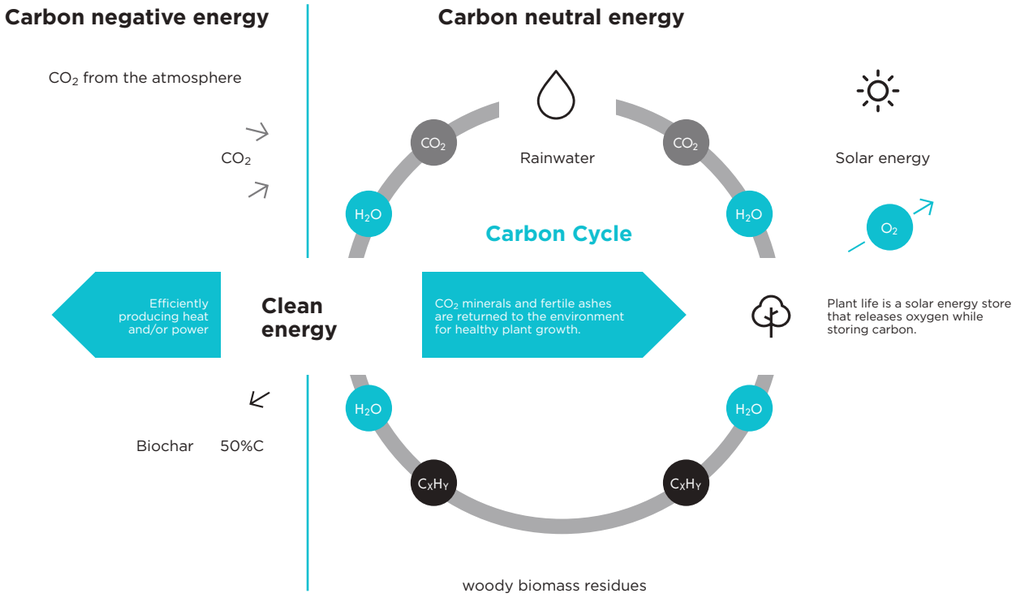
POLYTECHNIK
Biomass Energy

GREENCARBON

HIGH-TECH PYROLYSIS PLANT

Sustainable technology for
greenhouse gas reduction

CARBON NEGATIVE VS CARBON NEUTRAL



The movement of carbon in its various forms between the biosphere, atmosphere, oceans and the earth's crust is called the carbon cycle. The earth's natural balance also includes carbon storage in plants and soil, but human activity has disturbed this balance.

CARBON NEUTRAL ENERGY FROM BIOMASS As plants grow, carbon dioxide is removed from the atmosphere through photosynthesis. This carbon dioxide is converted and stored in the biomass of the plant. The carbon is released when the plant dies, decays or burns. In Polytechnik's highly efficient energy plants, we use forest and wood residues from sustainable sources and collect the released carbon as a renewable, clean and carbon neutral form of energy.

CARBON NEGATIVE ENERGY BALANCE Polytechnik's Green Carbon Technology can transfer approximately 50% of the plant's carbon into an inactive carbon pool, which means it is not released. This is done by processing it through pyrolysis under low-oxygen conditions. The remaining 50% of the carbon can be used for heat or electricity production – enabling you to produce biochar with up to 97% carbon and carbon negative energy at the same time (provided sustainable sources are used).

WHAT IS BIOCHAR?

All three forms of carbonaceous material are produced by pyrolysis — heating animal or plant matter in kilns or specially designed carbonisation plants under limited oxygen conditions. These materials are also referred to as PCM (pyrogenic carbonaceous matter).

Charcoal has been one of the basic materials of civilisation for thousands of years. It is produced by pyrolysis and used for cooking, heating and as a metallurgical fuel in smelting and refining processes for iron ore, steel, pure silicon and ferrosilicon.

Biochar is produced under limited oxygen conditions to maintain its unique agronomic and environmental properties.

It has been found that thousands of years ago, pre-Columbian Amazonians used biochar to increase soil fertility. The result was terra preta – an extremely fertile soil additive that binds minerals and nutrients and keeps them in the soil for thousands of years.

