ENVIRONMENTAL HOT TOPICS

By Tim Shelford

To understand why anaerobic digestion on small U.S. dairy farms is uncommon, it helps to look at Europe's adoption of the technology

Small farm anaerobic digestion: What's holding it back?

There are approximately 160 farm-based anaerobic digesters (AD) operating in the United States, according to the U.S. Environmental Protection Agency (EPA). Compare that to Germany which has more than 3,000 on-farm biogas plants. That's in a country where the average herd size is 50, compared to the average U.S. herd size of 120 lactating cows.

Why has AD flourished in Europe but not in this country? Financing and revenue sources are two answers.

Given the capital cost of an AD system – estimated at approximately $1,200 per cow – it's key that a digester's revenue and benefits can pay down the installation costs. European digesters have an advantage in this regard.

This digester at Farber Dairy in East Jewett N.Y. was built to accommodate manure from 100 cows. The digester cut manure odors and greenhouse gas emissions while reducing purchase of commercial fertilizers.

In Germany the current feed-in tariff rate for electricity produced from biogas is 0.215 Euro ($0.31 USD) per kWh. Depending on where you are in the United States and your local utility, there may or may not be a feed-in tariff.

A few states have feed-in tariffs, with Vermont offering rates of $0.16 per kWh. Elsewhere dairies are limited to net metering with any excess energy sold at market rates,which is in the neighborhood of $0.04 per kWh.

Operation and maintenance costs on engine-generator sets are on the order of $0.017 to 0.022 per kWh, further affecting the system's bottom line.

Depending on the state and utility company, farmers may also be responsible for the interconnection cost. If local power lines are not adequate, this can potentially run into hundreds of thousands of dollars. In Germany, progressive legislation guarantees access to the electrical grid.

Carbon offset credits associated with the destruction of methane are another major contributor to the revenue of European digesters. This is not the case currently in the United States.

Depending on how on-farm manure is handled, it can release significant amounts of methane to the atmosphere where its contribution as a greenhouse gas is 24 times greater than carbon dioxide. Digesters capture this methane where it can be destroyed through combustion.

On Europe's carbon trading markets these reductions are currently worth 16.5 euro ($24 USD) per

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metric tonne. AD systems can lead to a carbon credit offset amount of approximately 2.5 metric tonnes of CO_2 per cow per year, or $60 per cow per year at the European carbon credit pricing. At $24 per metric tonne many more digester projects in the United States would become viable, as identified in a USDA report.

U.S. carbon markets are still uncertain. The Chicago Climate Change (CCX) reached a peak of $7.50 per metric tonne in 2008; then ceased operations in 2010 at a value of only $0.05 to $0.10 per metric tonne of CO_2.

California is in the process of implementing a new cap and trade market exchange to reach its greenhouse gas emission targets. That could help projects throughout the country.

To further maximize biogas production, many digesters in Europe and this country co-digest non-manure biomass materials. These range from food processing and other organic waste to crops grown specifically for use in digesters.

Besides increasing biogas yield, co-digestion can be beneficial if dairies receive a tipping fee comparable to what a waste stream producer would pay at a landfill. The increased value of biogas in Europe encourages diverting organic waste streams to digesters.

Funding stream

Financing is the other key factor to digester adoption. In the United States financing the construction of digesters has been identified as a key barrier to the spread of digester technology. Uncertainty over revenues due to changes in the carbon credit markets and low prices paid for the power generated make it difficult to secure credit. An historically poor track record of success – since 1998 14% of digesters have encountered system failures – exacerbate the situation.

Third-party operated systems are an answer to financing. And because of increased digester revenues in Europe, this type of investment is increasing. Typically in such a system a third party finances, builds, owns and operates the digester, receiving manure from the farm and returning the digestate for use on-farm.

The sale of carbon offset credits, electricity, biogas and possibly excess combustion heat, plus revenue from tipping fees, can increase the opportunity for digesters to become profitable.

AD systems benefit greatly from economies of scale, and combining the output from several farms, regardless of size, into a single operation is considered to be an option for increasing AD use. However, the value of the energy in the manure has to be high enough to justify transporting it to a central location. This has generally been cost-prohibitive in this country.

Community or centralized digesters are not unique to Europe, but they're rare in the United States. One of the first U.S. community digesters was recently commissioned in Dane County, Wis., to take advantage of the concentration of dairy operations there. Others are under consideration or in varying stages of development such as the project in Auburn, N.Y.

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Removing the duties of operating a digester from the daily routine of a small dairy is a significant benefit of third-party systems. It's estimated that daily observation and maintenance of digesters require a half hour per day and a half day per month. On a small dairy, it can sometimes be hard to dedicate this additional time.

Improper or inadequate maintenance of a digester and equipment can reduce biogas and electricity production and possibly result in total digester failure. Not operating a digester system to its design capabilities reduces revenue.

No major technical hurdles preclude small farm AD in the United States as is seen by the number of systems in Europe and the few U.S. projects. One such project was located at Farber Dairy in Greene County, N.Y. With the assistance of grants a group installed a digester to treat manure from 100 dairy cows. Because of the dairy's location in an area of high recreational value, reducing odors – and the accompanying complaints – was the main goal of the project .

While in operation the digester was very successful. (In 2007 the owner of the farm decided to retire.) Manure odor was sufficiently reduced, allowing the dairy to spread on hay ground between cuttings with no neighbor complaints.

With the assistance of feed-in tariffs and a stable carbon credit market, single farm digesters and larger centralized digesters are financially successful in Europe. In many areas of the United States feed-in tariffs exist for wind and solar power projects. But such programs are few and far between for biomass energy.

As the value of energy and the demand for renewable energy increase, the size of farm necessary to financially benefit from an AD system decreases, making it an option for small dairies to consider. ❐

Keys to success

1. Feed-in tariffs for electricity produced from biogas.
2. Guaranteed access to electrical grid.
3. Carbon offset credits associated with methane destruction.
4. Third-party operated systems to address financing. Also community or centralized digesters.