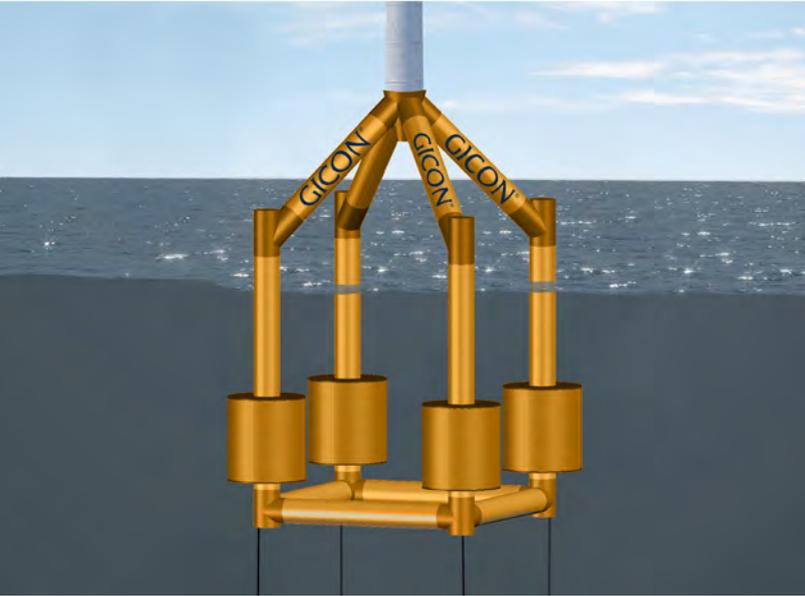


# GICON®



## GICON® Technology Portfolio



**"In-house research and development secure the future of our companies!"**

**Prof. Dr.-Ing. habil Jochen Großmann**  
 Founder GICON® Group

„The creation of innovations has been an essential core of our corporate philosophy since the foundation of GICON®. On the one hand, this applies to our own core business - engineering and consulting - in which we offer our clients unique added value, for example through novel exploration techniques, analysis and evaluation methods, and special software developed in-house. With our own technology development, we go one step further by bringing innovations for our clients' business areas to the market and thus helping to shape these markets. Our focus in technology development is in the area of renewable energies and the sustainable use of resources. The three most important lighthouses of the GICON® Group to date are the GICON® Biogas Process, the GICON® SOF (floating offshore substructure) and the GICON® Photobioreactor. They are the results of years of research and development and have been successfully developed to market maturity.

As a GICON® client, you also benefit from our worldwide licenses and patents for all technologies, professional engineering support for your projects on a commercial scale, and insured services, even for pilot plants."



**"We master innovation processes"**

**Dr.-Ing. Hagen Hilse**  
 Managing Director and Head of Research & Development

„The research and development teams of GICON®, which have a pronounced practical orientation, see themselves as an "innovation bridge" between university and institutional research on the one hand and large-scale practical application on the other. In addition to excellent technical qualifications, our strength is the experience of our employees from our commercial core businesses in various economic sectors. In connection with an innovation culture explicitly promoted by the management, our employees are highly motivated to efficiently and precisely evaluate R&D results for market exploitation. In conjunction with a comprehensive network of cooperative relationships with leading research institutions and our own high-quality technical infrastructure for R&D, we at GICON® have developed a special competence to master the path from invention to market-ready technology."

LOCATIONS IN GERMANY AND INTERNATIONAL



STRATEGIC PARTNERSHIPS

Our partners from science and industry are an integral part of our R&D work. GICON® is networked with more than 20 renowned companies and scientific institutions.

Together with universities, research platforms such as the Central German Biosolar Center in Köthen and the Large-scale Research and Development Center in Cottbus have been created.