Activated carbon, also known as activated charcoal, is charcoal that has been chemically or physically treated to develop a interconnected series of pores inside it. This greater surface area makes it highly porous, meaning it can be used for various absorption applications.

PCM

The umbrella term for material produced by thermochemical conversion that contains organic carbon.

Charcoal	Biochar	Activated carbon
Produced by thermochemical conversion from biomass (mainly but not exclusively wood) for energy generation.	A solid material from thermochemical conversion of biomass in an oxygen-limited environment.	A PCM that has undergone activation, e.g. by using steam or adding chemicals.
		

Carbon from agricultural residues is highly porous and can have a surface area of up to 400m2/g, depending on the raw material.

BIOCHAR ADVANTAGES

Biochar has many applications and offers affordable and environmentally sustainable solutions across several industries. It traps carbon dioxide and prevents it from re-entering the atmosphere for thousands of years.

Biochar provides high-quality thermal, noise and building insulation, regulates moisture and absorbs odours and toxins. Biochar also improves the drying and curing process of concrete mixtures, increasing its strength.

Biochar is an effective soil substrate. It improves soil fertility by reducing the strength and density of the soil. This makes it easier for roots to grow and penetrate the soil and creates a habitat for microorganisms and fungi, which improves plant health.

Its excellent adsorption capacity means it can be used to adsorb pollutants and decontaminate groundwater, soil, drinking water and wastewater. It can also act as a barrier for preventing pesticides and herbicides from getting into surface water.

As a feed additive, biochar improves digestion and hygiene and strengthens the immune system; feed and energy efficiency boosts growth rates. It also reduces chronic botulism and methane production.

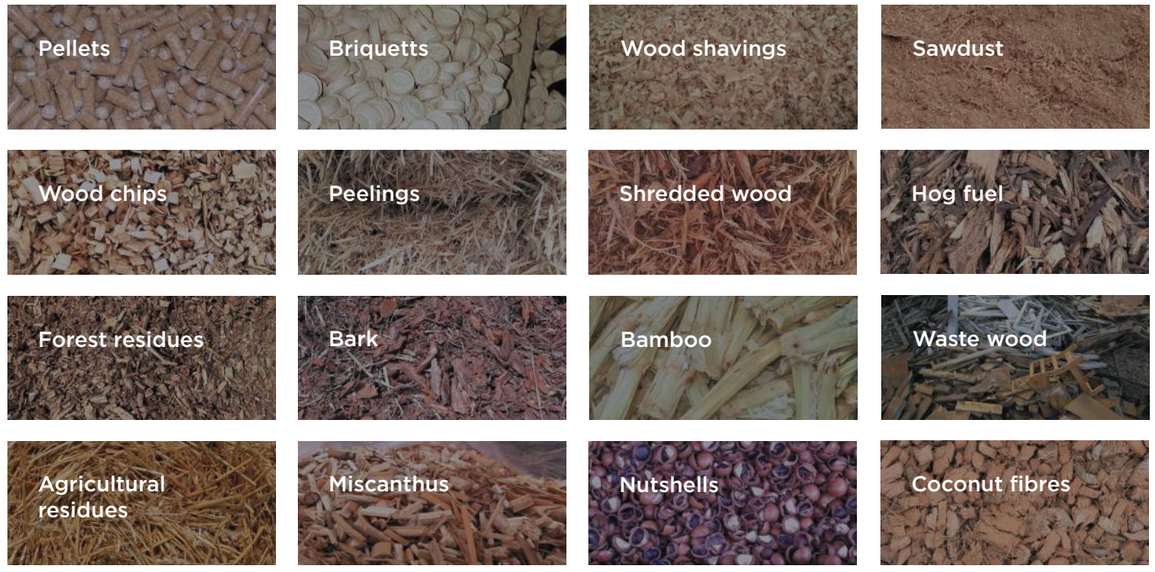
It can be used as an adsorbent for emission control systems, for carbon enrichment in metallurgy and in the production of carbides (e.g. tungsten, silicon, etc.), and as a carbon source for tyres, rubber and plastics.

