BIOCHAR
turning wood to gold

The U.S. Endowment for Forestry and Communities and the National Association of State Foresters have a shared interest in advancing sustainable forestry in the U.S. This brief is intended to inform public dialogue on sustainable markets and forests.

GOOD NEWS for forest managers who need options for moving low-value trees and wood waste into multiple markets. Biochar, a charcoal byproduct of thermal gasification or fast pyrolysis, has proven agricultural benefits. Biochar markets are on the rise and could make the economics for renewable wood-to-energy much more attractive.

Biochar is touted as beneficial on multiple levels:
- Soil amender increasing crop yields
- Prevents fertilizer runoff and leeching
- Reduces need for fertilizers
- Retains soil moisture, especially helpful in arid regions
- Fosters growth of soil microbes essential for nutrient absorption, particularly mycorrhizal fungi
- Sequesters carbon
- Water filtration
- Other products include pencil lead and toner cartridge ink (black carbon)

HOW IS BIOCHAR PRODUCED?

Biochar is the result of baking biomass—either through pyrolysis or gasification—driving off volatile gases and leaving behind a solid residue richer in carbon content known as char.

Pyrolysis is heating in the absence of oxygen. The word derives from the Greek pyr for fire and lysis meaning to separate. The process does not require a lot of energy but does need careful reaction control and fast heating and cooling rates to prevent the liquids from breaking down to gases.

Gasification is a high-temperature, high energy-use process, with or without oxygen and/or water, producing synthesis or "syn" gas as well as methanol, ammonia, diesel fuel, etc.

Both pyrolysis and gasification are capable of producing biochar and carbon monoxide and hydrogen, but according to John Gelwick of Genesis Industries, producer of pyrolsis systems in Redondo Beach, CA, "gasification produces a much higher quality product."

Feedstock also affects chemical and physical properties. For example, biochar made from manure will have a higher nutrient content than biochar made from wood chips, but woody biochar is more stable and persists longer.

EMERGING MARKETS

A nascent market for biochar has led numerous companies to attempt commercial production. For Phoenix Energy based in Merced California, biochar is quickly becoming their primary product with electricity moving to second place. Phoenix uses gasification to create synthesis gas to help California Pacific Gas and Electric meet renewable energy standards using wood chips and wood waste, including pallets and grapevines as the fuel source.

Greg Stangl of Phoenix Energy says, "We are no longer in the energy business but the biochar business."

Stangl and John Gelwick of Genesis agree that while still in its infancy, the biochar market is rapidly growing. They both claim no one knows for sure the depth of the market or real price for the final product.

The profitability of a biochar product depends on fuel prices for hauling and processing biomass and the ability of a plant to produce its own energy versus buying electricity as well as the emergence of potential taxes that could be imposed on society for carbon release.

Phoenix Energy's repeat buyers, mostly soil scientists making their own soil amendment blends and selling into the agricultural markets, claim 15 cents a pound is the maximum they can pay. Yet, Phoenix has been selling loads recently at 50 cents per pound.

Most biochar producers have their sights set beyond soil to the activated carbon market, i.e. water filtration. Coconut shell-based activated carbon is the primary source due to porosity. It is bought in large quantities from places like Indonesia for prices as high as $2 per pound by municipally owned water treatment facilities.

Stangl says, "Woody biomass can replace coconut. It may require more volume to do the same job as a coconut, but it's American-sourced and we have lots of it."

If Phoenix ran their facility at full steam, they would consume three quarters-of-a-ton of wood chips per hour resulting in 550 to 580 kilowatts of electricity and 274 pounds of biochar per hour.

Genesis, using a newly patented process, based on old pyrolysis methods developed by the Germans, is just starting up in Northern California utilizing "green waste." Owner John Gelwicks feels the sky is the limit with their technology. He has plans to produce wood vinegar, popular in Asia for detoxification, and bacteria inoculated biochar that could help with forest pest control.

BIOCHAR RESOURCES

See a lengthy list of companies exploring biochar at the Biochar Discussion Website.

See a comprehensive list of university, government and private foundation research into biochar at www.biochar.info

Follow the Woody Biomass Joint Venture

The Woody Biomass Joint Venture, a partnership between the U.S. Endowment for Forestry and Communities and USDA Forest Service, encourages advancement of near-term technologies and new procurement model development to promote sustainable uses of woody biomass. We seek out organizations with proven promise, stimulate new sets of networks and disseminate rapid learning.

Learn more about the Woody Biomass Joint Venture at http://www.usendowment.org/theendowmentonwoodybi.html

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