scenarios
- Development of floating foundation solutions
- Planning and execution of true-to-scale wind and wave trials in cooperation with recognised research institutes
- Calculation model validation based on measurement results
- Development of guidelines for draft and dimensioning of floating foundations for wind power plants
- Development of new and still unused sites for wind power plants (forests, post-mining landscapes etc.)
- Site-specific static-constructive development and optimisation of pile and raft foundations for wind power plants
- Development of a requirements catalogue for wind power plant foundations on problematic building grounds

# INNOVATIVE CUSTOM SOLUTIONS

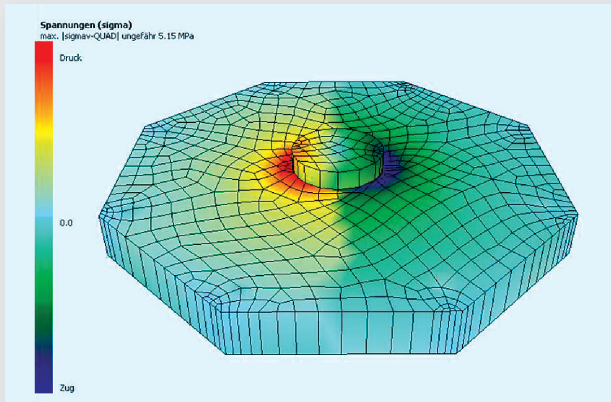
Foundations on landfill sites, waste dumps and post-mining landscapes



Combined pile and raft foundation



Installed driven piles at the wind farm in Cottbus Nord



Stress distributions

## Wind power plants on problematic subsoil

Usually, landfill sites, industrial wasteland and post-mining landscapes are sites that can be purchased at low cost and are often in exposed areas suited for the development for wind power plants. However, the subsoil of these sites often has a low load-bearing capacity even at greater depths. Therefore, the development of these sites requires innovative foundation planning solutions.

## GICON innovation: Combined Pile Raft Foundation

An innovative special solution is the combined pile and raft foundation (PRF). This foundation type was further developed by GICON by means of adaptation to various subsoil conditions. In this context, it might be required to improve the subsoil through vibro compaction. This prevents liquefaction of loosely dumped, water-saturated and rolling dump soils. For the PRF, piles are arranged below the foundation slab, which serves to transfer loads.

The piles only serve to limit settling and are included in the planning with regard to their ultimate bearing capacity. This eliminates the need for taking additional safety coefficients, which would result in a higher number of piles or longer piles.

## Advantages of PRF

- Higher rigidity against canting through integration of the piles in the foundation slab
- Foundation slab can be relatively small
- Ensuring permanent stability and serviceability of the wind power plant
- Better economic efficiency, as a PRF – in comparison to a conventional pile foundation – is measured in the limit state

# INNOVATIVE CUSTOMISED SOLUTIONS

## Wind turbines in the forest



Photo: Herbert Grabe/Ostwind

First forest wind farm in Bavaria, built with expert support from GICON

### First forest wind farm in Bavaria, built with support from GICON

The installation of offshore wind turbines in the German North Sea and Baltic Sea is delayed and open land areas are only available in limited numbers. In the context of expanding the generation of renewable energy, there is growing interest in building wind farms in forest areas.

As an example project, the company Ostwind Gewerbe Bau GmbH with the support of GICON specialists erected the first forest wind farm in Bavaria in 2011. Since then, five wind power plants of the Enercon Type are operating near the city of Hof, each with 138 metres of hub height and 2.0 megawatts of output.

### Example schedule of specialised consultancy for the erection of a forest wind farm

- Site Determination in the context of regional planning
- Approval management, creation of technical and ecological expert opinions
- Building ground examinations
- Foundation consultancy
- Presentation of site alternatives and foundation variants
- Construction management, particularly geotechnically specialised site management
- Optimisation of foundation expenditures

# ECOLOGICAL EXPERT OPINIONS AND MAPPINGS



*Installation of the GICON/IfAOE radar system for the observation of bird migration*

With its special knowledge, GICON supports wind farm projects in terms of environmental planning and nature conservation. For onshore and offshore wind farms, our employees prepare the following environmental documents:

- Environmental compatibility studies (preliminary examination of individual cases, environmental impact study)
- Compatibility studies in the context of the EU Habitats Directive (FFH-VU, FFH-VS)
- Landscape Envelope Plans (LBP = Landschaftspflegerische Begleitpläne)
- Landscaping execution plans (LAP = Landschaftspflegerische Ausführungspläne)
- Assessment of habitat protection rights (BRP = Biotopschutzrechtliche Prüfungen)

- Specific species protection law assessments and expertises on species protection (AFB = Artenschutz-Fachbeitrag)
- Environmental controlling and construction supervision

With regard to nature conservation, we develop expert statements on specific issues or special opinions on certain groups of species. The special mapping of species according to the EU Habitats Directive, appendices II and IV, also are part of our task spectrum.

