Microwave Transforms Trash Into Fuel

Microwaves can be used for a lot more than popping corn or warming soup. Global Resource Corp. (GRC) is using microwave emitters to make fuel out of everything from tires and oil shale to biomass and plastics. GRC estimates their prototype one-ton system will process 10 tons of tires, plastics or vinyl per hour into 17 million btu's of energy, with an 18:1 return on energy used in the process. And since it all takes place in a vacuum, nothing is released into the environment.

"It doesn' t take more energy to process oil shale, tires or coal, but the output varies," explains Jeff Kimberly, GRC. "The energy ratio depends on the size of the system. A bigger unit will require more and bigger pumps and more energy, but the output will be greater because it can handle more material."

GRC plans to build 5, 10 and 15-ton systems once the prototype has proven itself. Regardless of size, the heart of the unit is the microwave emitters. When company founder Frank Pringle first experimented with bits of tire and microwaves, they turned into ash. However, when the gasses inside the microwave condensed, they created a black puddle of oil.

According to Pringle, the microwaves crack the molecular chains of hydrocarbon molecules. The molecules are broken into carbon black and hydrocarbon gases, which can be burned or condensed into liquid fuels.

Ten years and a million dollars later, GRC's one-ton unit is turning a wide variety of carbon-based materials into oil. As material is augered into and through a vacuum chamber, it's bombarded with microwaves. Gasses and water vapor are pulled out the top, and carbon black is augered out the end for further processing.

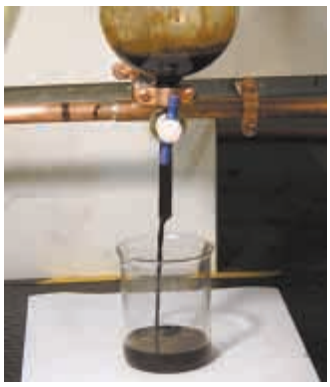
The key is to find the specific frequency for the material being processed. Frequencies for high return materials like plastics, tires, oil sand, oil shale and even coal have already been identified. According to GRC, a 20-lb. tire can produce 1.2 gal. of no. 4 oil, 50 cubic ft. (3,000 btu) of natural gas, 2 lbs. of steel and 7 1/2 lbs. of carbon black.

"We've started testing corn stalks, grass clippings, and other crop material," he says. "We're also looking at biofuel potential in sludge. There's not much we don't look at."

Contact: FARM SHOW Followup, Global Resource Corporation, Bloomfield Business Park, 408 Bloomfield Dr., Unit 3, West Berlin, N.J. 08091 (ph 856 767-5661; inquire@globalresourcecorp.com; www.globalresourcecorp.com).

Original GRC "fuel maker" uses microwave emitters to make fuel out of everything from tires and oil shale to biomass and plastics.

Prototype 1-ton system shown above can process 10 tons of tires, plastics or vinyl per hour into 17 million btu's of energy, with an 18:1 return on energy used in the process.



Manure Drying System Fuels Itself

Faced with high costs for bedding and hauling manure, Van Der Geest Dairy solved both problems and more. The 3,000-cow operation installed a manure drying system that eliminates hauling 4,500 loads of solids to the fields. It also replaces five to six semi loads of sawdust with dried manure. Best of all, it fuels itself with dried manure.

"About 50 percent of the material ends up as fuel," says Lee Van Der Geest. "The neat thing is it doesn't just dry cow manure, but also waste feed, pen pack material, and green sawdust. Anything organic can be run through it. And we're bedding our stalls heavier than ever, and that lowers our somatic cell count."

The system consists of the dryer from Energy Unlimited, Inc. and a manure solids separation process. About 30 percent of manure solids are separated out of manure flushed from the milking parlor and freestyle barn. The solids are sent through a rotary drum dryer where they're heated to 1,000 degrees F, killing any bacteria and pathogens and making the product safe for use as bedding as well as fuel to fire the 1,500 degree furnace.

Water from the separation process is used to process and cool the exhaust from the furnace and dryer. After solids have been removed, it is pumped to a concrete trench where the exhaust heat is incorporated with paddles that oxygenate the liquid. Ammonia is eliminated by aerobic bacteria growth aided by the heat and the oxygen. The high temperature exhaust cools to about 100 degrees. Once the water has been "air scrubbed", it's reused to flush the barn and parlor floors, and the process repeats.

Even the ashes from the furnace have a use. "We clean out about two wheelbarrow loads of ash per day and set it aside to apply to our crop fields," says Van Der Geest. "It's extremely high in potassium."