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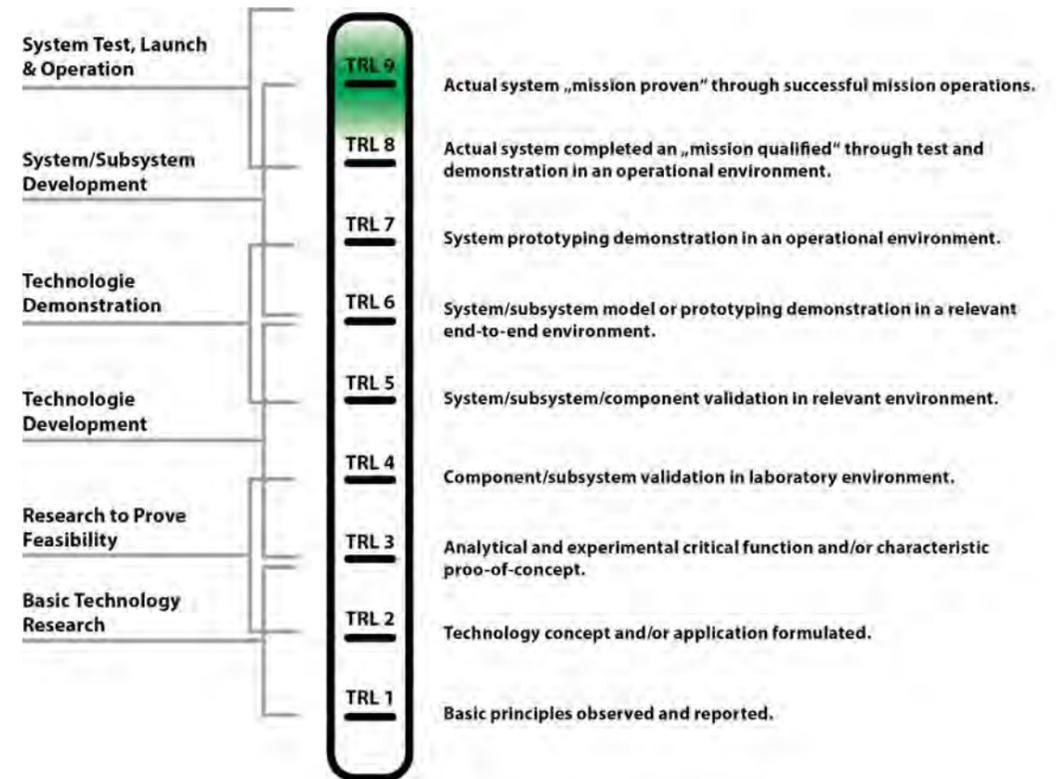
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*\*ALL INNOVATIONS OF THE GICON® GROUP ARE OFFERED WORLDWIDE AND WITH AN INSURANCE PACKAGE TAILORED TO YOUR PROJECT.*

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## LEGEND



	Special technological advantages, which you can only obtain from us.
	List of all available patents and licenses relevant to our technology.
	Products and services that we offer you!

## COMBINED PILE-PLATE FOUNDATION FOR UNSTABLE BUILDING SITES



Landfills, mining legacy landscapes and abandoned industrial sites are generally inexpensive and exposed locations that are suitable for wind turbine development. Since the soils of these sites are usually of low bearing capacity down to greater depths, their development requires innovative solutions in foundation planning.

An innovative and implemented specialized solution is the combined pile and raft foundation (KPP). With the KPP, piles are arranged, if already required, in the ground under the foundation raft, which has been improved by deep compaction. The foundation raft is used for load transfer. The piles serve only as a settlement inhibitor and are therefore considered in the planning with their maximum load-bearing capacity. This eliminates the need for additional safety factors that would lead to a larger number or length of piles.

The combined pile and raft foundation is thus a possibility to safely and economically support heavy structural loads, even with problematic subsurface conditions.

	<ul style="list-style-type: none"> <li>• Use of specially-designed calculation- and 3D-software</li> <li>• Possibility to keep the foundation raft relatively small</li> <li>• Guarantee of permanent stability</li> </ul>
	-
	Engineering and environmental consulting

## GICON® HIGH-ELEVATION WIND TOWER (GICON®-HWT)



Together with external partners, GICON® has developed a "high-altitude wind tower" (GICON® HWT) for the utilization of increased wind yield potentials at very high elevations to production readiness. The patented concept of the GICON® HWT is a telescopic tower structure. The special feature is that hub heights of up to 300 meters can be realized. Thus, increased yield potential can be exploited at great heights. Existing wind farms can be expanded to a second level by retrofitting with the GICON® HWT, thus enabling the areas to be used much more efficiently. The construction of a pilot plant is planned by 2022.

