Farm gets energy from manure

COLUMBIA, Mo — Smack dab in the middle of Missouri is this farm that converts livestock manure into usable forms of energy.

It also gets a shot of energy from its "liquid fuel plant" which is, as of now, an alcohol still.

Some unconventional energy equipment—like an electric generator and an internal combustion engine fueled by bio-gas—provides the power that makes the energy farm systems go.

Built on the University of Missouri-Columbia's South Farms just last summer, the farm with its "integrated energy systems" is an important new research tool for those who want farmers to make the most of their energy resources.

"This is a research facility, so we are always studying ways to improve the farm's efficiency," said James Fischer, USDA agricultural engineer largely responsible for design of the integrated energy system.

"The aim of our research is to help make farmers more efficient at producing food," added Albert Garcia, UMC agricultural engineer involved in some of the farm's projects.

"We try for complete use of as many energy sources as possible," Garcia said. "These improvements in energy use will help make farming more profitable."

Said Fischer, "We want to use all the energy system recaptures for food production on the farm. After all, we only get 1.4 cents per kilowatt-hour when we sell electricity back to the rural electric co-op, but it's worth 5 cents per kilowatt-hour if we use it ourselves." (Utilities, by law, buy energy at wholesale prices and sell at retail.)

Fischer is proud of the farm's "liquid fuel plant" which allows him to convert biomas to liquid fuel. So far, the unit is used only to produce enthanol (alcohol), but researchers at the farm have already begun to study the production of other fuels from corn grain as well as other forms of organic matter.

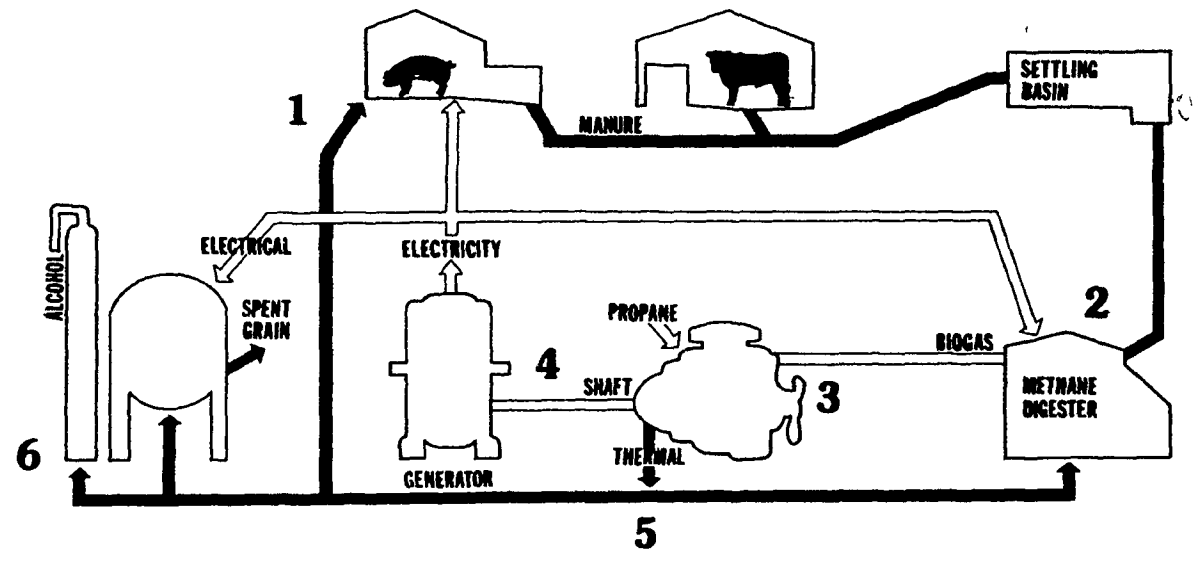
The best part of the liquid fuel plant is that it allows farmers to store thermal energy (heat) from the engine for use at a later date as a liquid fuel.

For example, the manure digester produces methane gas which is not dense enough to run vehicles but is a good stationary energy source. So the gas is used to run a cogenerator which produces electricity and heat

From the engine's heat comes hot water that can be used to heat buildings in winter. Or in summer, the hot water can be used in the still to convert biomas into other fuels (like alcohol).

"The concept allows us to use most of the energy produced from the manure digester," Fischer said.

"That means we can make good use of the manure and, as a result, more efficient use of livestock feed."



How the "Integrated Energy Systems" work: 1. Livestock eat residue from alcohol distillery and methane digester; 2. Methane digester produces biogas from manure; 3. Biogas fuels internal combustion engine; 4. Engine powers generator which produces electricity; 5. Engine's thermal energy (heat) helps run alcohol plant and heats methane digester; 6. Distillery produces fuel for vehicles.

Some intriguing studies using Energy Farm residues as feed are also being conducted by other UMC scientists.

An example is what animal scientist John Paterson is doing with the spent grain from the alcohol still, which usually presents some feed handling problems because it's mostly water.

He is combing the mash with fescue or straw to make a drier mix, then ensiling the mixture in silage bags. The idea is to come out with a complete ration for beef cattle—high in energy and protein.

Poultry scientist Joe Vandepopuliere is feeding the effluent from the manure digester to chickens because the "highly liquid residue contains protein, minerals and some carbohydrates." Vandepopuliere is analyzing the nutrient content of the effluent, determining how much chickens will eat and figuring what additional supplement they need for a complete ration.

The "reteeding" studies by Paterson and Vandepopuliere are just one of five major efforts now underway at the farm The others include.

—Microcomputer control of the distillation process.

—Evaluation of fermentation efficiency.

—Improving thermal (heat) recovery from the co-generator.

—Improving the performance of the manure handling system

Altogether, nine scientists from three UMC departments are carrying out research at the farm which has attracted a terrific variety of people—from farmers to congressmen to brewers to reporters.

"We like visitors, but we're getting so many that we can't give individual tours," Fischer said.

He suggested that persons interested in visiting the farm contact their area agricultural engineering extension specialist and arrange a group tour.

Facts on Integrated Farm Energy System

Manure Digester: Volume - 5,000 cu. ft. of liquid manure; Biogas production from digester - 10,000 cu. ft. per day.

Engine: 4 cylinder, 4 stroke, 220 cu. in. Waukesha spark ignition engine (set to run at 1,200 rpm to enhance longevity under 24-hr. operation). Output - 17.5 kilowatts of electricity, 23 kilowatts of thermal energy.

Induction generator: Rated power is 22.5 kilowatts.

Ethanol Plant: 1 steam jacketed cookpot - 500 gallons; 1 steam jacketed potstill - 500 gallons; 1 column 18 ft. packed with rachid rings; Four 500-gallon fermentors with agitators; Ethanol (alcohol) production - 1 batch per day; 30 gallons of 200 proof ethanol from 17 bu. of corn.

* The above figures represent the Energy Farm systems at full capacity.