How-to manual available

5.5 million tons of manure: that's a lot of fuel

UNIVERSITY PARK — The average 1500-pound Pennsylvania dairy cow producers about 125 pounds of manure a day. The annual "harvest" from all the state's dairy cows is estimated at 5.5 million tons.

If all this manure could be turned into a methane fuel called "bio-gas," the result could meet 20 percent of Pennsylvania farms' energy needs.

That potential never will be realized, but manure-derived energy may soon play an important role on large, and even medium-sized dairy farms–thanks to Penn State researchers.

The have developed and built an experimental "anaerobic disgester" that generates methane gas for power and heat, and leaves a rich nitrogen fertilizer that plants can absorb nutrients from more readily than they can from the original manure.

Converting the wastes from 50 cows, the device daily produces the methane energy equivalent of 20 gallons of gasoline. About 30 percent is used to run the digester. The rest is available for powering stationary machinery, such as an electrical generator unit, or for cooking, and space and water heating.

"Unfortunately," says one of its developers, agricultural engineering professor Howard D. Bartlett, "the device presently is expensive to build–at least $20,000–and only can pay for itself on a large farm, where all the energy produced can be utilized efficiently."

This situation may change, however, Bartlett adds, if conventional fuel prices continue to rise, and if the basic digester components begin to be mass produced.

Seeking to design a relatively efficient and economical digester that could be modified and manufactured by industry, Bartlett and his colleagues completed, in 1975, one of the nation's first large-scale anaerobic digesters for processing dairy manure. (The University of Missouri built one for swine wastes.)

Since then, the original Penn State model has been modified, and the 3500-cubic foot device has been operated successfully at a University dairy barn. And last fall, a digester was started at Mason-Dixon dairy farm to fuel an engine-generator for supplying most of the farm's electrical needs.

To encourge and aid other farmers, the Penn State scientists--Bartlett and Sverker P.E. Persson, professor of agricultural engineering; Raymond W. Regan, associate professor of civil engineering; and August E. Branding, professor emeritus of dairy science–have written a manual on construction and operation of digesters.

It will be published in late February by the University's Agricultural Experiment Station.

The idea is not new–Sir Humphrey Davey experimented with a digester in 1808; fuel-starved Germany built 30 of them during World War II; and small models are today used in China and India for cooking and as fuel for engine driven generators. But digesters have not been economical enough to warrant widespread use in the United States.

The Penn State researchers hope that, as more are built, with varying specifications, the systems will become more efficient and less costly.

What is an anaerobic digester?

"Essentially," explains Bartlett, "it's a device that speeds up and controls nature's process, which occurs spontaneously.

"Bio-gas is like marsh gas. It results from acid-forming bacteria decomposing organic materials in the absence of air. Thus, by sealing appropriate bacteria, along with manure and/or other farm wastes, in an airtight tank called a digester, and regulating the temperature you get methane and carbon-dioxide gases, and a large amount of nitrogen-rich effluent.

"Only a small percentage of manure becomes bio-gas, mainly because manure is 85 percent water. In the Penn State digester, 20 to 30 percent of the manure solids are converted to bio-gas, which has 60 percent of the energy of natural gas."

The manual "Agricultural Anaerobic Digesters," will be available as Bulletin #827, from the Agricultural Experiment Station, Penn State University, University Park, PA 16802.

Minimum tillage saves soil, oil

LINCOLN, Neb. - "If farmers want to hold fuel costs down, their best bet is less tillage," says William A. Hayes, agronomist for the U.S. Department of Agriculture's Soil Conservation Service in Lincoln, Nebraska.

Figures compiled Oct. 15, 1979, by the department show that the price of diesel fuel delivered to farms rose 77 percent during the last year and gasoline went up 51 percent.

Conventional – or "clean" – tillage, which most farmers use today, requires an average of 7.4 gallons of fuel for each acre cultivated. In conventional tillage, the moldboard plowing, disking and other operations require many trips over the same field.

A no-till system, in which the soil is not touched until planting time and residues from earlier crops are left on the field, requires only about 1.25 gallons of gasoline per acre.

"There is no doubt about it," said Hayes. "Conservation tillage not only reduces oil consumption to about one sixth of that required for ordinary tillage operations, it also reduces soil erosion 50 percent to 90 percent."