Van Der Geest notes the last time he had checked prices, potassium was selling for $650/ton. That combines with eliminating most sawdust, which has increased in price with the popularity of wood pellet furnaces. Add in savings in fuel from reduced trips to the field with manure solids, and the system is paying for itself, he says.

A big Wisconsin dairy operation solved the high costs for bedding and hauling manure by installing new EUI manure dryer.

While the Van Der Geest dairy was the first manure drying installation for Energy Unlimited, it isn't the last. The company has been building dryers for wood pellets, alfalfa and other products for 20 years. They're putting in more units at dairies and have also installed one in Georgia to dry tree shavings for use in poultry litter. The trees are thinned from loblolly and Southern pine plantations.

"Dry shavings were $100 per ton," says John Lindell, Energy Unlimited. "The thinned logs only cost them $25 per ton. With our biofeed furnace, they can replace natural gas, and payback is even faster."

Lindell admits the unit requires a minimal three-tons/hour size to be economical. He notes that Van Der Geest's unit handles four-ton/hour, and their dryer/furnace unit would be priced around $400,000.

Contact: FARM SHOW Followup, Energy Unlimited, Inc., P.O. Box 7, 4881 Highway YZ, Dodgeville, Wis. 53533 (ph 608 935-9119; fax 608 935-0008; info@ energy unlimitedinc .com; www. energy unlimited inc.com).

On-Farm Gasification Unit Turns Straw Into Electricity

Early results suggest an on-farm gasifier developed in Washington State could make excess crop residue more valuable than ever. Jack Zimmer is the project manager for Farm Power, a non profit organization overseeing the gasifier project. He says the second-generation unit should be ready for start up about mid May with hopes for a commercial unit by fall.

"We successfully operated a prototype unit for 100 hours and then engineered new components based on that test," says Zimmer. "The idea is to use finely chopped straw off the field without baling or pelletizing."

The 27-ft. tall, 12-in. dia. tube within a tube is built from stainless steel pipe. It's designed to use pyrolysis to spin straw and other biomass material into carbon gold. Temperatures of 1,800 degrees will produce hydrocarbon gases that can be used to replace up to 80 percent of the diesel fuel needed to power an electrical generator.

Straw stored in a neighboring shed is blown to the top of the tube. As it falls down the length of the tube, it's turned into gas, with the ashes removed at the bottom for spreading back on the fields.

"It will produce enough fuel to power itself and produce 350 kW of electricity to feed onto the grid," says Zimmer. "The nitrogen is gone, but the potash, phosphate and other trace minerals will be returned to the fields."

The design is based on a process for coal gasification. Cast iron components were used for bluegrass gasification at the University of Wyoming, but they wouldn't stand up to the higher temperatures needed for biomass gasification. It was also more than four times heavier than the stainless steel.

The prototype unit was designed and built with a Federal research grant and constructed on the Larry Gady farm in eastern Washington. The blue grass seed producer has high hopes for the unit's success.

"We used to burn our bluegrass straw, but have been unable to do so for the past 13 years," he says. "This gasifier could revolutionize the use of crop byproducts like that straw."

Although costs for developing the gasifer may total more than a million dollars, the basic design is simple, says Gady. "It's so simple that you look at it and wonder what it is," he says.

The real beauty of the gasifer is its on-farm design, suggests Gary Banowetz, research leader, USDA Ag Research Service, Corvallis, Oregon. He's working with the project to determine how much straw can be taken from surrounding fields without mining nutrients or encouraging erosion. He is also looking at the nutrient value of the ash and how to apply it.

Most biomass-to-energy conversion systems require the straw or other material be baled and transported to a central facility. Even in corn country, economics are doubtful. In the West, it's an even bigger issue. "In a lot of places we can only take off a ton per acre, and fields are scattered," says Banowetz.

He estimates a commercial Farm Power gasifier will likely cost around $350,000 and should pay for itself in about three years. In addition to generating electricity, the gasses produced by the unit can also be turned into a liquid fuel at the rate of 60 gal./ton of straw.

Contact: FARM SHOW Followup, Gary Banowetz, USDA ARS, 3450 SW Campus Way, Corvallis, Oregon 97331 (ph 541 738-4125; fax 541 738-4160; gary. banowetz @ars.usda.gov) or Jack Zimmer, Farm Power (ph 208 772-7294; seedguys@verizon.net).