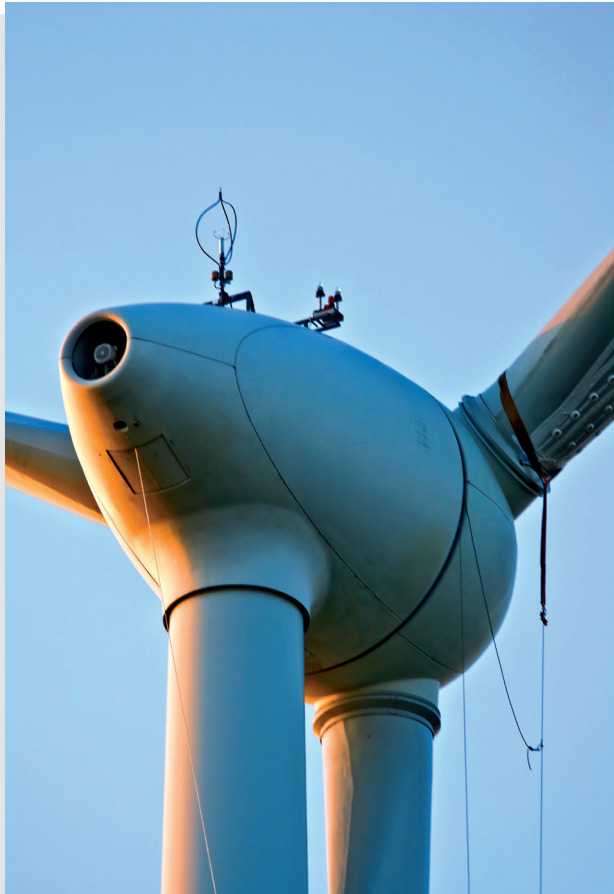
For sampling, GICON uses its own high-tech equipment:

- Underwater robot (ROV) and underwater video equipment
- High-resolution camera systems for the documentation of birds in flight or at rest
- Radar systems for quantification of bird migration rates
- Ultrasonic detectors for the recording of bat calls

GICON prepares ecological opinions in varied fields of expertise: Amphibians and reptiles, ichthyology (fish/fishing sector), benthic organisms and habitats, marine mammals, resting, flying, breeding birds and birds of prey, bats, ground beetles, flora, vegetation and habitats as well as forest conversion. In addition, GICON provides opinions on bat population and migration.

# REPOWERING

Inventory check for more productive plants



## Assessment of existing plants

Onshore wind farms, which were erected before the 21st century, cannot achieve the performance levels of modern wind power plants. At the latest by the time the technical lifespan of a plant is exceeded, keeping it in operation is not economically viable any more. Prior to reaching the age limit, existing wind farms are often offered for sale. These are profitable long-term investments for e.g. power supply companies.

Prior to conclusion of contracts and agreements, the qualified GICON employees can support investors by means of technical and approval-related in-depth assessments of the wind farm.

## In-depth regulatory approval assessment and repowering

Opinions for example comprise contractual agreements (contractual terms, transferabilities), application and approval related documents, administrative decisions and operating logs.

We also carry out intensive visual inspections to determine, whether the technical condition corresponds with the operational phases and maintenance intervals. If required, the findings thus obtained can be used in the contract negotiations.

For wind farm owners, GICON develops concepts for modernisation of their plants on the basis of current planning guidelines. These concepts comply with all requirements relevant in terms of licensing aspects, environment and regional planning and can directly be applied in the approval procedure.

In close collaboration with long-term cooperation partners, GICON provides the following services:

- Technical management
- Analysis of operating data
- Determination of site-related yield potential for repowering
- Clarification of planning and approval-related reliability
- Creation of a wind farm concept
- Economical, technical and approval-related assessment of existing plants and wind farms
- Data logging and processing for technical due diligence and legal due diligence assessments required for sales negotiations

# PLANT MANAGEMENT

## Special conditions for wind power plants

Wind power plant efficiency is largely determined by its technical condition. Therefore, predictive maintenance, future-oriented and efficiently planned maintenance and repair is of particular importance. Down-times require meticulous documentation, analysis and cause studies. For effective plant management, GICON has developed special software solutions.

