

# Village-scale wastewater treatment plants



**Biower** 

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**Biower village-scale wastewater treatment plants efficiently and reliably process the wastewaters of village-size communities and production plants. In addition to removing ordinary water-contained impurities, they may be used to remove detergents and solvents, for example. These plants have a minimal space requirement and are delivered pre-installed in sea containers. Bioreactors may also be installed underground.**

Biower's innovative wastewater treatment technology is based on a Rotating Bed (RB) bioreactor with specialised bacteria that grow on carrier elements and decompose water-contained chemicals and other impurities. The carrier elements are kept in a continuous rotary motion inside the reactors, which maintains their oxygen supply and keeps the carrier clean.

**Biower wastewater treatment plants consist of the following sub-processes:**

- A sedimentation tank that also removes phosphorus.
- Bioreactor 1: oxygen-free denitrification that releases the chemically bound nitrogen.
- Bioreactor 2: carbon removal that converts carbon compounds into water and carbon dioxide and initiates the oxygenation of nitrogen compounds.
- Bioreactor 3: nitrification that oxygenates the nitrogen into nitrates.
- A mechanical clarifier.

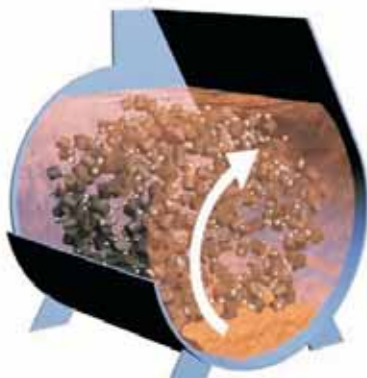
### Functional description

Incoming wastewaters are collected into a sedimentation tank where solid matter is removed from the water. Phosphorus is removed by using a non-toxic chemical. After sedimentation the wastewater passes through three bioreactors. In a typical solution, each reactor uses a task-specific strain of specialised bacteria attached on the carrier element surface to remove nitrogen and organic matter from the water.

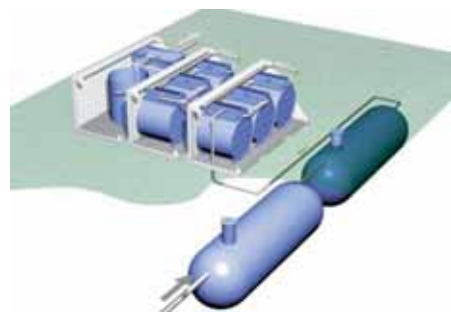
The treatment process extracts up to 80 percent of the water-contained nitrogen. The system's unique purification efficiency is based on selective specialised bacteria, a wide carrier surface area, and the favourable chemical conditions created by intelligent process technology.

If necessary, the selective bacteria technology can also be used to decompose other chemical compounds such as phenols, formaldehydes, isocyanate, cyanide, acetone, MTBE and hydrocarbon dissolvents.

Dead bacteria are separated from the water by centrifugal force and discharged into the sludge tank. Downstream of the third reactor, the water passes through mechanical filters and returns into nature in a purified form.



At best, an RB bioreactor's energy consumption is only ten percent of that consumed by conventional methods.



A container-based 500 population equivalent solution of a village-scale wastewater treatment plant.

## Technology comparison

	Rotating bed	Moving bed	Active sludge	Trickling filter	Biorotor
Size	●●●	●	●	●	●
Energy consumption	●●●	●	●●	●	●
Hydraulic overload tolerance	●●●	●●●		●●●	●●●
Restart-ability	●●●	●●●		●	●
Temperature tolerance	●●●	●●●	●	●●●	●●●
Need to clean carrier	●●●	●●●	●●●		
Maintenance costs	●●●	●●	●●●		
Chlorine and detergent tolerance	●●●				

Biower village-scale wastewater treatment plants use technology developed by Clewer.

### Intelligent aeration minimises energy and space requirements

The bacteria living on the carrier surface need oxygen to decompose the impurities in the water. The required oxygen is blown into the reactor by an air blower that also generates the water bed's rotary movement.

The RB reactor's carrier element filling ratio is over 90 percent. Thanks to this high filling ratio, the amount of bacteria is high, which means that the water purification process is much faster compared to conventional methods. In addition, the reactor's water column is of minimal height, which essentially reduces the aeration energy consumption. The high filling ratio is also reflected as a remarkably low space requirement.

Since the carrier elements do not move in relation to water, the reactor is free from energy consuming turbulences. Compared to conventional processes, Biower reactors retain the water-contained air bubbles much longer. Their rotary motion inside the reactor drum enables efficient bacterial activity, which further reduces the energy requirement.