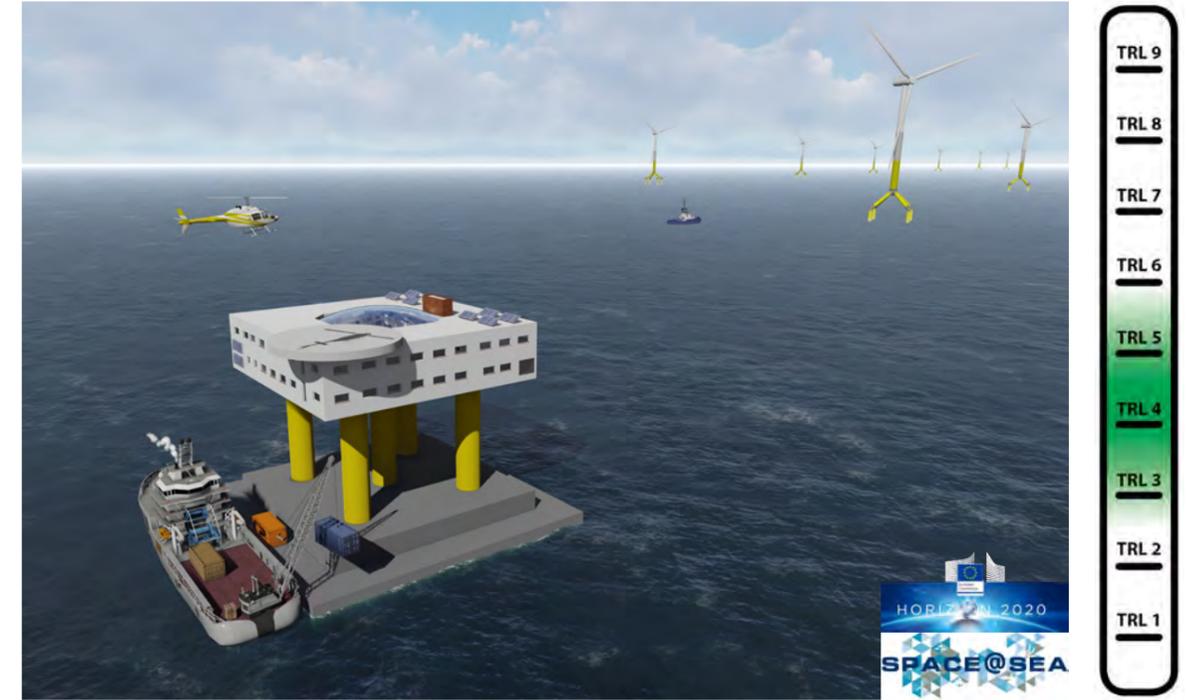
	<ul style="list-style-type: none"> <li>• Patents</li> <li>• Telescopic tower</li> <li>• Low material requirement, high self-damping</li> </ul>
	10 2017 223 624.8; PCT/EP2018/085871
	Patents, licenses, engineering, environmental consulting

## GICON® SOF FLOATING TLP SUBSTRUCTURE



With the SOF, GICON® has developed a floating substructure for offshore wind turbines that can be used in water depths of 45 to 350 meters or more and enables a levelized cost of electricity of 5 to 8 cents/kWh. This makes GICON® one of the world's leading developers of floating offshore substructures and gravity anchors for wind turbines. Since 2009, GICON® has been developing the SOF, cooperating with renowned partners such as the TU Bergakademie Freiberg and the University of Rostock. Thanks to continuous development based on results of research & development, such as various wind & wave tank tests, the GICON® SOF is ready to prove its performance as a multi-megawatt prototype.

## SPACE@SEA FLOATING WORK AND LIVING PLATFORM



The aim of Space@Sea is to develop sustainable artificial islands that can be assembled in modules. The project aims to develop low-cost, floating platforms that can be used off the coast as logistics, housing, energy and/or aquaculture bases. The background for the project is, among other things, the ever-increasing population and limited land area worldwide. Due to the increasing demand for renewable energy and food, new forms of residential and logistics centers are required.

GICON® has developed an independent living and working hub that rests on stilts and a floating substructure. In addition, a self-sufficient energy supply system has been integrated. The concept provides for electricity to be generated, for example, by a wind turbine, solar panels or wave generators. Heat for heating the working spaces is produced by heat pumps. Thus, the artificial island will be used as a logistics, service and residential island as well as an energy and/or aqua base.