- Extended operating time
- Centralised management by operational management companies

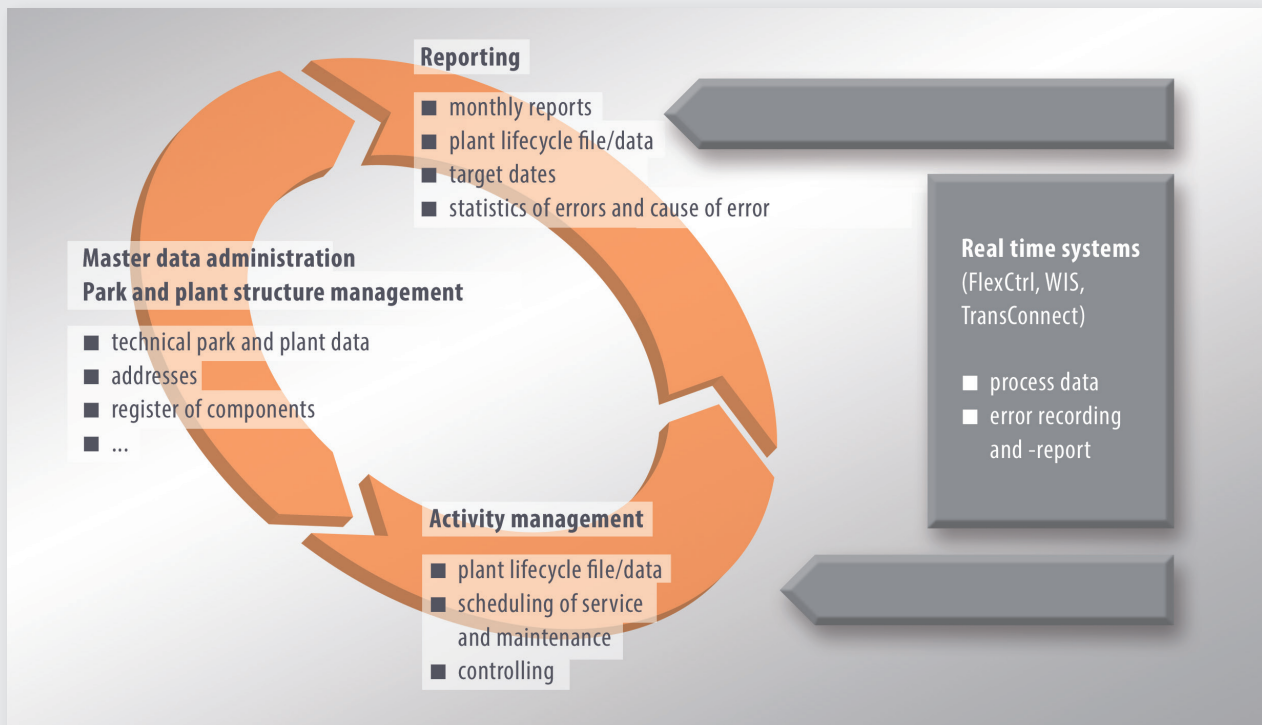
## Challenges of wind energy

- Maintenance and repair in the offshore area is highly dependent on the weather and availability of ships
- Large number of plants jointly operating in wind farms
- Often with different owners, who have to be provided with information
- Increasing number of plant types and increasing degree of automation

## System for operational management, technical supervision and documentation

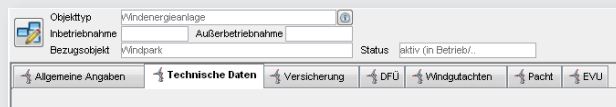
CoCheck – ComplianceCheck is a highly flexible plant management software that works for every market segment. It is ideally suited for centralised management of the most diverse types of wind power plants at one or at multiple sites.

Functions of CoCheck – ComplianceCheck



# CO-CHECK COMPLIANCE CHECK

Software for production management, monitoring and documentation



## CoCheck functions for wind power plants

Currently, CoCheck is used for operational management of about 80 wind farms.

The system is of particularly advantage regarding the following functions:

- Comprehensive knowledge base on asset investment (if required, RDS-PP compatible), mapped in a freely definable hierarchical object structure, which can be expanded in a flexible step-by-step manner with the CoCheck – Object type designer tool.
- Activity management and documentation complete with responsibilities, schedule planning with reminder function, error pattern and error cause management and auditing of accounts on behalf of the plant owner
- Monthly reporting to plant owners based on the data gathered from real-time monitoring systems connected via interfaces.

For further details on the plant management system CoCheck, please visit [www.cocheck.de](http://www.cocheck.de) or request information from the following email address: [info@gicon.de](mailto:info@gicon.de).

Input screen for technical details of a wind power plant



# GICON®

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