Fueling the Farm

Using waste for energy and independence.

*by **Ann Perry,** Agricultural Research Service information staff*

Imagine turning a noxious agricultural waste into a value-added bioenergy product for on-farm heating and power — or even into transportation fuels.

Agricultural engineer Keri Cantrell, environmental engineer Kyoung Ro and research leader Patrick Hunt work at the Agricultural Research Service (ARS) Coastal Plains Soil, Water and Plant Research Center in Florence, S.C. They have teamed up to explore how thermochemical conversion technologies could be used to generate bioenergy from manure — a resource that the United States, with its intensive livestock production, has in abundance.

"Our goal is to develop new waste-treatment methods and strategies that small farms and concentrated animal-production facilities could use to meet their energy needs," Cantrell says.

One approach — wet gasification — converts wet manure slurry into energy-rich gases and relatively clean water. The catalytic version of this technology is under development at the U.S. Department of Energy (DOE) Pacific Northwest National Laboratory. This process is expected to destroy pathogens and has been found to destroy odor-generating volatile organic compounds at the processing conditions of 350° C.

At this high temperature, wet gasification can destroy pharmaceutically active components like hormones. This process could theoretically convert the manure in as little as 15 minutes, far exceeding the days and months required by existing anaerobic and composting methods.

The Florence researchers developed a cost-benefit model of wet gasification to calculate estimated returns and concluded that liquid swine waste can have a net energy potential comparable to that of brown coal.

In addition, the ARS team is investigating pyrolysis technology, which uses heat and an atmosphere devoid of oxygen to convert the manure into a char, or "green coal."

"Green coal can serve as an energy source for on-farm use, or it can be transported to coal power plants for feedstock," Ro says. "It can also be transformed into activated charcoal. This charcoal can be applied to soil to improve soil quality, and it also reduces greenhouse gases by permanently sequestering carbon."

The group is also working in collaboration with the Advanced Fuels Group at the DOE Brookhaven National Laboratory in New York. They are evaluating different catalysts needed to facilitate conversion of "syngas" — the gas produced when animal wastes and other biomass are gasified — to liquid fuels.

"Computers used to take up the basement of the math building," Hunt says. "We'd like to be able to shrink down a process to run the farm engine in the same way." With this kind of system, farmers would be able to produce their own energy sources and eliminate the need to transport manure offsite. The trick is to make the system productive and affordable.

The Florence researchers know that the benefits of any biofuel must be weighed against its economic and environmental production costs. "The truly exciting reality is that numerous needs in energy, nutrient recycling, climate change and biosecurity will foster synergistic development of technology for future agriculture," Hunt says. "Our research is only one part of the answer as we look for new energy supplies."

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Editor's Note: *This research is part of Manure and Byproduct Utilization, an ARS national program (#206) described at* www.nps.ars.usda.gov. *Keri Cantrell, Patrick Hunt and Kyoung Ro are with the USDA-ARS Coastal Plains Soil, Water and Plant Research Center, 2611 W. Lucas St., Florence, SC 29501-1242; phone 843-669-5203, ext. 113 [Cantrell], ext. 101 [Hunt], ext. 107 [Ro], fax 843-669-6970. "Fueling the Farm" was published in the October 2008 issue of* Agricultural Research *magazine.*
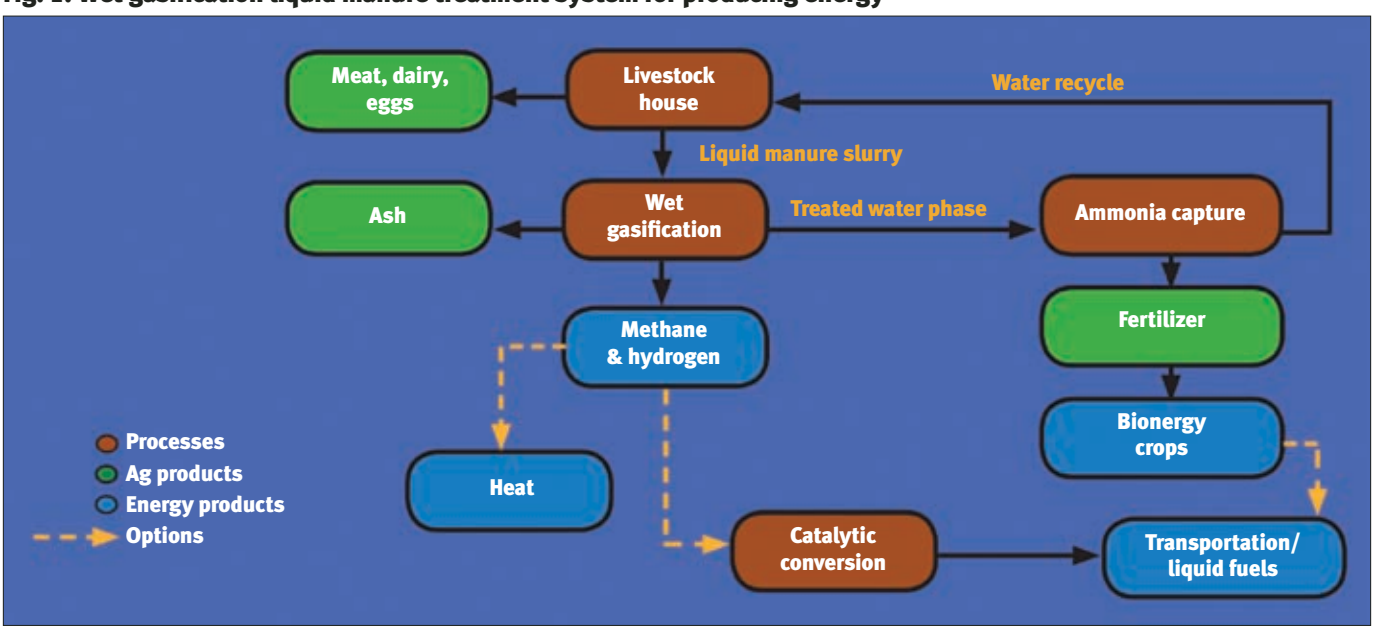
Fig. 1: Wet gasification liquid manure treatment system for producing energy