

How to cook up a new fuel Chemical, biological meet in ethanol



Trucks back up to a bay, where they dump their corn onto grates.

(THE BLADE/LORI KING)

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BLISSFIELD, Mich. — At Global Ethanol Inc.'s new \$80 million plant in Riga Township in southeast Lenawee County, the first thing one notices is the smell.

There's no offending odor, despite a huge labyrinth of steel towers, pipes, and odd-shaped buildings that hums steadily while pumping out 163,000 gallons a day of high-octane, 200-proof ethyl alcohol.

The aroma wafting through the facility is more like that of warm corn flakes, not surprising given that the plant is making alternative vehicle fuel from corn kernels distilled using a process similar to a beer brewery's.

Ethanol production, which began on a test basis in late February in this Michigan town 22 miles northwest of Toledo, looks and is managed like a chemical process, said Mark Fisler, the firm's president and a 10-year veteran of the industry.

"But it is actually a biological process," he said. Enzymes, yeasts, and other ingredients turn a bushel of corn into about 2.85 gallons of ethanol. The technicians and others keeping tabs on the process are like doctors, trying to make sure the patient doesn't get sick and performs at its best, and if not, they inject penicillin and amoxicillin into vats to kill germs.

A tour last week of the facility provided a rare look at the entire 57-hour production process. The \$80 million plant is the only such business operating in northwest Ohio and southeast Michigan.

The Riga plant is 60 percent owned by Global Ethanol, of Brisbane, Australia, and 40 percent owned by Midwest Grain Processors, of Lakota, Iowa, and Great Lakes Ethanol Inc., of Blissfield, Mich.

It uses a dry-milling distillation process, the most common in the industry, according to the Renewable Fuels Association in Washington. Dry milling grinds corn so it can be converted into ethanol, dried grains, and carbon dioxide.

Wet milling, a more expensive process, first separates corn into starch, fiber, germ, and protein, then ferments it into ethanol. Wet milling produces corn oil as a by-product.

Matt Hartwig, the trade group's spokesman, said dry milling is the most cost-effective process and corn the most commonly used fuel source.

The nation has 124 ethanol plants, mostly clustered in the Midwest, producing about 6.5 billion gallons annually. Seventy-six more plants are under construction, and seven plants are expanding, including in Riga.

‘A big oven’

Simply put, the Blissfield-area facility is a big oven. Plant manager Jason Veirs is the “chef” charged with correctly following a delicate “recipe” to squeeze as much ethanol from a corn kernel as current technology allows.

“You have to find that ‘sweet spot’ where you have your optimal point,” he said. “It’s a cooking process.”

When the factors are in line, Mr. Veirs hopes to squeeze 2.9 gallons of ethanol from a bushel of corn. On the wholesale market, ethanol fetches \$1.70 to \$1.90 a gallon, so the more ethanol he can distill — even if it’s an increase of just five-hundredths of a gallon — the more money the plant makes.

Global Ethanol expects the factory to be running smoothly by year’s end and able to make 50 million gallons a year, the bulk of which is contracted for sale to big oil companies.

Global Ethanol, Riga Twp., Mich.

- Cost: \$80 million
- Workers: 42
- Corn storage: 642,000 bushels or 16,800 U.S. tons
- Daily corn shipments: 1,300 tons to 3,900 tons
- Daily ethanol production: 163,000 gallons
- Production time: 57 hours
- Ethanol storage: 1.2 million gallons
- Dried grain production: 465 tons a day

In addition, the plant makes a by-product called dried distillers grain — which is corn stripped of its sugar — that is sold to livestock feed producers. Each day, the plant makes 465 tons of dried grain, most of which is shipped out in up to seven trucks or is stored in five 90-ton rail cars that are moved out every few days to cattle and poultry food processors nationwide.

On the nation’s commodities markets, dried distillers grains are selling for \$90 to \$110 a ton, making the 164,000 tons a year that the Riga plant can produce worth \$14 million to \$18 million.

Second by-product

This fall, the company will build a small unit to capture a second by-product, carbon dioxide, which it will sell as a liquid and as dry ice, officials said.

Before anything is produced, the plant needs corn, and lots of it. It has two storage bins that can hold a combined 16,800 tons, or about a 10-day supply. The operation contracts with Michigan Agricultural Commodities Inc., of Lansing, to supply corn, which arrives in about 10 truckloads a day.

The trucks dump the corn onto grates leading to underground conveyors that shuttle it to the storage bins, officials at the plant said. From there, it goes to a grinder, called a hammer mill, that pounds it into a light yellow flour.

The hammer mill is one of several noisy areas of the plant where hearing protection is required.

Next, the flour is pumped to a large tank to make slurry, a thick, steamy mix of flour, water, and enzymes. That is shipped to holding tanks where enzymes break down starch in the corn into fermentable sugars.

The liquid is pumped to one of four fermenting tanks, where yeast is added and the mixture sits for nearly two days, separating into liquid and solids.

Fermentation takes up most of the 57-hour window needed to turn corn into ethanol. It's also where things can most easily go wrong, resulting in less ethanol.

