



# **PYROLYSIS AND BIOCHAR PRODUCTION PROJECT**

## **A brief introduction**

SusTeco is an industry leading provider of biomass and biochar technology. Our systems utilise proprietary technology developed in Germany and Austria by our engineers, scientists and technicians. We provide turn-key solutions to our clients covering site survey's, design, civil & mechanical engineering, equipment, construction, installation, commissioning, operational training services and maintenance. As a company we pride ourselves on the professionalism and integrity of our engineers, project managers and their ability to constantly innovate and develop groundbreaking solutions and technologies that ultimately combat climate change.

## **What is biomass?**

In simple terms biomass is renewable organic material that comes from plants and animals. It has numerous applications and is an important source for energy and fuel in many countries.

Biomass sources for energy include:

- > Wood and wood processing waste – firewood, wood pellets, and wood chips, lumber and furniture mill sawdust and waste.
- > Agricultural crops and waste materials – corn, soybeans, sugar cane, switchgrass, woody plants, algae, and crop and food processing residues, mostly to produce biofuels.
- > Biogenic materials in paper products; cotton and wool products, and food waste.

## **What is Biochar?**

Biochar is black carbon produced from biomass sources including wood chips, plant residues, manure and or other agricultural waste products with the express purpose of transforming the biomass carbon into a more stable and usable form. Biochar supports the build-up of humus in soil and prevents the leaching of nutrients like phosphorus and nitrates. It improves the Edaphon which plays a crucial role in soil fertility, nutrient cycling, and the decomposition of organic matter and in addition, also reduces nitrous oxide emissions on agricultural land and minimizes the need for irrigation. As an additive in the earth industry, biochar can replace peat and thus contribute to the preservation of peatlands, whose degradation in peat extraction causes methane emissions, a greenhouse gas that is 28 times more harmful to the climate than CO<sub>2</sub>.

## **The Value of the Global Biochar Market**

The global market for biochar is expanding year on year with revenues in 2024 exceeding US\$678million, the CAGR for the sector is forecast to grow at 13.9% from 2024 to 2030 with global revenues surpassing US\$ 1.35 billion by 2030.

## **Key Biochar Market Sectors**

1. Agriculture – Soil enhancement – increases the harvesting yield, soil fertility and water retention while decreasing the cost of irrigation.
2. Livestock feed supplement to increase animal health which leads to higher meat and milk production.
3. Carbon Credits and Environmental Projects – Carbon sequestration initiatives.

4. Renewable Energy – Use in biomass gasification and as a secondary fuel source.
5. Construction – Green building materials, such as biochar-enhanced concrete.
6. Wastewater Treatment – Filtration medium for removing contaminants.
7. Horticulture and Landscaping – Potting mixes, turf, and greenhouses.
8. Forestry and Land Restoration – Reforestation projects and erosion control.
9. Industrial Applications – Absorbents in chemical processing or air purification systems.
10. Consumer Goods – Ingredient in cosmetics, water filters, or pet products.

### **The Livestock and Pet Industry:**

Adding biochar to animal feed, livestock bedding and pet food, neutralizes harmful toxins. It provides a natural solution which enhances the health of livestock and pets while also contributing to sustainable animal care. When biochar is added to ruminant feed it significantly reduces the methane emission of the animals.

#### **Key Benefits:**

- >> Substantial methane reduction
- >> Enhanced metabolism
- >> Reduced veterinary costs
- >> Increased dairy and meat production
- >> Enhanced manure quality

### **Carbon Sequestration**

Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide CO<sub>2</sub>. It is one method of reducing the amount of carbon dioxide in the atmosphere with the goal of reducing global climate change.

Carbon sequestration through biochar involves pyrolysis of organic material in low-oxygen conditions from biomass, the resulting char can be mixed with soil and other materials such as concrete which in turn sequesters carbon for thousands of years.

### **Renewable Energy Production**

Direct biomass carbonisation generates substantial amounts of heat which can be captured on site and then utilised to directly power steam turbines and in turn generators which subsequently produce electricity or high-pressure steam that can be used to provide either electricity or heat to homes, business and industrial facilities.

### **The Concrete Sector**

Adding Biochar to concrete has numerous benefits including outstanding carbon sequestration properties along with a beneficial influence on the mechanical characteristics of concrete due to its nucleation and densification effects which ultimately leads to an

increase in concrete strength and durability while also substantially reducing costs. Biochar is an efficient binder, it improves both flexural strength and fire resistance of certain concrete mixes while also substantially improving the rheology of concrete. When applied in the construction of buildings it provides chemical stability, water retention capacity and increases the crack resistance of the concrete.

