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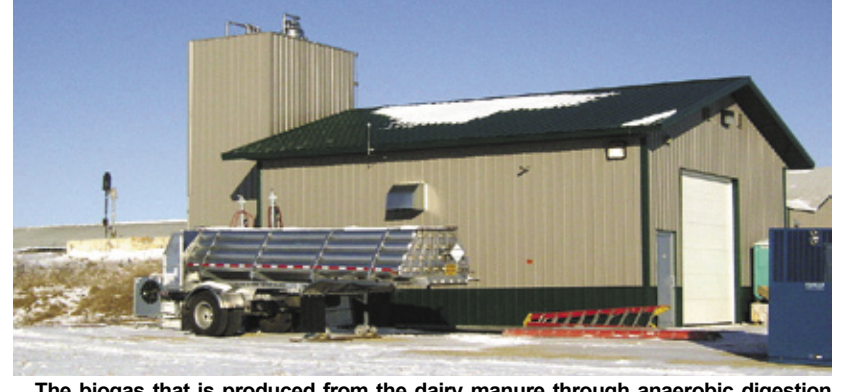
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John Vrieze owns Baldwin Dairy (left) home to 1050 milking cows and is part owner of Emerald Dairy LLC (right) home to 1200 milking cows. He also co-owns the Transition Management facility which houses 450 cows. For 25 years, he milked 60 cows. Today, Vrieze operates two dairies that are CAFOs, and his pioneering spirit and positive attitude have led to a variety of manure to energy, manure to water (dischargeable water), and manure to revenue innovations. He is also working on a "future farms" project that can be a model for risk management on small dairies throughout the region.



John Vrieze (right) uses energy and nutrients from Emerald Dairy to grow algae in this "bioreactor" (above). He's learning how to make biodiesel with algae and collecting byproduct protein that can be fed to the cows. The algae is also currently used as a food source for the tilapia-raising enterprise.



The biogas that is produced from the dairy manure through anaerobic digestion comes to this "gas scrubbing" facility (above), where it is cleaned to natural gas quality and loaded onto a semi for transport to the natural gas pipeline in nearby Baldwin, Wisconsin. Of the state's 21 digesters, the two operated by Vrieze at Baldwin and Emerald dairies are the only ones not generating electricity. The value as natural gas and potentially vehicle fuel is two to four times greater than the value as electricity.

Manure fuels his innovations to provide revenue for large and small dairies alike

By SHERRY BUNTING
Special for Farmshine

LANCASTER, Pa.—What would it mean to your dairy if you could first use your manure to make energy, then process the manure to separate and condense the nutrients, then divvy up those nutrients between the crop fields and a new revenue-generating enterprise on the farm, then turn the liquid fraction of the manure from waste to potable water—water that is not only clean enough for you and your cows to drink, it qualifies for a discharge permit?

John Vrieze is doing these things at his Baldwin and Emerald dairies near Baldwin, Wisconsin. He showcased his farms as a speaker at the 2009 Pennsylvania Dairy Summit last month.

Yes, Vrieze is a large dairy producer, operating two CAFOs milking a combined total 2,400 cows. But large though his dairies may be, he is discovering and streamlining innovations that serve as models for thousands of other dairy farms—large and small.

"We have 14,000 dairymen here in the state of Wisconsin," he said. "Some are struggling, and may not want to take on millions in debt to expand their dairies. They need alternatives to consider for increasing their revenue."

Vrieze, who, not surprisingly, admits to being easily bored, is in the process of modeling closed-loop enterprises that any one of the thousands of small dairies in Wisconsin, or elsewhere for that matter, can benefit from.

As founder and president of the Wisconsin Dairy Business Association and member of the Governor's Climate Change Task Force, Vrieze is a no-nonsense innovator with a pioneering spirit, particularly when it comes to the handling of manure, the production of renewable energy, and the development of new enterprises on the dairy farm that provide revenue and opportunities for risk management.

In the midst of all the negative news in this downtrodden economy, Vrieze brings a breath of fresh air—literally—to discussions about the future and the very positive impact dairy producers can have on their own futures, and that of their neighbors, even the planet.

Vrieze views dairies to be at the center of the so-called green movement, with the potential to generate revenue while solving the problems they encounter as environmental regulations (air, water, odor, etc.) continually increase.

What Vrieze shared with Dairy Summit attendees on Feb. 11 holds the promise of squeezing—literally—every ounce of revenue and environmental benefit from what is largely considered a problem on dairies today: Manure.

Just three weeks before the Summit, after a lengthy period of proof, discussion and negotiation with Wisconsin's Department of Natural

Resources (DNR), Vrieze finally received his state pollution discharge (WPDES) permit, allowing Emerald Dairy to discharge water from its state-of-the-art wastewater treatment system to Dry Run Creek in St. Croix County.

At the same time, Vrieze has been developing a small dairy model in his "future farm" project at the home farm, after reading about a Missouri dairy farmer who turned a portion of his farm into a hydroponic produce and tilapia fish-raising enterprise.

When he called the dairyman, he learned the motivation for the project was that, "He really liked his wife," said Vrieze. "His wife had to go to town and work because they needed health insurance, and they didn't have enough money on the farm. So he created another enterprise on his farm to be able to bring her back. He said he didn't want to deal with labor, and he didn't have a large enough land mass, so expanding his cow numbers was not an option."

"So here's this entrepreneurial guy who figured out a different enterprise that could literally bring his wife back to the farm, generate enough revenue to pay family living expenses, and he's using some of the energy and nutrient streams that are created on the farm to do it," Vrieze explained.