Biochar reduces the need for fertilisers and the leaching of nutrients and nitrates into groundwater. It improves plant growth, soil microbial biomass and water absorption and storage properties while reducing methane emissions.

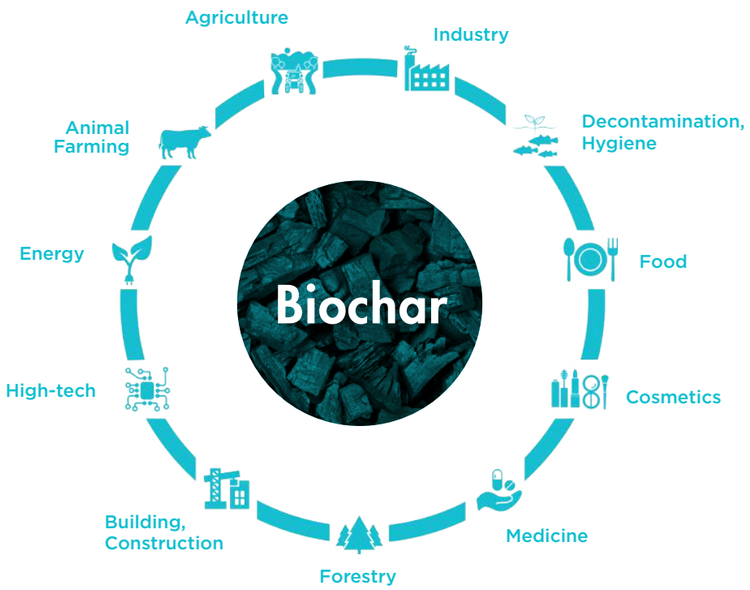
Biochar is a main source for producing pure carbon (e.g. for carbon fibre). It can also be used for electromagnetic shielding, in 3D printing and as a source for activated carbon production.

Biochar in the form of charcoal is a high-quality energy source. It can also be used as a solution for energy storage (long-term carbon sink) or in semi-conductors, batteries and fuel cells.