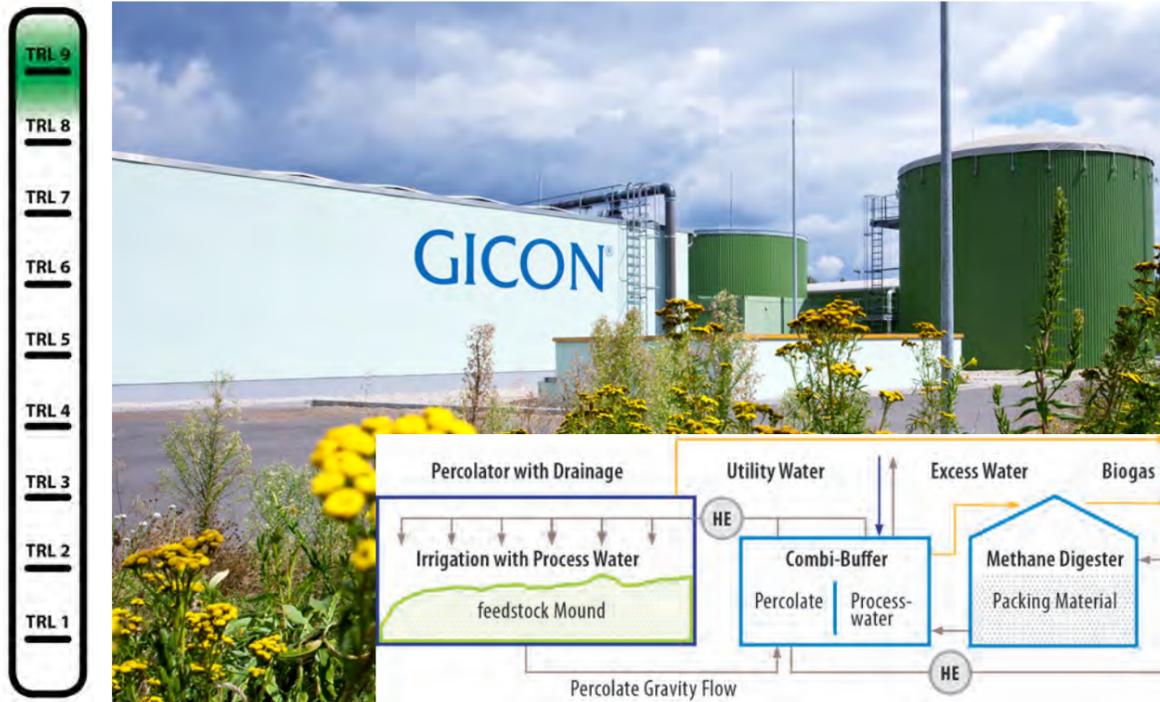
	<ul style="list-style-type: none"> <li>Worldwide patents and licenses to the technology</li> <li>In-house engineering</li> </ul>
	EP2229313; US8,622,011; EP2311725; US8,657,534; EP1876093; EP2931596; PCT/EP2014/073342; US 10/259,542; PCT/EP2018/056007; PCT/EP2020/051007
	Patents, licenses, engineering, environmental consulting

	<ul style="list-style-type: none"> <li>Patents on technology</li> <li>Capability for integration of other technologies</li> <li>Variable size and use</li> </ul>
	10 2019 104 178.3 10 2018 124 072.4
	Patents, conceptual consulting + engineering

# ANAEROBIC DIGESTION TECHNOLOGY

## GICON® BIOGAS PROCESS

### TWO-STAGE DRY-WET FERMENTATION WITH SEPARATE HYDROLYSIS



The GICON® Biogas Process was developed together with GICON® by Prof. Busch's team at the Dept. of Waste Management at the Brandenburg Technical University in Cottbus and is protected by international patents. It is specially designed for waste with high levels of impurities as a feedstock. As a discontinuous high-solids anaerobic digestion via percolation, its unique selling point is its two-stage nature. This means a consistent separation of the degradation processes of hydrolysis and methane formation.

GICON® has extensive international experience in the planning and construction of biogas plants. Over 180 reference plants bear the signature of GICON®. Clients receive biogas plants and infrastructure from one source.

	<ul style="list-style-type: none"> <li>• Flexible use of feedstocks due to robustness against impurities</li> <li>• Methane content 15 - 20 % higher</li> <li>• Anaerobic digestion of organic residues (solid organic waste)</li> </ul>
	<p>GICON®-Biogasverfahren:                  ZL200580042903.5; US7854840; EP1807225; EP2566946B1</p>
	<p>Patents, licenses, engineering, environmental consulting, technology provider</p>



