

## An investment in a PyroDry system is a green and sustainable investment.



Highlights of your key challenges	The PyroDry system - in brief	The PyroDry-system benefits the environment	From sludge to BioChar – a valuable product	An investment that quickly pays off
<p><b>Today</b></p> <ul style="list-style-type: none"> <li>✓ Energy consumption for sludge drying and storage costs burden operations.</li> <li>✓ Disposal of sludge entails significant expenses, particularly through incineration or landfilling.</li> <li>✓ Spreading sludge on agricultural land releases CO<sub>2</sub>, which impacts the green profile.</li> <li>✓ Sludge's presence of environmental pollutants and hazardous substances necessitates special handling and disposal measures. Particularly, the presence of microplastics, PFAS/PFOS, pesticide, and pharmaceutical residues pose challenges, both economically and in terms of meeting regulatory limits.</li> </ul> <p><b>In the future</b></p> <ul style="list-style-type: none"> <li>✓ What do we do when organic sludge is no longer permitted to be applied on agricultural land?</li> <li>✓ In some form, the disposal of sludge can be subject to a CO<sub>2</sub> tax.</li> <li>✓ The allowable limits for emissions will become stricter.</li> <li>✓ Utilization of phosphorus and energy from sludge will be mandated.</li> <li>✓ The capacity of incineration plants may be reduced.</li> </ul>	<ul style="list-style-type: none"> <li>✓ PyroDry is the name of a fully automatic, complete system that converts organic sludge into BioChar</li> <li>✓ The PyroDry system is unique because the high-efficiency drying oven recycles the generated gas from the pyrolysis furnace (process patent), eliminating the need for a chimney.</li> <li>✓ The dried sludge from the drying oven (with a total solids content of 90%) is pelletized before carbonization in the pyrolysis furnace, using a self-developed pelletizing unit. This avoids dust and cake formation, ensuring uniform handling and carbonization</li> <li>✓ The system is currently operational in multiple countries, and it is possible to arrange inspections by appointment.</li> <li>✓ A PyroDry5000 system, designed for treating approximately 5,000 tons of sludge per year, only requires a frost-free building of around 250 m<sup>2</sup></li> <li>✓ The system consists of a container with a walking floor, a drying oven, a pelletizing unit, a pressureless pyrolysis furnace, a BigBag station for the final BioChar product, and biofilters through which the purified moist air is passed. Additionally, there are connecting channels, pipelines, and a control system.</li> <li>✓ The entire system is CE-marked and manufactured in Germany and Austria in compliance with EU standards.</li> <li>✓ The exhaust air from the drying process is directed through the biofilters, which are located outdoors.</li> </ul>	<ul style="list-style-type: none"> <li>✓ The treated sludge is reduced to approx. 1/10 of the input through drying and pyrolysis, resulting in significant savings in handling and transportation costs.</li> <li>✓ CO<sub>2</sub> is carbonized and captured in the system's output: BioChar. 0.7-0.9 tons of CO<sub>2</sub> per ton of BioChar. The CO<sub>2</sub> is released slowly over several decades</li> <li>✓ The majority of the organic matter, including microplastics, pesticides, and pharmaceutical residues, is converted into gas in the pyrolysis furnace at temperatures ranging from 450 to 950 degrees Celsius. The gas is returned to the drying oven, which has the lowest kWh consumption in the market, serving as a drying medium. Approx. 0.7 kWh/kg of BioChar.</li> <li>✓ The building blocks in PFAS and PFOS chains also undergo transformation and degradation. In independent analyses, PFAS 22 and 4 can no longer be measured/detected.</li> <li>✓ The heavy metals in the sludge remain in the BioChar after pyrolysis. Some metals undergo degradation, but residual amounts are bound within the BioChar.</li> <li>✓ If there is surplus energy/dry matter balance, this thermal excess heat can be utilized for water or air heating.</li> <li>✓ The PyroDry system is registered with the international organization cdr.fyi, which certifies CO<sub>2</sub>-reducing processes and companies, enabling the sale of CO<sub>2</sub> certificates.</li> </ul>	<ul style="list-style-type: none"> <li>✓ The BioChar retains the phosphorus content from the sludge, containing approximately 7 - 12% P<sub>2</sub>O<sub>5</sub> and around 20-25% carbon. During the process, phosphorus is separated from other elements, making it available for plants.</li> <li>✓ BioChar used as fertilizer on agricultural land has proven to have a value similar to traditional NPK fertilizers. Approximately 5,000 tons of sludge can be converted into around 675 tons of BioChar.</li> <li>✓ This contributes to a societal reduction in NPK consumption and promotes the reuse of phosphorus resources.</li> <li>✓ BioChar has a water-holding capacity of up to 20% of its own volume, making it ideal for poor/sandy soils. Additionally, BioChar improves pH value, reducing the need for lime application.</li> <li>✓ There is significant interest in BioChar for afforestation, planting larger trees, among vine growers, and in landscaping.</li> <li>✓ By incorporating BioChar into concrete and asphalt products, its CO<sub>2</sub> sequestration capability can help reduce their carbon footprint.</li> <li>✓ Trials are being conducted to explore the use of BioChar in water purification for micro-pollutants and odor reduction in wastewater treatment plants.</li> <li>✓ The addition of BioChar to biogas plants can stabilize and increase productivity by up to 10%.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Utility companies and biogas companies can economically benefit from investing in a PyroDry system.</li> <li>✓ Based on specific mass balances, current operating costs, energy consumption, taxes, and potential contributions, management can expect a payback period for the investment ranging from 5 to 7 years. This calculation includes anticipated savings and direct revenue generated by the investment.</li> <li>✓ The produced BioChar can be sold at increasing prices as the market demand grows, currently ranging from 800 to 2,000 DKK per ton.</li> <li>✓ The business case can be further enhanced through potential exemptions from future CO<sub>2</sub> taxes and the potential sale of CO<sub>2</sub> certificates. On exchanges, certificates trade for 500-3,000 DKK per ton of CO<sub>2</sub>.</li> <li>✓ Aquagain and PyroDry organizations provide non-binding assistance in developing a business case based on received sludge and financial information. We're also available to help with system design tailored to the conditions of wastewater treatment or biogas plants.</li> </ul>