Vrieze is now modeling a similar closed-loop system in his "future farm" project. And he's added another twist, of course.

He has a neighbor who was interested in making biodiesel. So he's using the streams of nutrients and energy from the dairy farms to grow algae, or green-gold as he calls it.

"We're actually feeding the algae some of the high phosphorus manure, and we're using some of the energy (heat) created in our water treatment plant to raise this stuff," he said.

Vrieze views the algae project as risk management for the dairy.

"I don't know if I can make diesel from it for \$5 or \$20, but I am going to find out," he said. He explained that part of his motivation is the variability of fuel, feed and milk prices and the concern that if he ever gets shut out of the market for diesel—either by a mandate or through the price being so high that he can't afford it—he wants to know how to make his own.

But that's not all: "If we press the oil out of this algae (to make biodiesel)," he says. "I think I can feed my cows the algae pulp that's left over because it is a high protein and can offset some of our soybean meal."

Meanwhile, as he develops and streamlines these models and projects, Vrieze said the algae is a home-grown feed source for the tilapia-raising portion of his "future farm" project.

"We in agriculture talk about risk management all the time," he said. "It usually has to

do with buying our inputs and selling our milk. But I'm concerned about risk management from an energy standpoint. I feel very vulnerable today. I used to be able to go out 10 years and make decisions. Not so with the price volatility today."

This is the direction in which Vrieze's innovations—along with the manure from his dairies—are going.

Looking back over that process, he explained that it began with covered lagoons. Baldwin and Emerald dairies have had covered lagoons since the beginning. They captured the manure gas emissions and simply flared-off the methane, so, early on, they were able to control odor and sell carbon credits.

But Vrieze kept thinking about the energy potential of that methane he was flaring off. It was going to waste, and as is very evident about this dairyman, Vrieze hates to waste anything. He's continually looking for ways to pull elements from the manure and target them to where they have the greatest value.

The investment in "greenfield projects" that have followed Vrieze's gas-flaring days have financed three farm projects.

Both Baldwin and Emerald dairies now produce substantial quantities of biogas through anaerobic digestion. The biogas is "scrubbed" to remove hydrogen sulfide and then transported by tractor trailer to the natural gas pipeline in the nearby village of Baldwin.

"We in dairy have to think about all the ways we can produce energy," said Vrieze, as he talked about multiple energy conversions from biogas.

There are 21 digesters now in the state of Wisconsin and Vrieze's two digesters are the only ones not generating electricity with the biogas. Vrieze chooses to scrub the gas and transport it to the natural gas pipeline instead. He also talked about liquefying the biogas to run natural gas vehicles.

"This is where the money is," he said, adding that the revenue from producing natural gas is more than twice that of electricity, and to make vehicle fuel, the value is four times greater.

Emerald Dairy produces 100,000 cubic feet of natural gas per day, and Baldwin Dairy produces 15% more than that through its underground anaerobic digester. In addition, Vrieze has boilers for utilizing the captured heat.

While using anaerobic digestion to create renewable energy, produce revenue, and control the odor of the manure, the farms still have the manure mass and nutrients to deal with.

"Essentially, I'm putting 50,000 gallons of manure in the anaerobic digester. That means I have 50,000 gallons of manure coming back out," he declared. "After we take all the energy

out of it, we still have all the N, P, and K, and we still have the problems involved with this large mass of manure to deal with."

But not to worry... Vrieze's solution has been to "dewater" this vast amount of manure. His wastewater treatment facility at Emerald Dairy includes a disc filter, press, and centrifuge.

"The liquid effluent goes through the centrifuge, which takes out one-third to one-half the total phosphorus in my manure," he said. "And it gets this into a real concentrated form."

Vrieze has been working with the University of Minnesota to pelletize this condensed material and burn the pellets to utilize the heat source. "I can walk away with three five-gallon pails of ash holding 25-50% of the total manure phosphorus," he said. "In that form, we can haul it great distances to the potato guys and other vegetable guys who can really use some high phos."

Meanwhile, the remaining effluent goes through an ultra-filtration unit and then a reverse osmosis unit. The result? Distilled water.

"Today, one-third of our manure is discharged as clean water," Vrieze confirmed.

Not only is this an environmental milestone for the dairy's manure, it is also a considerable savings to the dairy in not having to haul large quantities of liquid manure to the fields. With the nutrients separated and condensed, the volumes used for field applications are decreased and the nutrients are more optimally targeted.

Sustainability is one of the goals Vrieze is passionate about. He wants the dairy industry to lead the discussion in determining the definition of "sustainable" and the description of low carbon footprint.

The ideas and projects he presented at the Summit show the tremendous range of opportunities for dairymen, revolving around manure.

"We can provide local milk production and do it in a sustainable fashion whether we're milking 50 cows, 500 or 5,000," said Vrieze. "Putting a price on carbon can affect decisions on the dairy and how we build our projects. It's not just the cost of carbon (fuel), but how we can also take advantage of the value of carbon as revenue"

Of the three PDMP Issues Forums that are planned for 2009. The August 6th Forum in Juniata County will focus on the "green" movement and the dairy industry, including a tour of the Reinford family's dairy, which includes a methane digester that is generating electricity. The June 4th Forum in Lancaster County will provide another very timely topic focusing on family relationships on the dairy farm. This event will include a tour of the nearby Rohrer family's dairy farm. Stay tuned for details and visit www.pdmp.org to learn more.