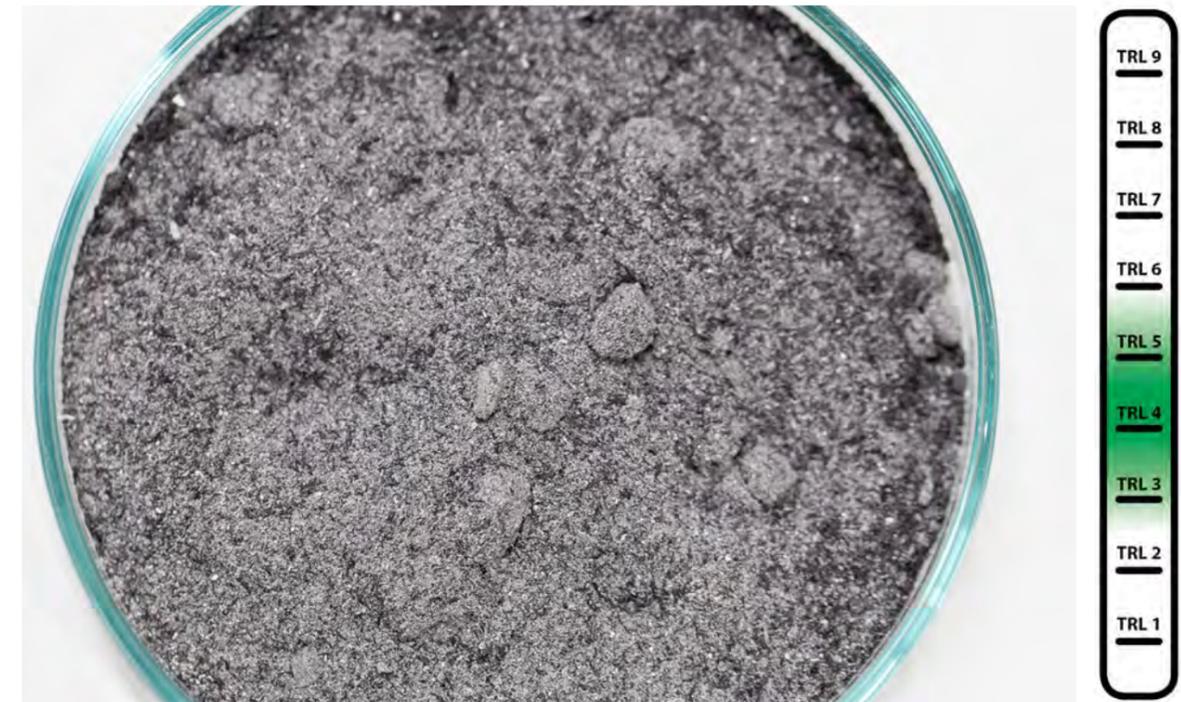
Reference project - Harvest Energy Garden Richmond (Canada)

## BIOLOGICAL METHANIZATION / SECTOR COUPLING



Since 2015, GICON® engineers have been working on the production of biomethane from hydrogen and carbon dioxide in so-called trickle bed reactors. The aim is to store renewable energy at peak loads in the power grid via the electrolysis of hydrogen and subsequent methanization. Trickle bed reactors can be used as supplementary systems for biogas/wastewater gas plants and power plants.

## RECOVERY OF NUTRIENTS FROM FERMENTATION FEEDSTOCKS



GICON® has set itself the goal of processing the fermentation residues produced in biogas plants (including drying and weight reduction to reduce storage capacity). The nutrient content of the fermentation residues can also be used for additional purposes (e.g. as a substitute for mineral fertilizers). This process is called "refinement" and is of great (economic) importance for agriculture, especially since the EU Fertilizers Regulation, which has been in force since summer 2017, contains extended regulations for determining and recording the nutrient content of fertilizers. These include stricter closed periods during which the application of fertilizers is prohibited as well as the mandatory creation of larger storage capacities.

	<ul style="list-style-type: none"> <li>• Biological methanization with GICON® trickle-bed processes</li> <li>• Own large-scale pilot plant for large-scale project preparation</li> <li>• Supplementary system for biogas plants, wastewater treatment and power plants</li> </ul>
	DE 10 2013 209 734.4 EP 14731164.1
	Engineering for system integration, consulting

	<ul style="list-style-type: none"> <li>• Patent (license BTU Cottbus)</li> <li>• Waste recycling from animal husbandry and processing plants</li> <li>• Own large-scale pilot plant for large-scale project preparation</li> </ul>
	DE 10 2012 100995.3
	Patent, engineering, laboratory services, cross-technology planning

# MICROALGAE CULTIVATION

## GICON® PHOTOBIOREACTOR (GICON® PBR)



A stable and resource-conserving production of microalgae biomass requires a cultivation system with a high degree of effectiveness and controllability. A process control within the ideal growth range of microalgae requires a gentle temperature control with an effective supply of sunlight. The innovative GICON® PBR combines for the first time the main requirements of photobioreactor systems for stable growth yields according to the Christmas tree principle. For this, the photobioreactor has already been awarded "Innovation of the Month" (May 2012) by the German Center for Research & Innovation in New York.

The reactor consists of several truncated cone-shaped base structures, which act as supports for the flexible tubular double-wall system. The biomimetic design is reminiscent of a Christmas tree (Christmas Tree Light Collector Module, or TLM for short). For a photobioreactor, several TLM are combined to form a "forest".

	<ul style="list-style-type: none"> <li>• Temperature-controlled double-wall tubing system</li> <li>• Energy-saving operation through pulse technology</li> <li>• Applicable worldwide</li> </ul>
	DE 10 2012 215 476; DE 10 2012 216 339; US 9,732,312, EP 2 895 431 u. w.
	Patents, prefabricated small reactors, engineering, consulting

## GICON® OCTAGON



One of the greatest global challenges of the 21st century is to sustainably supply a growing world population with food, raw materials and energy in times of climate change. Microalgae are regarded as the hope for an organic-based future. The advantages of producing this renewable raw material include low land and water consumption combined with high productivity. Algae are rich in ingredients and valuable substances and thus guarantee enormous potential for use.