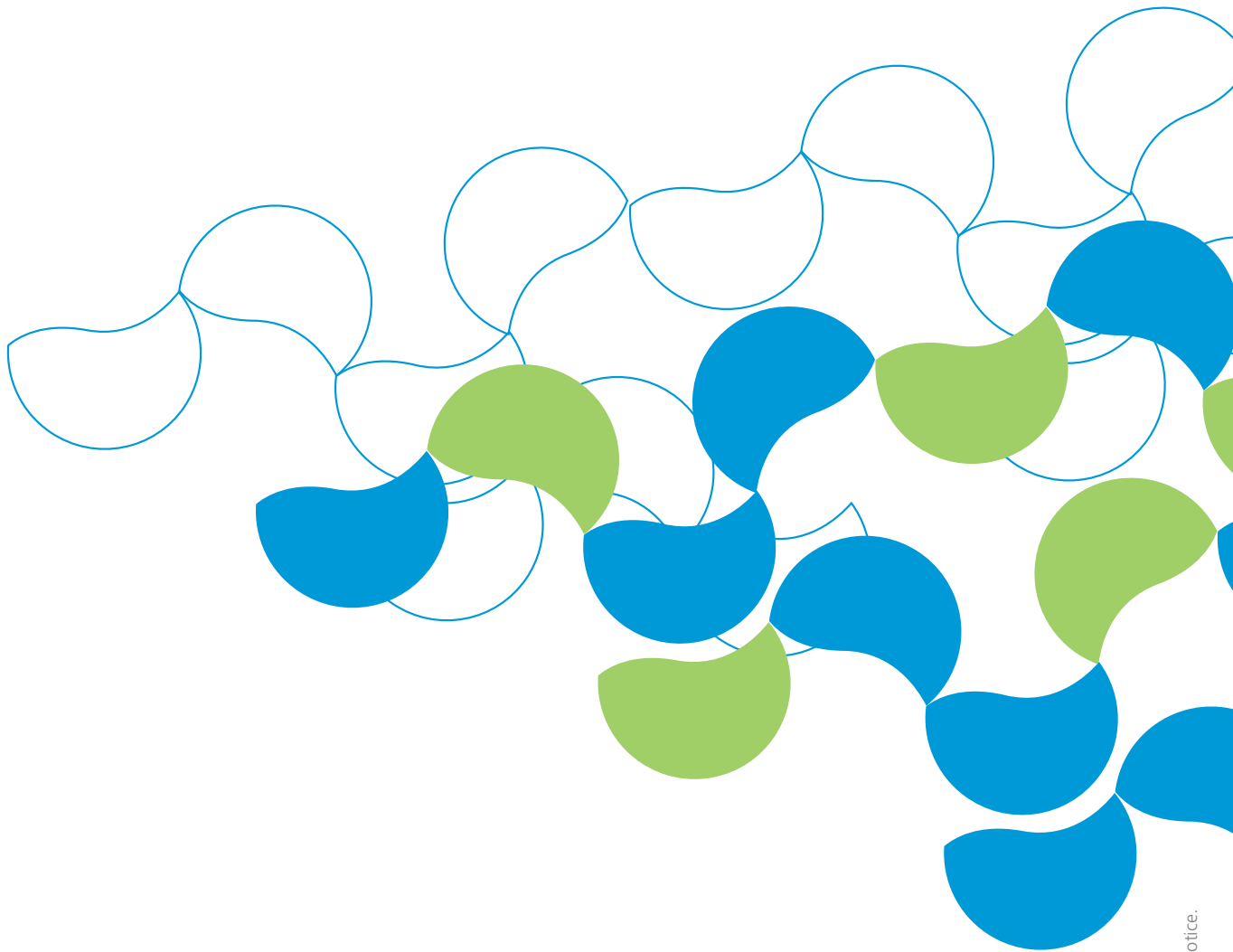


Village-scale plants can also be installed in warehouses and other buildings. The picture shows a wastewater treatment plant of the 150 population equivalent type.

### High purification power throughout the year

A village-scale wastewater treatment plant functions reliably and withstands great water flow variations, because the bacteria attach to the carrier medium and cannot be flushed off with water. In addition, the plant's functions are unaffected by long-term shutdowns and cold weather, due to the fact that the bacteria are long-lived and survive even the arctic winter, sustained by mere internal water circulation. In addition to cold weather, the bacteria withstand a variety of chemicals such as chlorine and cleaning agents.

The plant can easily be started up again, following any unavoidable shutdown situations. The plant's functional reliability is also seen in its minimal maintenance requirement.



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