Biogas Technology: "Cow Power" Catching On in US

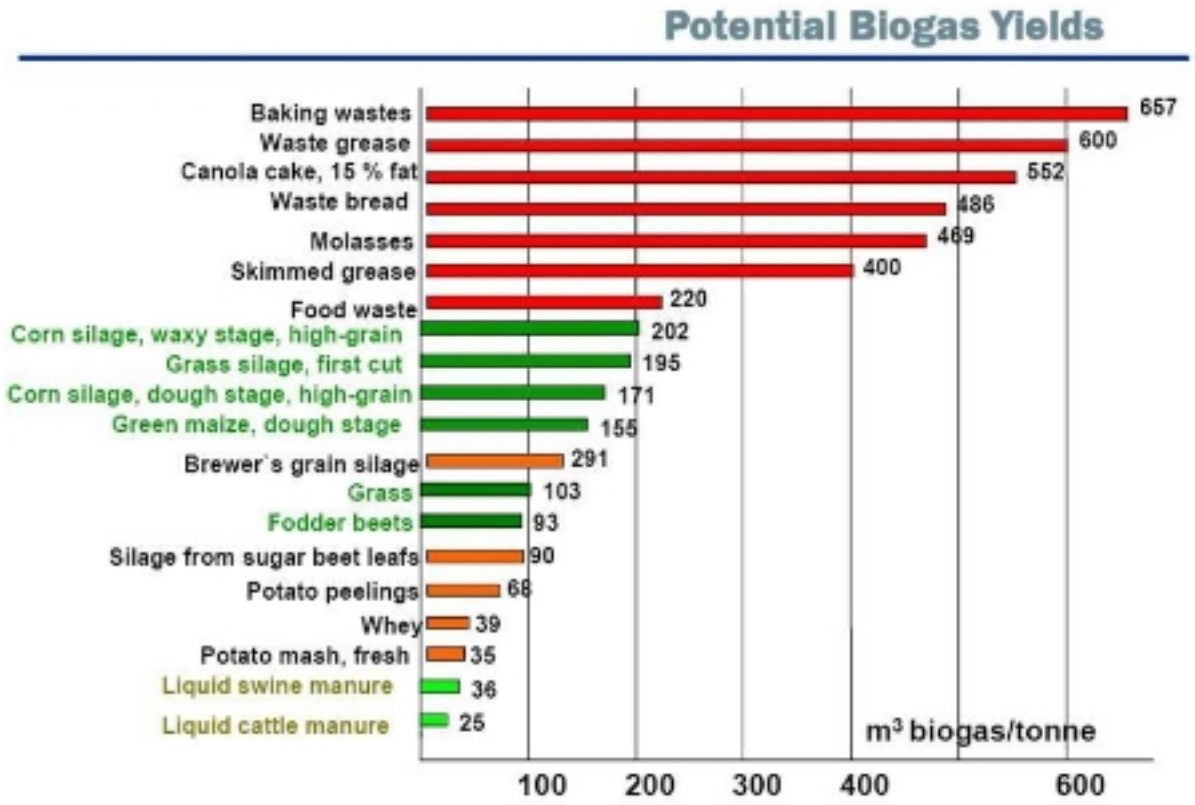
For years, third world ranchers have been using methane from manure to run electrical generators down on the farm. This clean-burning biogas is not only a good local fuel in countries with little or no infrastructure, now even countries like the U.S. are reaping energy from this foul-smelling source.

Some 80 percent of the estimated 160 biogas energy projects in the U.S. are currently installed on dairy farms, which then combust the gas to generate electricity. The combined installed capacity of all dairy farm projects is nearly 60 MW.

It’s a complicated process. First the farms have to facilitate both the production and collection of biogas in anaerobic digesters. These are processing systems that allow methanogenic bacteria to feed on the manure’s natural acids in a very oxygen-depleted environment. In turn, the bacteria both generate methane-rich biogas and reduce the manure’s foul odor by as much as 90 percent.

After collection from storage systems such as covered lagoons — akin to large swimming pools very nearly brimming with manure — this gas is usually piped to an electrical power generator.