The fermentation tanks operate on staggered shifts, so only one is starting or stopping at a time. Because the stage is so critical, technicians take samples every four to six hours from each tank for analysis.

The samples are checked for six things: carbohydrates called dextrans, glucose, lactic acid, acetic acid, ethanol, and the amount of unconverted mixture.

At midday one day last week in the control room, the No. 4 fermenting tank was showing problem levels of acetic acid, and its ethanol output was dropping unsatisfactorily.

Despite sealed pipes, sterilization, and other efforts to exert tight control over one of nature's basic processes, Mr. Fisler said, "This is showing me right now that nature's finding a way to break out."

Mr. Veirs had a simpler explanation: "No. 4 has caught a cold." Rogue bacteria, he explained, were eating sugars that enzymes and yeast change to ethanol.

Soon, a worker would dump a bucketful of antibiotics into the tank.

"We're trying to kill the infection so that it doesn't continue to clog the mixture," he said. "If we don't, it could end up contaminating the whole system."

Brad Geyman, of Dundee, is one of the lead control operators. For 12 hours a day, 7 straight days, he mainly sits in front of two computer screens reading numbers, watching for critical deviations.

The system, designed by Delta-T Corp., a top name in ethanol technology, provides a wealth of data. Nearly every part of the plant can be controlled at Mr. Geyman's location.

Trained for his job less than a year ago, he admitted it "was a bit scary" the first time he took the controls.

Now, with a click of a computer's mouse, he easily makes minute adjustments at various points of the facility, which is largely automated, to squeeze out a high volume of ethanol.

"Based on the samples, I make adjustments everywhere. I can turn up the heat, reduce the corn flour, add steam, add water, add enzymes," he said.

"But you have to remember that when you change something, even through very subtle movements ... you do so knowing that 10 minutes later you'll have to battle something at the other end that's been

Regional ethanol plants

Ohio

- Liquid Resources of Ohio, Medina, 3 million gallons, uses waste beverage
- The Andersons Marathon Ethanol LLC, Greenville, 100 million gallons, corn feedstock*
- Poet Energy, Marion, 65 million gallons, corn feedstock*
- Poet Energy, Fostoria, 65 million gallons, corn feedstock*
- Poet Energy, Leipsic, 65 million gallons, corn feedstock*
- Greater Ohio Ethanol LLC, Lima 54 million gallons, corn feedstock*
- Coshoctan Ethanol, Coshoctan, 60 million gallons, corn feedstock*
- VeraSun Energy, Bloomingburg, 110 million gallons, corn feedstock*

Michigan

- Global Ethanol/Midwest Grain Processors, Riga Township, 57 million gallons a year, uses corn feedstock
- Poet Energy, Caro, 52 million gallons, corn feedstock
- The Andersons Albion Ethanol LLC, Albion, 55 million gallons, corn feedstock
- U.S. BioEnergy Corp., Lake Odessa, 50 million gallons, corn feedstock
- Marysville Ethanol LLC, Marysville, 50 million gallons, corn feedstock.*
- Liberty Renewable Fuels LLC, Ithaca, 110 million gallons, corn feedstock*

*Under construction

affected.”

Bill Welever, of Toledo, a shift supervisor at the plant, came to Global Ethanol from the Sunoco refinery in Toledo. His background helped, but he was surprised at the differences in the plants, despite that both produce fuel for vehicles.

“It’s less stressful here than at the refinery,” he said. “It’s less toxic and not as hazardous working here.”

It may be a little lonely, though. The plant’s 42 workers, who are paid \$35,000 to \$70,000 a year depending on skill level, work 12-hour shifts for seven days straight. So at any given time, there are rarely more than seven workers in the plant.

Once fermentation is completed, liquid is pumped into a “beer well” tank to separate the mixture and send various parts to different locations.

190-proof ethanol

The liquid goes to a distiller, which yields 190-proof ethanol. The solids move into a separate tank, then to a centrifuge to extract water, and then to an oven to produce dried distillers grain, which resembles fine cornmeal.

Meanwhile, the ethanol is put through a special sieve which removes any remaining water, leaving 200-proof ethanol.

Afterward, in two 600,000 gallon storage tanks nearby, a 5 percent mix of gasoline is added to comply with federal law requiring the ethanol to be made undrinkable. Any ethanol not rendered undrinkable is subject to a \$17-a-gallon tax.

Not that anyone would drink 200-proof alcohol. A drop left on one’s hand would spread a burn-like wound as it sucks the moisture from the body, officials said.

“Believe me, you don’t want to get any of it on you,” said Adam Gibson, safety manager at the plant.

Nearly 80 percent of the ethanol from the plant is loaded into a string of rail cars, each holding 29,000 gallons, and shipped east where refiners mix it with gasoline. The other 20 percent is loaded into trucks that hold 8,000 gallons.

Ethanol is shipped daily using 10 to 17 trucks. Six rail cars a day are loaded, but are moved out only every two or three days.

Most of the plant’s output is sold to about 20 large refiners, including Sun Co., but also smaller amounts (about 100,000 gallons) are sold to mom and pop distributors, Mr. Fisler said.

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