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Manure Power: Dairies harness methane to create renewable energy

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The 2,600 cows at Vintage Dairy west of Fresno produce up to 140 tons of manure per day. Photo by Jennifer Baldwin





Four times a day, 5,000 gallons of water flush manure down the rows of the open-stall barns at Vintage Dairy – collecting about 90 percent of the waste. Photo by Jennifer Baldwin



David Albers is a third-generation dairy farmer, and environmental lawyer, and founder and CEO of BioEnergy Solutions. Photo by Jennifer Baldwin



Albers demonstrates the thickness of the polyurethane liner covering the anaerobic digestion lagoon at Vintage Dairy. His guests are students from Independence High School's energy academy in Bakersfield. Photo by Jennifer Baldwin



The "scrubbing plant" at Vintage Dairy upgrades the biogas to high-quality methane that matches the purity of natural gas. The black tower on the left is the desulfurization tower and the white tower on the right burns off the carbon dioxide. Photo by Jennifer Baldwin





A red valve marks the spot where Pacific Gas & Electric Company takes title to the biomethane produced at Vintage Dairy. Photo by Jennifer Baldwin

David Albers knows the power of poop. Cow manure, that is. The third generation dairy farmer from Bakersfield has 2,600 cows producing about 130 tons of manure each day.

But he prefers to count it differently.

“The way we’ve broken it down is, two cows can power one home each day. So our cows power about 1,300 homes.”

Just how does he make the leap from poop to power? Albers’ Vintage Dairy, located west of Fresno, is the first in the state of California – and one of the first in the nation – to capture the gas released from the decomposing manure, turn it into high-quality methane, and sell it directly to a power company as natural gas.

In his case, he injects the gas into a Pacific Gas & Electric Company line that runs through his property. The utility company pays Albers for the gas, then pipes it to an energy plant, where it is burned to produce electricity.

So not only does Albers make a profit as a dairy farmer, he also brings in income for creating and selling renewable energy. Furthermore, he’s helping to lessen the affects of global warming by reducing his dairy farm’s greenhouse gas emissions.

It’s a practice he believes in so wholeheartedly, he has launched an entire business devoted to it. As founder and CEO of **BioEnergy Solutions**, based in Bakersfield, Albers offers to fund and install biogas systems at other dairies and split the gas revenue and emission credits with the farmers. So far, his is the only dairy with the system, which went online in 2008. He reports he has contracts with 39 dairies and letters of intent from 150 more.

His project is certainly gaining attention.

In September, the California Environmental Protection Agency and other state agencies honored BioEnergy Solutions with a **Governor’s Environmental and Economic Leadership Award** in the “climate change” category.

Albers’ project “is at the top of our list for uses for methane,” said Dave Warner, director of permit services for the **San Joaquin Valley Air Pollution Control District**. “It gets fed directly into a pipeline, so it’s a perfect solution.”

What to do with all that gas

There are about 1.8 million dairy cows in California producing methane – one of the main greenhouse gases that cause global warming, and also one of the main sources of energy in this state. With a little “scrubbing,” all that methane can be purified and used to heat homes, generate electricity and even fuel cars.

So why aren't more dairies capturing and selling their methane? It comes down to money.

“Financing is the big obstacle,” said Allen Dusault, program director for sustainable agriculture with the San Francisco-based nonprofit, **Sustainable Conservation**. He works with dairies that want to capture their methane and put it to use. But these systems are very expensive, and until recent law mandated power companies to use more renewable energy, dairies had a hard time selling either the natural gas or electricity generated on-site. For most dairies, the cost benefit of installing the methane digesters and scrubbing plants does not outweigh the savings from generating their own power. The systems can cost into the millions.

Even so, there are about 30 dairies in California that digest manure and generate power on-site, according to Cindy Pollard, spokeswoman with **PG&E**. Of the dairies that use internal combustion engines to burn the gas and generate power, some have recently shut down, according to Dusault, after new regulations required the dairies to cut down on the nitrogen oxides released from those engines.

Nitrogen oxides are one of the main culprits for ground-level air pollution, including summertime smog, said Warner of the air pollution control district. This is why the district prefers other uses for purified methane, called biomethane, such as injecting it into natural gas lines – or compressing it to fuel vehicles.

One large dairy in Lindsey is doing just that. Hilarides Dairy has converted its fleet to run on natural gas and compresses its biomethane to fuel their trucks. According to an article by **Dairy Herd Management**, the 9,000-cow dairy is capable of producing an equivalent of 700 to 800 gallons of diesel fuel each day.

Could California's dairies effectively fuel natural gas-powered vehicles? A 2005 report, researched by Ken Krich of Sustainable Conservation, posed this fact:

“Manure from about half the cows in California could provide enough biomethane to power all the natural gas vehicles currently operating in the state,” according to the report, **Biomethane From Dairy Waste**.

Other industries that also produce a lot of methane, such as swine farms, landfills, waste water treatment sites and food processing plants, are also prime for biomethane production. California may want to look to Europe, particularly Sweden and Germany, where biomethane has become an industry standard over the past 10 years, according to Dusault.

Warner says some waste water treatment plants in California are already capturing their methane and using it to produce their own electricity. And earlier this month, the world's largest landfill gas to liquefied natural gas facility opened in Livermore. The gas can fuel up to 300 garbage trucks operated by Waste Management, according to **the company's website**.

How it works

A tour of David Albers' Vintage Dairy shows just how big of an operation it is to capture, clean and sell natural gas-quality methane. The tour starts in one of the long, open-stall barns that houses row after row of cows. Each row has a feeding station along one side and a sandy spot for the cows to lay down on the other. All manure is aimed into the center of the row.

