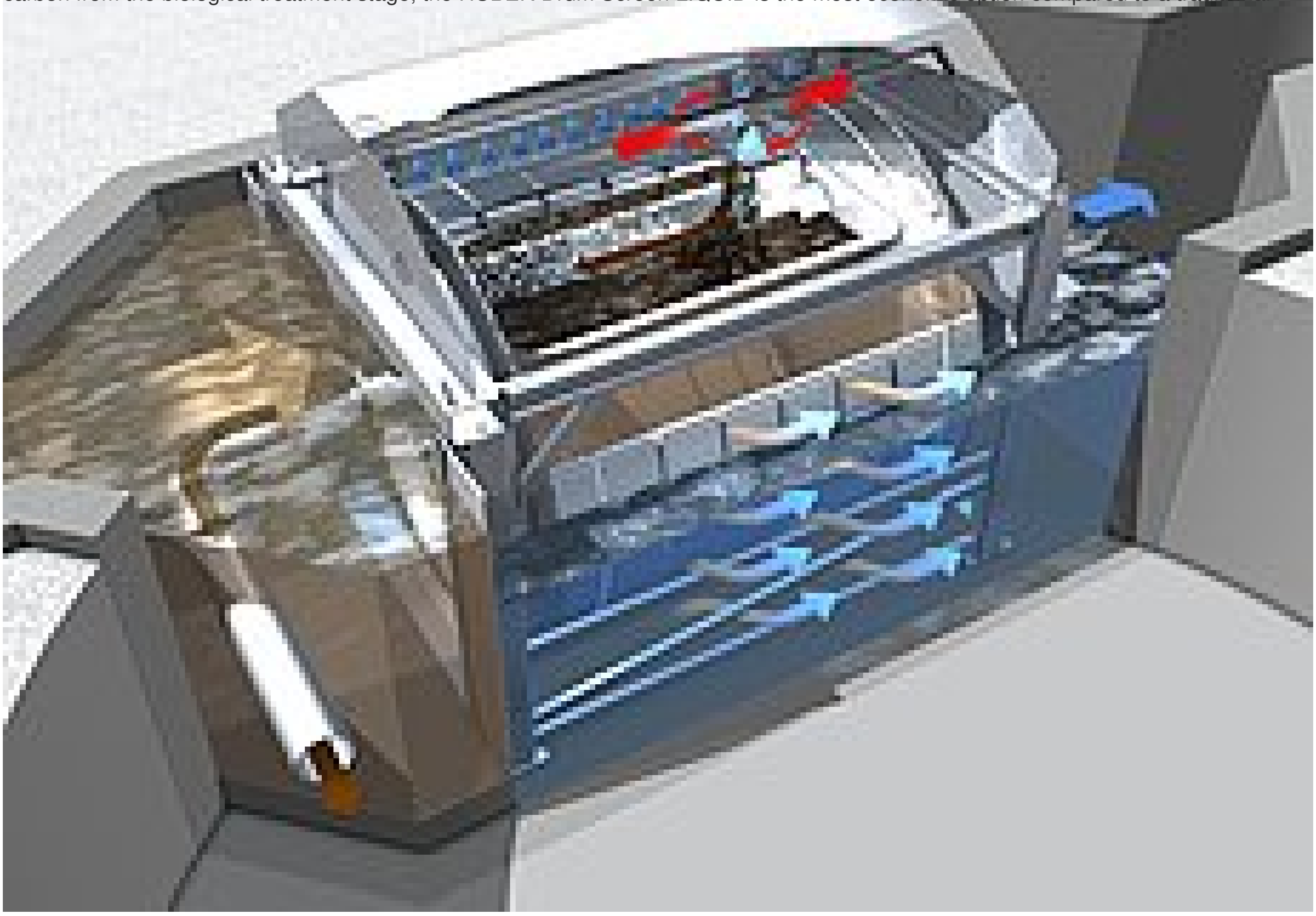
Implementation of economically efficient septic tank systems in the range of 10,000 to 20,000 p.e.