Most common feedstock



MARKETS FOR BIOCHAR



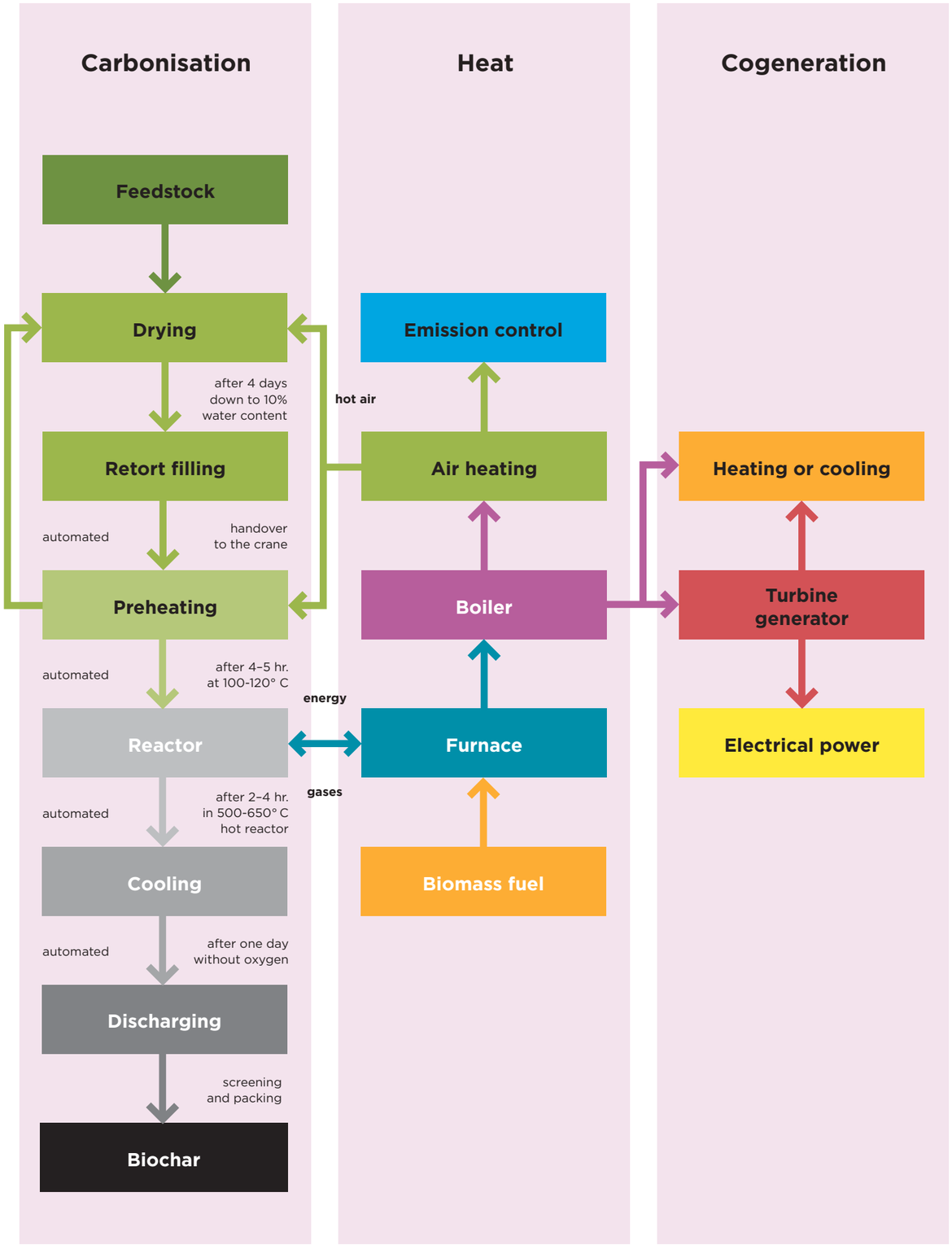
HIGH-TECH PYROLYSIS PLANT

Polytechnik's pyrolysis plants offer great flexibility — different types of feedstock can be used to produce large amounts of high-quality charcoal products. At the same time, the plant also produces carbon-neutral heat and power (CHP).

The world's first fully automated pyrolysis plant not only produces high-quality and certified carbon products from biomass waste, but it also produces energy with emissions well below the European Union's strict limits. One possible technology that can be combined with the Green Carbon process is Polytechnik's ORC (Organic Rankine Cycle) plant.

The CHP plant includes fully automated fuel storage and handling systems that feed the combustion system of the plant with biomass. The biomass is completely incinerated and the energy released is used to heat the heat transfer medium (thermal oil), which supplies high-temperature energy to an ORC unit. The electricity produced by the ORC unit can then be fed into the local grid and the thermal oil/ hot water can be used for heating. The entire process is fully automated and can be controlled remotely by both operators and Polytechnik service experts.