### **By Products of Biochar.**

Different material inputs and process parameters in the production of biochar allow a number of byproducts to be manufactured, including syngas and wood vinegar.

### **Synthesis Gas (Syngas)**

Also known as Syngas, Synthesis Gas is a combustible gas mixture of hydrogen and carbon monoxide that is used as a fuel and to produce chemicals. It is produced by heating carbon-rich biomass in an oxygen-depleted environment. Syngas is also known as water gas and has been used as a substitute for gasoline when supplies were limited. The Syngas produced on a SusTeco Biochar plant is primarily used to power the facility.

Other applications for Syngas include:

>> Fuel production: Syngas can be used to produce liquid fuels like methanol, diesel, and dimethyl ether.

>> Chemical production: Syngas can be used to produce chemicals like ammonia, hydrocarbons, and methanol.

>> Fertilizer production: Syngas can be used to produce ammonia, which is used as a fertilizer.

### **Wood Vinegar**

Pyroligneous acid, also known as wood vinegar, is a unique product that can be obtained in the process of pyrolysis of biomass when recovering the condensate from produced vapours. Its main components are acetic acid and methanol. Wood vinegar is a product widely used for pest repellent, for flowering plants, and soil improvement. As a bio-sourced material, it meets a rapidly increasing demand in the market worldwide. Simultaneous production of biochar and heat can be an additional benefit.

Wood vinegar is a high value by-product of biochar and is stable in nature, it does not pollute the environment and has no toxic effect on humans and animals. Applications of using wood vinegar include:

>> Acts as a natural fungicide and is effective in controlling plant disease.

>> Improves soil quality.

>> Eliminates pests.

>> Increases plant growth accelerating the development of roots, stems, tubers, leaves, flowers and fruit and increases fruit production in orchards

### **Biochar And Heat Energy**

#### **Pyrolysis**

Pyrolysis allows the conversion of clean wood biomass into biochar as a functional material (soil nutrient, bioremediation product, filtration material and many other). The ability to change the operating parameters within a SusTeco Biochar plant enables the operator to produce their own product. The energy produced from the process can be utilised for drying or the production steam for industrial and power generation purposes.

### **Renewable synthetic gases**

Syngas obtained in the processes of biomass pyrolysis is a mix of interesting molecules, containing not only CO, CO<sub>2</sub>, and nitrogen, but also significant quantities of H<sub>2</sub>. Additionally, the quantity of this molecules can be boosted by syngas post-treatment, making the process a useful source of bio molecules.

### **Sludge carbonisation**

Low or medium temperature pyrolysis applied to dry sewage sludge allows operators to obtain sterilized, odourless and easy to store end product which can then be supplied to ends user to provide another renewable source of energy. Due to the adaptability of SusTeco Biochar processing conditions, you can choose the degree of treatment in order ensure the material retains its fuel properties.

### **Sludge to heat**

High-temperature pyrolysis is a process involving a plant operating at temperatures of up to 700°C which ensures the maximum decomposition of the sludge which in turn generates the maximum possible calorific syngas, this can then be utilised as a source of energy for drying.

### **SusTeco Biochar Plants.**

SusTeco provides 'turnkey' Biochar production plants to its clients through our Engineering Services Division.

Our Engineering Division provides design, construction, commissioning and staff training services on our biomass plants.

We have an experienced engineering team made up of civil engineers, specialist chemical engineers, thermal and mechanical process engineers, along with surveyors, project managers, CAD, electrical, control and automation technicians.

The division's work begins when a client commissions the company to undertake a survey of the clients site, this subsequently leads to the production of the preliminary planning and cost documentation for the proposed Biochar production facility, this is done in co-operation with our R&D department which then enables us to produce detailed schematics of the site along with specifications of the plant equipment a detailed breakdown P&L for the construction, installation and start-up operation of the facility. Having our own plant engineering division enables us to efficiently deliver our biomass plants to our clients in a cost effective and timely manner.

### **Our Unique Modular Approach.**

SusTeco Biochar Plants are unique, all our facilities are custom designed to meet our customer's specific requirements. Each facility contains compact modular technology that can be easily integrated into an existing infrastructure and/or installed on a greenfield site.

Our modular system enables a plant to be designed so it can be upscaled with additional pyrolysis lines to produce more biomass and/or process different types of biomasses.



The Key USP in utilising our Modular Plant setup includes rapid setup and commissioning, clear assignment of modules as functional units; easily integrated with peripheral equipment such as shredders, dryers, conveyor systems, bagging stations and heat exchangers.

Below is the layout of a typical PYBC facility developed by SusTeco