The advantage: The GICON® PBR enables stable and efficient production of microalgal biomass, even under the wide-ranging climatic conditions worldwide. By arranging the reactors in an octagon, the basis for industrial up-scaling was created.

	<ul style="list-style-type: none"> <li>• World's first unrestricted outdoor PBR</li> <li>• Scalable reactor size and multi-product reactors due to modular design</li> </ul>
	102012216339; 2895431; 10217218001.3; PCT/EP2018/077264; 18785906.1; 16/649,995; 201880064080.3
	Patents, licenses, engineering, environmental consulting

# MICROALGAE CULTIVATION

# RESEARCH & DEVELOPMENT

## ADVANTAGES OF THE DOUBLE-WALL TUBE SYSTEM

### ECONOMIC VIABILITY

- Length of the systems can be scaled as required (extrusion)
- Connecting elements and connectors are not required
- Extra long life

### THERMAL RESISTANCE

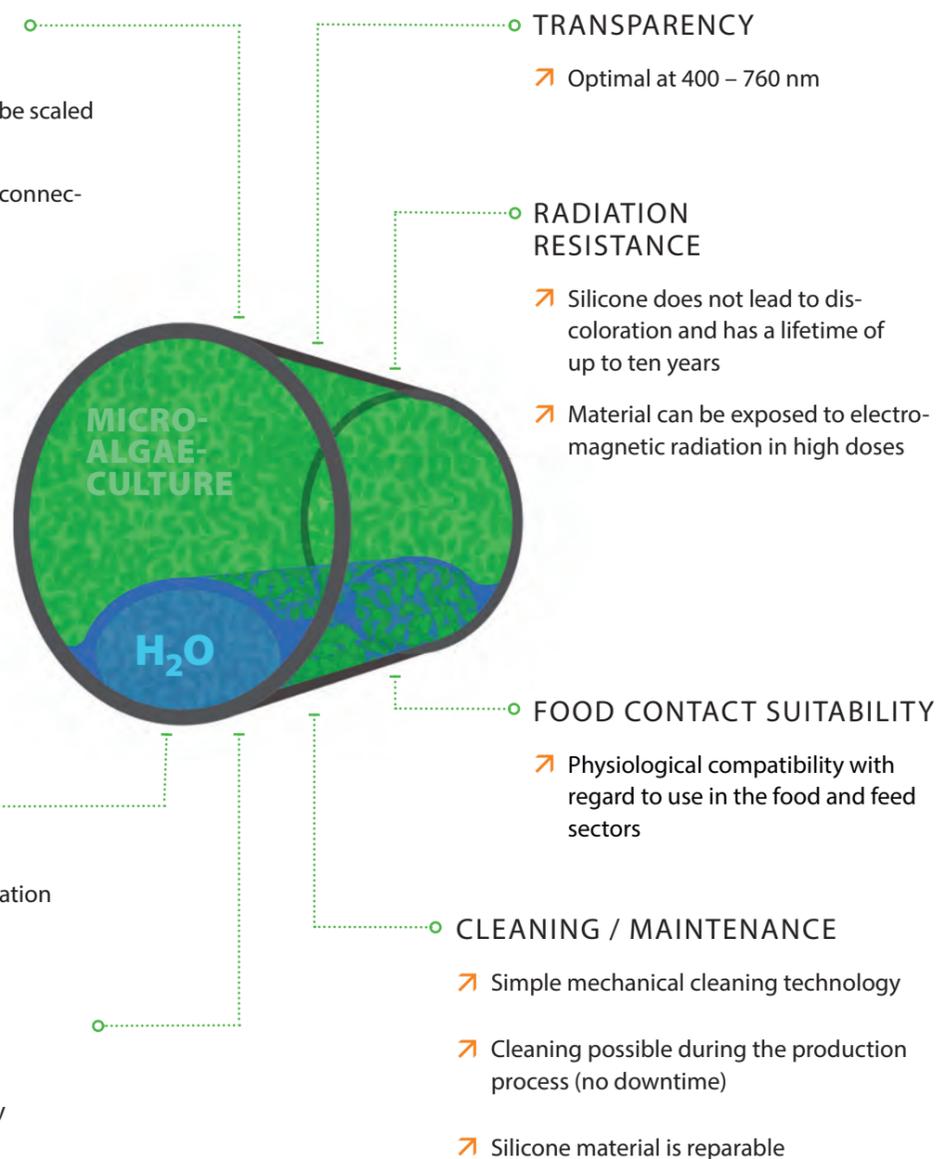
- Stable up to 150 °C
- Steam sterilization possible