The first step in the process is effective manure collection, Albers explains, and this type of housing – unlike an open feed lot – allows his dairy to collect about 90 percent of the manure.

“Four times a day, 5,000 gallons of water is pushed through here,” washing the manure down the row into a canal, Albers says.

The canal transports the sludge to a processing pit, where it is then pumped about 200 yards away to a mechanical separator. Solids are dumped into a composting pile to be turned into fertilizer for the dairy's feed crops.

The liquid remainder flows by gravity into a 5-acre, 38-foot-deep pit covered with a thick liner made of high-density polyurethane. This is the anaerobic digester. In the absence of oxygen, bacteria break down the sludge and release biogas, which is composed of mostly methane and carbon dioxide, with a little hydrogen sulfide as well.

The gas enters a perforated pipe that runs the perimeter of the covered lagoon and is delivered to an on-site “scrubbing plant” that first desulfurizes the gas, and then removes the carbon dioxide. The carbon dioxide is “flared,” or burned off (the effects of which are not harmful to the air, Warner of the air pollution control district said). What is left is high-quality methane that matches the purity of natural gas.

The gas runs to a station 1,500 feet away where a compressor brings it up to the same level as the natural gas flowing through PG&E's line running through the dairy's property. Then, at a red valve, PG&E takes title to the gas.

And, what happens to all of that water? Albers points to a crystal clear pond on the other side of PG&E's right of way.

“There's nothing floating in it. It's all been broken down in the digester,” Albers says. The water will be used to irrigate the dairy's crops of alfalfa, wheat and sorghum when the economy lets up and it becomes feasible to grow their own feed again, he says. For now, their crop farming operations are shut down.

Affects of the economy

The economic recession has also slowed Albers' plans for expansion. Once he's able to secure the financing, his first step will be to build digesters at four neighboring dairies and pipe their biogas to his plant for processing.

Next up will be to build a similar system in Shafter, starting with Tjaarda Dairy and expanding to its neighbors. That 3,000-cow dairy also has a PG&E natural gas pipeline running through it. By clustering the digesters,

Albers can invest in one scrubbing station to be shared by several dairies.

Perry Tjaarda has been in the dairy business for 45 years, starting in Corona, then Bakersfield and now, for the past 10 years, in Shafter. He's experienced ever-tightening regulations and knows he has to do something to get ahead of future greenhouse gas emission rules.

"Over the last few years a lot of focus has been put on dairies and the possible pollutants they produce. Are we polluting or are we not? And if we are, what are we doing about it?" he said.

Regardless of the "science behind the rhetoric," Tjaarda says he sees an economic benefit to capturing and utilizing the methane from his dairy's manure – especially if Albers' BioEnergy Solutions is willing to front the cost of the system.

"By pumping into PG&E's gas line, we get paid a little, David gets paid a little, and we get (emission) credits. It's a win-win. It makes sense," he said.

All this wouldn't be possible if a new law hadn't been passed in 2006 that mandated utility companies in California to get at least 20 percent of their energy from renewable sources by 2010. It also helps that Albers has 10 years under his belt as an environmental lawyer and knows his way around the legal issues and permitting processes for dairies.

Every time a project he represented was up for environmental review, "at least one person would say, 'Why not build an anaerobic digester?'" he said. "Under California law, I would have to respond with an analysis showing we researched the economic feasibility."

And in every case it would not be economically feasible to build a digester only to produce an excessive amount of power that utilities would be unwilling to pay for. But when **Senate Bill 107** passed in 2006, utilities changed their tunes. And, in November 2008, Gov. Arnold Schwarzenegger signed an **executive order** that utilities obtain at least 33 percent of their power from renewable sources by 2020.

Furthermore, dairies face possible mandatory greenhouse gas emission reductions under **Assembly Bill 32**. That bill, called the "California Global Warming Solutions Act of 2006," mandated the California Air Resources Board to develop a **scoping plan** to reduce statewide greenhouse gas emissions to 1990 levels by 2020.

That plan points out that 6 percent of greenhouse gas emissions in California come from agriculture, and they are "largely methane emissions from livestock, both from animals and their waste."

While the plan currently calls for voluntary reductions among dairies, it also recommends revisiting the issue in 2013 to possibly make the reductions mandatory.

If that becomes the case, manure digesters could become the industry standard for large dairies in California and Albers's BioEnergy Solutions could very well be the state's leader in the effort.

PG&E spokeswoman Pollard said the utility does have contracts with other companies to buy biomethane. One of those is **Microy**, a subsidiary of New York-based Environmental Power Corporation, which **has plans to**

build three scrubbing stations near dairy clusters in Kerman, Riverdale and Hanford. But those projects are not yet online.

Albers' Vintage Dairy is the only one injecting biomethane from dairy manure into existing pipeline in California today.

"I love what we're doing," Albers said. "With this kind of thing, we have to pinch ourselves. How cool is it to come up with something that's good all the way around? We are doing an environmental project on a dairy, we are providing renewable energy to PG&E, the dairyman gets a new revenue stream, and all of us get cleaner air because there are less emissions in the atmosphere."

David Albers will be one of the featured speakers at the third annual Kern County Energy Summit presented by the Kern Economic Development Corporation. "Kern County's Emerging Energy Technologies" is from 8 a.m. to 4 p.m. Thursday, Nov. 12, at Bakersfield Marriott at the Convention Center, 801 Truxtun Ave. Registration is \$50. For a registration form, go to www.kedc.com or call 862-5150.

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