Changing from aerobic to anaerobic sludge stabilisation

More and more municipalities in Germany are striving to optimise the energy efficiency of wastewater treatment on their sewage plants. Generally, there are two options: energetic rehabilitation or expansion of the treatment plant capacity. An expansion of the treatment plant capacity is possible through the construction of a new biological stage, but is counterproductive in terms of energy optimisation, since an additional biological treatment stage requires a considerable amount of additional aeration energy. This solution also increases disposal costs. The energetically more sensible option for the rehabilitation of small plants of 10,000-20,000 p.e. is very often to change from aerobic to anaerobic sludge stabilisation. This conversion makes it necessary to integrate both a mechanical pre-treatment unit and a digester for anaerobic sludge stabilisation into the system. Up to now, the literature has pointed out that the implementation of a digester would only be economically viable and make sense for expansion sizes larger than 20,000 PE. In view of rising energy costs and increasing disposal costs, this assessment has now changed fundamentally.

An economic conversion from aerobic to anaerobic sludge stabilisation does not only require the economically best design of the digester, but also the optimal method of organic carbon removal from the biological treatment stage. Regarding the removal of organic carbon from the biological treatment stage, the HUBER Drum Screen LIQUID is the most economic option compared to a traditional



HUBER Drum Screen LIQUID to relieve the biological system. Better separation performance than a primary clarifier with only 10% of the space requirement.

primary clarifier (sedimentation tank), as numerous feasibility studies and implemented concepts have shown.

The economic efficiency of a sludge digestion system depends mainly on the type of digester construction. In general, a distinction is made between concrete digesters, screwed steel silos with a bottom chamber, screwed steel silos with a concrete hopper and welded steel silos. However, it is not only the type of construction that influences economic efficiency, but also the type of sludge digestion process used.

Compared to the usual fully mixed digester, in the "2-phase digestion" process the digester is operated with hydraulic displacement or stacking from the bottom to the top. This mode of operation means that there is no fresh substrate slip, and an increase in gas yield of up to 20% is achieved compared to conventional permanently mixed digesters. Another advantage of hydraulic displacement compared to a digester with mixing (agitator) is that a saving of 3-10 W/m³ can be achieved. Due to this process management without mixing, an enrichment and concentration of the necessary microorganisms is possible, which contributes to an increase in gas production.

Economic process integration:

Decisive for the economic efficiency of a possible process change from aerobic to anaerobic sludge stabilisation are both the electricity costs and the level of disposal costs. For wastewater treatment plants with an expansion stage of 15,000 to 25,000 p.e., there should be at least 200,000 euros per year in electricity and disposal costs. Furthermore, gas yield curves are used to draw conclusions about biogas production and sludge dewaterability. If a comparison of the original configuration of the wastewater treatment system with the system changed to anaerobic sludge stabilisation shows as a result a saving of at least 50,000 euros, a recommendation is made to continue the planning process.

Illustration of the variants of 2-phase digestion

References of 2-phase digestion (change from aerobic to anaerobic process control)

- Project Hildburghausen: 20,000 p.e. (50 kW micro gas turbine)
- Project Kahla: 15,000 p.e. (30 kW micro gas turbine / 50% energy compensation)
- Project Staßfurt: 70,000 p.e. (two gas turbines 65 kW / energy compensation 70 %)
- Project Pocking: (17,000 p.e.; one gas turbine 65 kW / 50% compensation)

Advantages of 2-phase digestion:

- Retention time 10-14 days
- No circulation energy (savings potential: 3-10 W/m³)
- Increased gas production (up to 20% compared to mixed systems)
- Small installation space
- Low investment costs
- Fully welded stainless steel construction (preferred variant: welded steel silo)

Figure 2 shows the individual variants of 2-phase digestion. The volume in each variant corresponds to 200 m³ with construction heights of 8 to 22 m. Due to the shorter service life of the screwed tanks, the "welded steel silo" design with bottom chamber is the most economical variant. The other variants shown are 5-10% higher in price.

Subsidies for process conversion

The selection of the digester system and the associated investment costs are an important criterion when applying for subsidies.

With regard to compliance with effluent values, coordination with the lower water authority is necessary. No BiMSch procedure (procedure according to the Federal Immission Control Act) is required for the planning and implementation of the sludge digestion system.

The funding according to the Local Authorities Guideline 2020 shows that 40% of the eligible costs are subsidised. CHP and machine installation rooms are not eligible. The prerequisite for applying for funding is the submission of a meaningful potential study. As this is ERDF funding, it can be combined with the Local Authorities Guideline.

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