Although a large portion of the U.S.’ biogas energy projects are found in New York, Pennsylvania, Vermont, and Wisconsin, they represent only a fraction of the estimated 8,000 farms out there that could support some method of biogas energy production. By some estimates, the total electrical capacity of all these farms could range as high as 1,600 MW. But that's still only a fraction of the U.S.' current electricity needs.



To date, Vermont has been a standout. Since 2002, Central Vermont Public Service, the state's largest utility, has delivered over 47 million kWh of local "Cow Power" to some 3 percent of its 160,000 customers.

Dave Dunn, an animal scientist with the Vermont utility, says that while its cow power customers are mostly homeowners, they also have 200 non-residential customers, from a gas station to a brewery to Green Mountain College in Poultney. The college now gets about half of its monthly electricity (100,000 kWh) from the utility's biogas energy program.

Dunn says the 10 farms that currently are part of the cow power program have a total estimated capacity of 3.5 MW. All of this energy is fed back into the electrical grid. On average, Dunn says a 1,000 cow dairy has a capacity of some 250 kW. That's enough cow power to provide the electrical energy for as many as 250 Vermont homes. As a result, biogas power now makes up 10 percent of the utility's current energy mix.

"This is really last year's solar energy and a way to store solar [carbon] energy in crops that a cow doesn't fully utilize and is excreted and turned into biogas," said Dunn. "We're using about a fifth of all cow manure in Vermont."

But the program is still not a panacea for the farmer. After grants, the farm still has to pay for more than half the cost of an average $2 million dollar digester project, which would usually be amortized over a 10-year period. However, gross income from biogas energy for a 1000-head farm averages only $300,000 a year, about 7.5 percent of a dairy's total gross revenue. Given that the life expectancy of a given

system runs only about 20 years, biogas energy installation is not without financial risk.

“Because dairy farming profits vary quite drastically with the price of milk, it’s hard for farms to invest in something other than their primary business,” said Dunn. “Becoming an energy producer is not typically what farms think about doing.”

Barring conversion to electricity, another likely scenario for biogas energy production involves cleaning the gas to meet commercial standards and pumping it into a nearby natural gas pipeline.

A project underway in western Wisconsin is trying to do just that. Agri-Waste Energy, Inc. Of St. Paul, Minnesota, has already successfully demonstrated delivery of biogas from an Emerald, Wisconsin dairy into an existing natural gas pipeline.

The next step is installation of two separate digesters on farms in western Wisconsin. Bob Zwald, co-owner of Bomaz farms in Hammond, will allow Agri-Waste Energy to build and own a digester on his 1000 cow dairy. From there, the gas would be extracted and sent through a pipeline before being directed into a commercial natural gas network.

“Now our manure is stored in a clay-lined pit and injected into the soil as fertilizer,” said Zwald. “Agri-Waste Energy would pay us a stipend for extracting the biogas and afterwards we would still be able to use the manure.”

The Agri-Waste project, expected to cost several million dollars, may see fruition next year, when it is expected to begin producing an estimated 1000 dekatherms of methane gas daily.

Even while agricultural manure holds promise, there may be even more biogas energy potential from food waste than manure.

Dunn says that ice cream, yogurt, cheese, waste milk and anything else that has a sugar, starch or fat component all have great biogas energy potential.

“In the U.S., what’s yet to move forward with [biogas energy] is leftover consumer waste,” said Dunn, “stuff from cafeterias, restaurants and grocery stores; the old doughnuts, the leftover steak and mash potatoes on somebody’s plate.”

But that could also be changing. Since

2011, the University of Wisconsin at Oshkosh has been operating a $3.5 million digester that uses a combination of agricultural waste, yard waste, supermarket waste — even waste from the campus food court. When the digester goes into full production in April, it should process some 8,000 tons of organics annually providing as much as 10 percent of the university's electricity needs.

As Becky Larson, a bio-waste engineer at the University of Wisconsin in Madison points out: "We're at the cusp of finding a way to make these biogas energy systems profitable," noting that she expects the biogas market to be pushed along by the continuing emphasis on sustainability; high costs of competing energies; and concern over reduction of greenhouse gas emissions.

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