

From sludge to

sustainable energy

Dr. Dan Zitomer harnesses the power of anaerobic microorganisms

Deep in northern Wisconsin, four tanks hold a combined 230 million pounds of bacteria essential to the operations of Packaging Corporation of America. This soupy mixture constantly breaks down the waste produced by creating 500,000 tons of corrugated cardboard a year.

With the help of Dr. Dan Zitomer, director of Marquette's Water Quality Center and associate professor of civil and environmental engineering, Packaging Corporation of America is transforming this potent bacterial stew into a remarkable source of renewable energy.

Zitomer specializes in converting industrial waste, whether it comes from airplane de-icing fluid or restaurant leftovers. When anaerobic microorganisms break down waste, they give off methane gas, which can then be harnessed to power factory and industrial operations. This saves companies money, and it helps save the environment by conserving natural resources and reducing carbon dioxide emissions. It also helps keep waste out of sewers and landfills.

"It's a niche area in which our college excels," Zitomer says. "Sustainable

energy, going green — it's a good place for us to be. It's a place to make a difference."

Zitomer is a recognized expert and innovator in anaerobic digestion, and he offers a short course on the subject that brings academics and industrial scientists from around the world to Marquette each year. Clients as diverse as the Milwaukee Metropolitan Sewerage District, the Great Lakes Naval Training Center and Coca-Cola Enterprises of Atlanta look to Zitomer for help in applying this technology.

Currently Zitomer is researching a process called anaerobic co-digestion to perfect the process even further. Essentially he's trying to find the most potent mixture of microbes to produce the most methane, a process known as bioaugmentation. The more gas, the more waste companies can recycle into fuel. His work is funded by grants from the state of Wisconsin and We Energies, which provides natural gas, electricity, steam and water services to portions of Wisconsin and Michigan. Zitomer is also researching how to keep his blend of microorganisms stable and active so companies could purchase it as an off-the-shelf product.

Anaerobic digestion is attractive to companies because it's a relatively inexpensive way to dispose of unwanted by-products. "Anaerobic microorganisms operate without oxygen — they're the little guys operating at the bottom of the swamp generating that sour smell," Zitomer says. "They have great potential in that you can just add them to a waste stream and pretty soon thereafter start collecting

the gas." When it works, this can be significantly less costly than breaking down waste with methods that use oxygen, which require additional investments and energy for stirring or bubbling in air.

Most of the time, these anaerobic microorganisms handle their job without incident, but changes in temperature can cause the process to stagnate. When that happens, Packaging Corporation of America calls on Zitomer's expertise again. "It's a 200-million-pound organism," says John Piotrowski, the company's senior environmental engineer. "When it gets sick, it's going to kick us — and kick us hard. When it doesn't function well it's a nightmare."

Piotrowski met others who made claims to be experts in this process, but they often turned out, in his words, to be little more than snake oil salesmen. So he was skeptical of Zitomer's process at first. Until he met him.

"I was just floored," Piotrowski said. "Dan had a clear and competent understanding of how industrial processes worked — or didn't work. He's like a guru. Now we've stabilized our system so that we don't significantly worry about it."

For the Packaging Corp. plant in Tomahawk, Wis., the impact has been dramatic. The company has replaced natural gas, a fossil fuel, with renewable energy at a savings of more than \$1 million a year. The amount of energy it captures and reuses to power its boilers would be equivalent to providing energy to 2,700 homes in northern Wisconsin for a year.

