



COMBINED HEAT AND BIOCHAR



PRODUCTION OF HEAT AND BIOCHAR

Biochar produced from combined heat and biochar technologies is processed under known production parameters. Temperature, residence time, and oxygen affect the final biochar product and its uses. The biochar produced in an assessment of six different units ranged from 24 – 400 dry pounds per hour. Monthly, that equates to 86 – 1500 cubic yards of biochar requiring an input of 450 – 5400 cubic yards of woodchips each month.

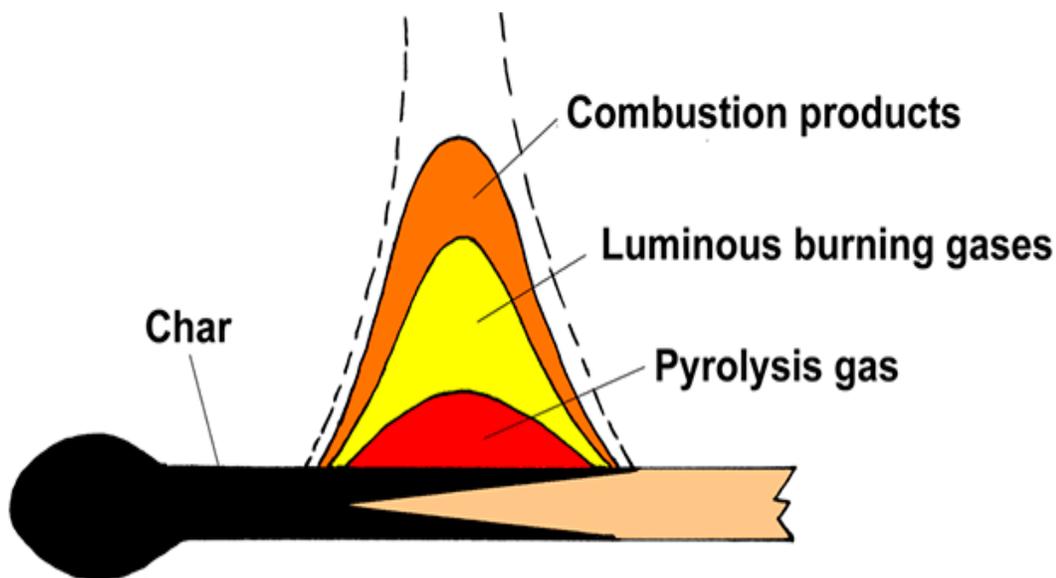
The heat produced by CHAB technology is substantial. The smaller units produce about 1 million British thermal units (MMBtu) each hour while the larger units can generate up to 8.5 MMBtu/hr. This heat production is significant considering the average home requires just 90MMBtu of heat annually.

WHAT IS CHAB?

Combined heat and biochar (CHAB) technologies are systems that optimize the combustion of wood residues. The process of combusting bio-mass for biochar produces not only a high carbon solid product but also thermal energy that can be used for heating and cooling.

CHAB technologies fall into one of three main categories: furnace systems, gasifiers, and retort systems.

All three types of technology can be configured in a number of ways depending on the manufacturer and the project specifications.



WHERE IS CHAB MOST APPROPRIATE?

Current markets for biochar are limited, but growing, especially in the Midwest. Given current markets for biochar, a combined heat and biochar production unit is most logically incorporated into operations that could benefit from both the heat and biochar. Some operations that are most suitable for biochar are:

- Greenhouses
- Compost operations
- Lumber drying kilns
- Other operations that require process heat or product drying

UNIT CONSIDERATIONS

In addition to the CHAB unit itself, other equipment and infrastructure will be needed to handle the material and process the feedstock. Due to the seasonal nature of woodchip supply, you will need to consider how the woodchips can be stored and stockpiled for later use. Additionally, infrastructure for drying, resizing, and conveying the feedstock to the CHAB equipment will need purchased. This infrastructure will make up a large portion of the costs and site footprint for the overall CHAB system.

Most CHAB systems operate best with woodchips. However, many systems are capable of handling other feedstock including manures, wood pellets, sawdust, municipal solid waste, and agricultural residues.



Chip auger.

EMISSIONS & REGULATIONS

Non-industrial wood energy systems, when fueled by clean wood chips, rarely require pollution controls beyond appropriate technologies to remove particulate matter from the gasses. In Nebraska, the Department of Environmental Quality regulates air quality and monitors emissions by issuing air quality operating permits.



Clean chips.

PRICING

Pricing for combined heat and biochar systems varies widely. Smaller units on the lower end of the price spectrum start around \$150,000. Large systems that are designed with a specific and large purpose can cost up to \$2 million. However, most systems are about \$500,000 and under.



Woodchip pile for windrow composting.

UNDERSTANDING BIOCHAR

- **Biochar** – a form of charcoal that is produced by exposing organic material to heat in a low oxygen environment and is not used for cooking
- **Pyrolysis** – a chemical change brought about by the action of heat
- **Gasification** – conversion of an organic material into gas