### CHEMICAL RESISTANCE

- Use of salt water for cultivation and temperature control

### ENVIRONMENTAL SUSTAINABILITY

- Flame retardant and easily



## RESEARCH HUBS - COTTBUS AND KÖTHEN

At the Cottbus research hub, GICON® operates a pilot plant to conduct targeted research and development in the fields of biogas and microalgae. Located on 450 m<sup>2</sup>, the area offers optimal conditions: state-of-the-art facilities that enable us to individually examine organic raw and residual materials as well as new technological developments and to evaluate them with regard to their suitability for industrial-scale use.

### PRODUCT RANGE:

- Complete or partial plants for the industrial production
- Self-sufficient small reactors for agriculture and aquacultures
- Coupling systems for microalgae technology and biogas production according to the biorefinery principle
- Customized concepts for our clients

### SERVICES:

- Design and plant engineering based on PBR
- Microalgae screening
- Biomass production
- Recyclables analysis
- Algae screening in the laboratory and in the field
- Services for the operational management of microalgae plants
- Cultivation stage for pilot plants and production facilities
- Microalgae culture breeding and application development for the animal feed industry



**BIOSOLAR CENTER**

A co-operation of GICON® Group and Anhalt University of Applied Science

In 2011, GICON® founded the Biosolar Center in cooperation with the Anhalt University of Applied Sciences in Köthen. The goal of the employees of this innovative research hub is to develop internationally competitive solutions in the field of biosolar technology.

# REMEDIATION TECHNOLOGIES

## RISK ASSESSMENTS, REMEDIATION PLANNING AND REMEDIATION



Contaminated former industrial sites or abandoned sites are potential sources of danger for soil and water (surface and groundwater). However, whether and to what extent this hazard is real and may need to be remediated is only partially possible on the basis of the methods, processes and technologies used to date. Due to the resulting limited forecast reliability, the actual remediation costs can significantly exceed the planned scope. GICON® has succeeded in eliminating these disadvantages. The basis for this is a two-stage risk assessment. Due to the innovative solutions developed, a simplified risk assessment already evaluates whether further investigations are necessary and purposeful. Only if this is warranted, further investigations and, if necessary, remediation planning and the accompaniment of remediation measures are carried out. This always ensures that the costs of our services do not exceed the savings achieved.

	<p>Reliable data:</p> <ul style="list-style-type: none"> <li>• On the requirement and scope of remediation measures in the soil and groundwater zones</li> <li>• To the value of a contaminated property</li> <li>• To the valuation of accrued liabilities or to costs of the remediation of contaminated sites</li> </ul>
	DE102009038017B4; DE102009043134B4; DE102011005904B4
	Engineering, environmental consulting

## MONITORING



The basis for a resilient risk assessment is the monitoring of changes in soil and water (surface and groundwater) in terms of quantity and quality. This presupposes that the collected monitoring data enable conclusions on the processes taking place in the soil and water zones with respect to type and extent. This is the only way to ensure the necessary analysis of the significant processes, the resulting selection of suitable prognosis models and their representative parameterization. GICON® has set new standards with its innovative developments in this field, which have enabled a transition from information-oriented (state of the art) to process-oriented monitoring of soil and water bodies.

	<ul style="list-style-type: none"> <li>• Guaranteed higher benefit than expense</li> <li>• High regulatory acceptance of the developed solutions</li> </ul>
	The method developed by GICON® for process-related groundwater monitoring for collecting representative groundwater samples from groundwater measuring points has been included in the standards applicable across Germany.
	Patent, engineering, environmental consulting, laboratory services

# EXPLORATION AND ANALYSIS TECHNOLOGIES

## DAISI (DIGITAL AERIAL IMAGERY SYSTEM BY IFAÖ)



In the field of ornithological monitoring and analysis, GICON® can employ the Digital Aerial Imagery System by IfAÖ (DAISI), a tandem camera system developed in cooperation with the University of Rostock, which is aligned vertically to the observation area in an airplane and allows a ground resolution of 2 cm. Project applications of the photo flights have shown that with the DAISI system, an up to 98 percent higher accuracy is possible for species counts when compared to an observation flight.