GREEN CARBON PROCESS



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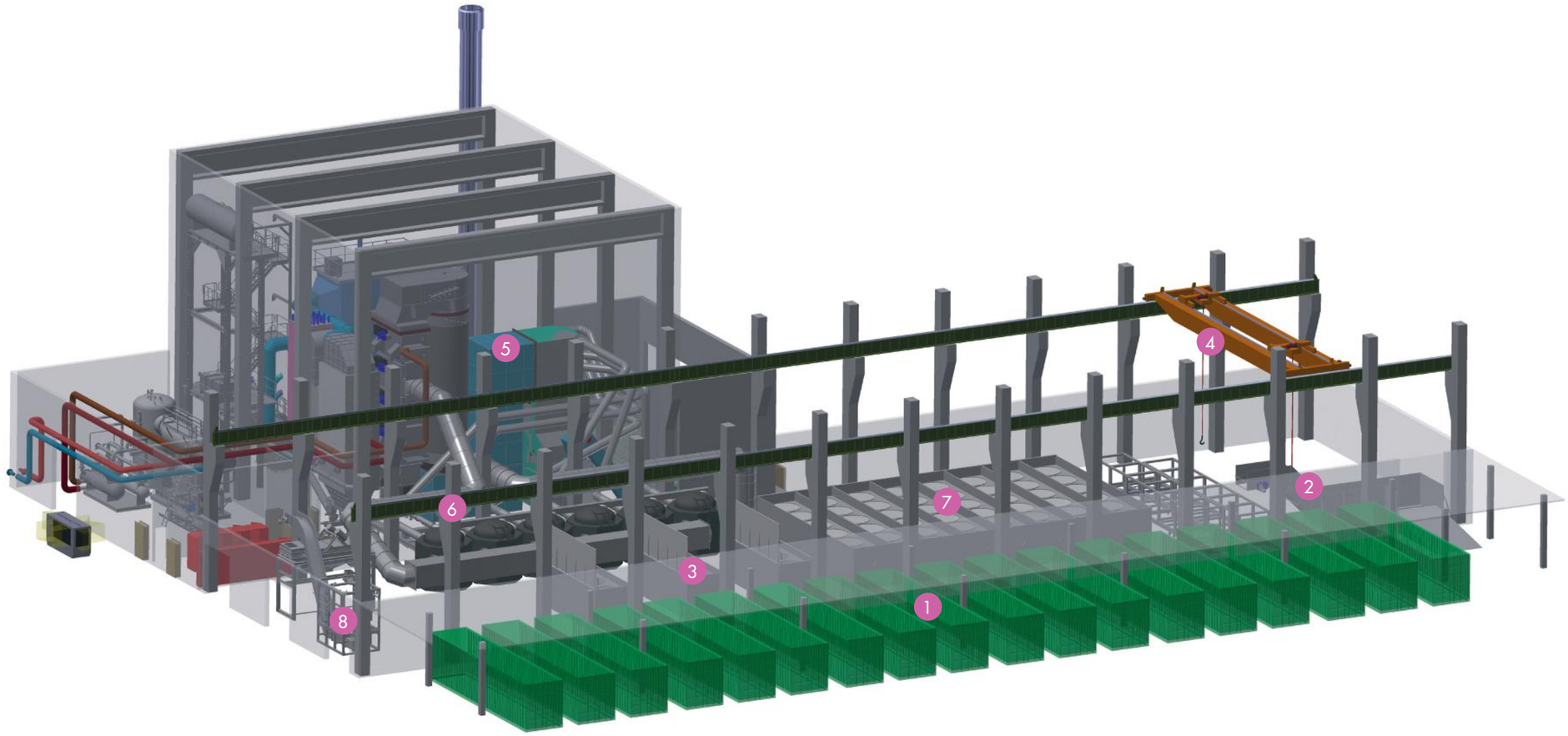

1 DRYING

The containers are filled with organic raw material and dried with hot air (waste energy from the pyrolysis process).

2 RETORT FILLING

After drying, the raw material (feedstock) is tipped into a receiving hopper and transported to the retort filling station, where an empty retort is waiting.

3 PREHEATING

The filled retorts are automatically transported to a connected preheating station to prepare the raw material for carbonisation. Here, the feedstock is heated with hot air. This reduces the time required in the pyrolysis station and increases the output of the plant.

4 AUTOMATED MATERIAL TRANSPORT

An indoor crane equipped with two separately operated lifting devices transports the retorts quickly and safely from station to station. The material movements are optimised to ensure continuous efficient operation of the energy plant and the pyrolysis station. Advanced automation ensures operational flexibility.

5 FURNACE

The pyrolysis station is supplied with energy from a custom-built combustion system with a water-cooled reciprocating grate for the combustion of the automatically fed feedstock. The combustion of the pyrolytic gases takes place in a specially designed combustion chamber via gas burners. Advanced controls, primary and secondary air systems and an adiabatic combustion chamber ensure complete oxidation of both biomass fuel and pyrolytic gases – resulting in high efficiency and low emissions.

6 REACTOR

After preheating, the retorts are closed with airtight covers. Once a reactor has completed carbonisation, the reactor is opened and the crane removes the retort. The pyrolytic gases are directed to the burners of the combustion system, providing clean energy for the pyrolysis process.

