



Community Power Corp. technicians Mike Walker, left, Jim Diebold and MAFES agricultural engineer Alex Thomasson during installation of the Biomax gasifier.

Bob Ratliff

4 Researchers

'gasify' agricultural waste

By Bonnie Coblenz

MAFES and other scientists at Mississippi State are converting grasses and agricultural waste into energy, hoping to lower ethanol's cost enough to compete with gasoline as a fuel.

The MSU researchers, along with colleagues at Oklahoma State University, are pursuing the conversion of biomass from switchgrass or agricultural byproducts into energy. This energy is in the form of either biofuels, such as ethanol, or electricity.

Mississippi has an estimated 4.75 million acres in crop and hay production. Jerry Gilbert, head of MSU's Agricultural and Biological Engineering Department, said the state has the potential to produce almost 13 million tons of biomass. This would come from dedicated acreage and salvaged agricultural residues, cotton gin and forest byproducts, and chicken litter.

"If the infrastructure were in place, Mississippi theoretically could convert its future waste and cultured biomass into 948 million gallons of biofuel or 7.58 billion kilowatt hours of electricity. That's enough to power 702,000 average homes for a year," Gilbert said.

MSU and OSU are looking at the gases produced in a gasifier by different plant-based materials and how efficiently these gases can be converted into energy. Gilbert said any

cellulose-based material can be put into a gasifier and used to produce a synthesis gas, or syngas.

"Syngas is produced by burning plant material at a very high temperature to produce a mixture of gases such as carbon monoxide, carbon dioxide, hydrogen and methane," Gilbert said.

These gases can be directed into a generator to produce electricity or sent into a bioreactor to produce ethanol or some other desirable biofuel. A bioreactor is a vessel in which bacteria are grown in solution. Syngas is bubbled through the bioreactor where bacteria convert the gas through fermentation into compounds that are useful to industrial processes.

MAFES agricultural engineer Alex Thomasson and MSU chemical engineer Mark Bricka are using a Biomax gasifier—the only such unit in Mississippi and one of only six in the world—to determine how to efficiently convert various biomass materials into gases and, subsequently, into energy-related and value-added chemicals such as ethanol and acetate. The machine, which arrived on campus in mid-August, is built by Community Power Corp. of Littleton, Colo.

"The gasifier has been designed for wood chips, and requires materials to be uniformly dense. Since several differ-

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JERRY GILBERT

ent substances are going to be tested in the gasifier, a way had to be developed to use different materials in it,” Gilbert said.

MAFES agricultural engineer Eugene Columbus found a used John Deere cuber that will form cut grasses into 1 1/4-inch cubes that can be fed directly into the gasifier.

“This will reduce transportation costs and possibly storage costs by doing the processing in the field,” Gilbert said.

OSU researchers designed their own gasifier, which uses a fluidized sand bed to incinerate biomass materials placed inside. With both land-grant universities working on this project, researchers will be able to test both different and similar biomass materials and the results of two different gasifiers.

Gilbert said producing ethanol from plant material using a gasifier and bioreactor is currently not as economical as producing it the traditional way through corn fermentation, which produces a known amount of ethanol. Ethanol has a higher production cost than do petroleum-based fuels. However, the research has the potential to dramatically reduce the cost.

“There’s always a desire to find a better organism to produce ethanol,” Gilbert said. “The goal of finding microorganisms for bioreactors is to identify and isolate these organisms that are better suited to ethanol production. Increased ethanol production by newly identified organisms will mean lower production costs for ethanol.”

While researchers are trying to find microorganisms that produce greater amounts of ethanol, they are also looking at using different biomass materials to produce syngases of varying compositions. Microorganisms will respond differently to different syngas, and researchers want to learn what results will occur.

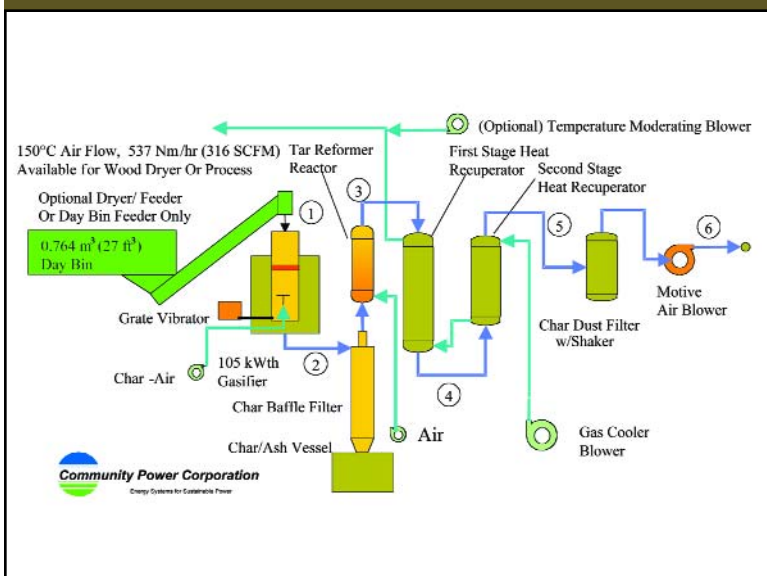
At MSU, MAFES is coordinating this research along with the Swalm School of Chemical Engineering. The effort also involves MSU’s Extension Service, College of Arts and Sciences and the Diagnostic Instrumentation and Analysis Laboratory.

In a related MAFES-funded study, scientists in the Forest and Wildlife Research Center are looking to the forests as a future source for chemicals. They are studying a process that turns sawdust-sized wood particles into “BioOil” for use in specialty chemicals, wood preservatives and polymers.



Marco Nicovich

Graduate student Lin Wei feeds wood chips into the gasifier.



The gasification process.



Marco Nicovich

Wood chips used in the gasification process.