## VARS (VISUAL AUTOMATIC RECORDING SYSTEM)



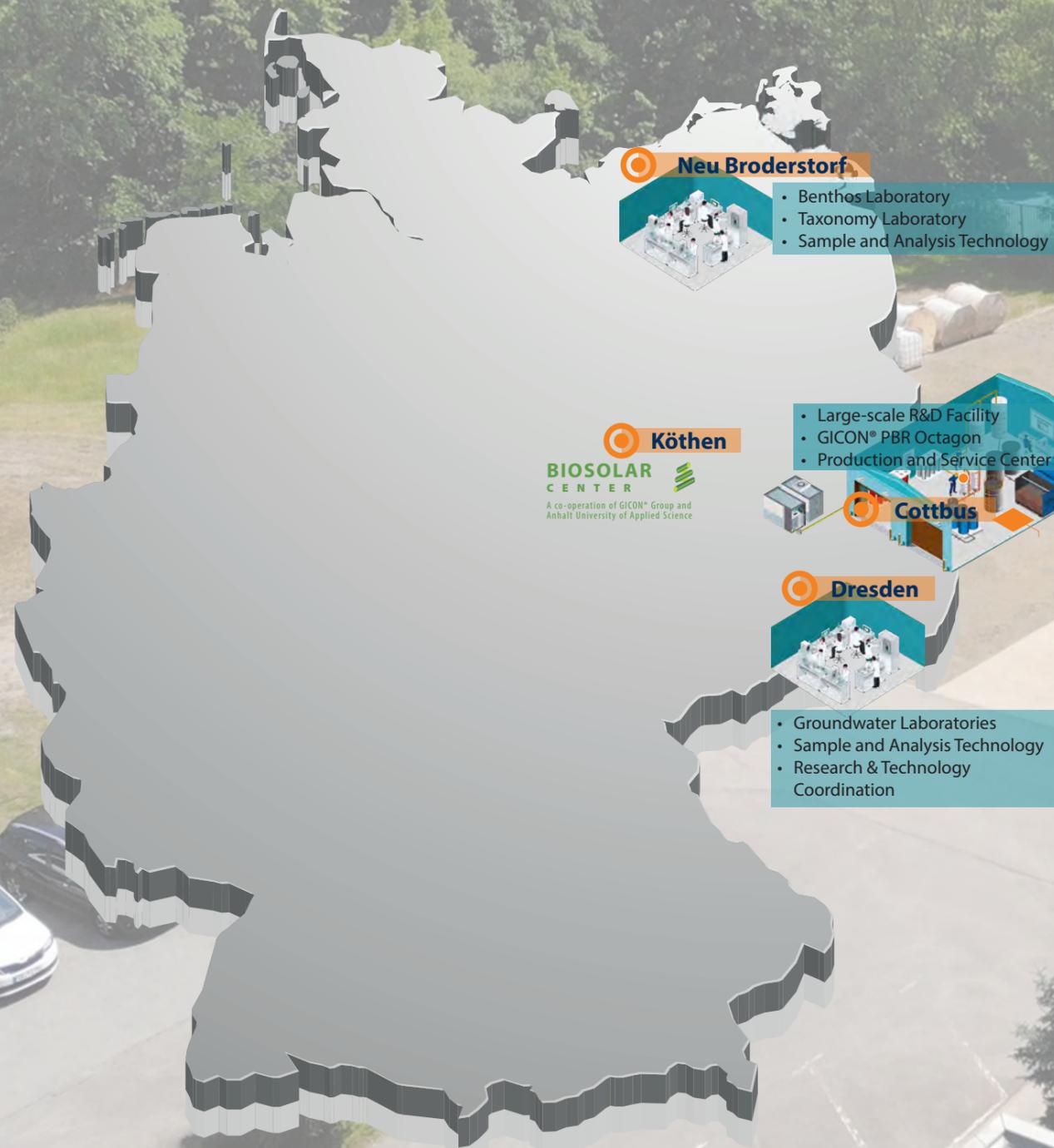
VARS is a camera system for automatic recording of diurnal and nocturnal flying birds. Via motion analysis software, a video sequence is only recorded if one or more objects move through the image section. In the darkness, the use of infrared technology enables the visibility of birds and bats. Through a specially developed process, the camera system generates a very low data volume per recorded event. Currently, one system each is in use on the FINO 2 research platform in the Baltic Sea and in the "alpha ventus" offshore wind farm.

	<ul style="list-style-type: none"> <li>• Special evaluation software for detailed object recognition</li> <li>• Provision of own server structure</li> <li>• 98 percent higher accuracy in species counts</li> </ul>
	-
	Engineering, environmental consulting, evaluation platform

	<ul style="list-style-type: none"> <li>• Motion analysis software</li> <li>• Provision of own server structure</li> </ul>
	-
	Patent, engineering, environmental consulting, laboratory services

# GICON® TECHNOLOGY HUBS

GICON® research and technology facilities



Research and technology location Cottbus

# GICON®



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