7 COOLING

After pyrolysis, the hot retorts are stored in a cooling station and brought to ambient temperature with cool air. To prevent further oxidation of the charcoal produced, the openings of the retorts are sealed with sand.

8 DISCHARGING

The cold retorts are transported to a connected unloading station at the end of the process.
A conveyor brings the charcoal to a screening or crushing station, allowing the customer to produce different product sizes. It is then transferred to the packaging station (e.g. bulk bags).

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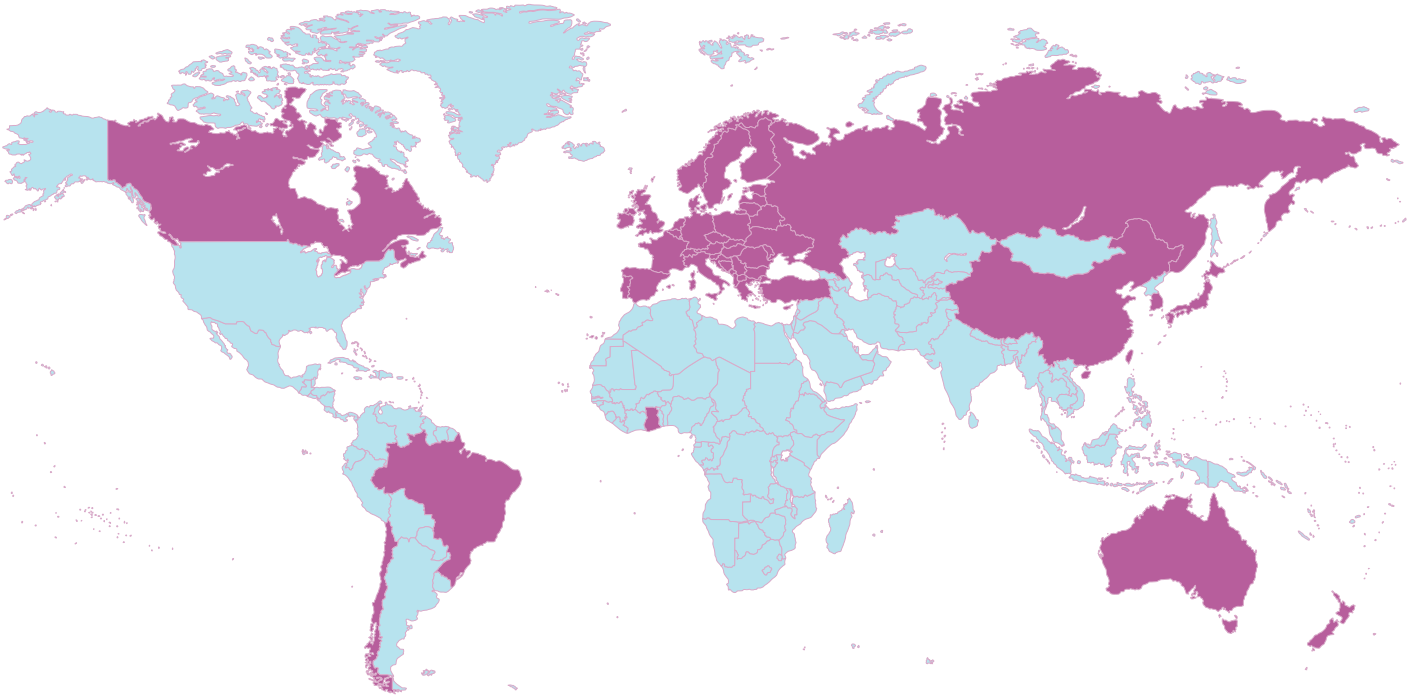

GREENCARBON

HIGH-TECH PYROLYSIS PLANT

- Products for carbon capture and storage
- High-quality biochar from renewable ressources
- Up to 97% carbon content
- Energy-efficient, closed-loop process
- Possible combinations with cogeneration technologies
- Automated batch process

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