Ethanol plant preview of Energy Center

By Kathryn Burke
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Long lines of silver, yellow, white, blue and red pipes span the length of the Western Plains Energy ethanol plant east of Oakley.

The intricate system delivers steam, water, caustic materials and the corn and milo grain mixture that is used to make ethanol.

Though larger than an ethanol plant planned for west of Goodland, the Oakley plant is a preview of one part of the new Goodland Energy Center slated to open a year from this fall. The three-plant complex at Caruso will combine a "co-generation" power plant with ethanol and biodiesel fuel production, using steam from the power plant to heat materials at the other two.

Making ethanol at Western Plains, at a dusty railroad siding known as Campus, starts when a line of 75 to 80 tractor-trailer trucks per day that deposit milo and corn into a large silo on the east side of the factory.

The mixture is pulled into a holding bin set up with two hammer mills for grinding.

Mike Erhart, chief executive officer and general manager of Western Plains, said milling the milo and corn produces a white dust that is collected and recycled back into the silo.

The ground-up mixture is then moved through an auger into the main plant. There, hot water and enzymes are added to the grain in a mechanical mixer, turning it into a mash.

The mixture then goes through strainers and is passed into a hydroheater. The hydroheater shears the starch molecules, Erhart said, breaking them down into smaller pieces.

From there, the mash is moved into a cook tube, he said, where the high temperatures swell the molecules.

After that, the stuff goes into a liquefaction process where enzymes are added for the final breakdown into simple sugars for fermentation. The mixture is chemically and mechanically broken down through each step.

The mash is then cooled. Yeast is added in large tanks, where the mixture is turned.

Because the yeast is susceptible to disease, Erhart said, they use caustic soda to sterilize the lines and containers between batches of ethanol. Each batch, he said, produces about 500,000 gallons.

Yeast eats the sugar in the mash and produces carbon dioxide gas and alcohol, the same stuff that you drink.

When the process is complete, the product is then moved to a column where it is rained down. The mash is heated and the alcohol is evaporated and captured. The mash drops out to the bottom.

The alcohol is then sent into a rectifier, where heat is used to drive off more water, leaving nearly pure alcohol. The alcohol is put through a series of molecular sieves where the last 10 percent of water is driven off. The vaporized 200 proof alcohol is then condensed into a liquid. Before the alcohol leaves the plant, it is mixed with a denaturant so that it can't be consumed by humans.

Julie Staley, a lab employee at the Western Plains Energy ethanol plant near Oakley, adds drops of dye to a sample of the milo and corn mash. The sample contains yeast and when the yeast eats the dye, Staley can identify and count the microorganisms.

Erhart said the alcohol is taken off by trains and trucks for oil companies to add it to gasoline themselves.

He said they keep all of the alcohol outside of the building. Keeping it a safe distance from the rest of the plant helps protect against fire. He said keeping any potential fire outside of the building helps firefighters put it out, too.

The remaining mash is separated into a solid, the used-up grain, and a liquid, containing fat and protein. The two are then combined again to create a wet-cake form of distillers grain, a livestock feed. Erhart says it's a "coproduct," a valuable commodity in it's own right, not a "byproduct" of the process.

The plant opened its doors on Jan. 29, 2004. It run 24 hours a day, seven days a week with only six days a year off.

Erhart said the plant was started by a group of investors from around the area who wanted to start an ethanol plant in northwest Kansas.

Corn and milo used in ethanol production are trucked into the plant from a 75-mile radius.

The benefits of the location, Erhart said, include access to the Union Pacific Railroad and I-70. A good water supply helps, too.

"Location is extremely important to an ethanol plant," he said.

Unit strives to keep clean

Environment remains top priority at Oakley facility

The Western Plains Energy ethanol plant east of Oakley boasts meeting or exceeding all environmental standards.

Mike Erhart, chief executive officer and general manager, said the plant is environmentally friendly.

All of the water used in the process is recycled.

Water is classified as contact water or noncontact water, he said; the contact water actually touches the grain.

The noncontact water is taken to a cooling tower and reused in the plant.

Contact water is recycled by purifying it and then reusing it.

Some of the plant's water is taken to a nearby polishing pond, where algae and bacteria eat the minerals and clean the water.

When the process is finished, the water can be released back into a stream.

The "gray" contact water is run through a machine called a methanator.

Bacteria in the machine make the water suitable for use.

After going through a filter, Erhart said, the water is reused in the plant.

The bacteria in the methanator is given calcium chloride and other "vitamins" to keep it alive.

Some of the recycled water is used for landscaping or in a water fountain that adorns the front of the plant next to the main office.

The methanator produces gas that is then used as a source of energy to help run the plant.

"I'm at the cutting edge of the new technology that comes along," Erhart said, adding everything in the plant meets or exceeds Environmental Protection Agency standards.

Erhart said they meet standards from the Kansas Department of Health and Environment, which monitors everything, taking the majority of the responsibility for regulating the plant; the Federal Railroad Administration on loading and handling rail cars; the Bureau of Alcohol, Tobacco, Firearms and Explosives, for ensuring the alcohol is denatured; and the state and federal clean air acts.

"We're a very regulated industry," he said.

Carbon dioxide produced in fermentation is taken into a scrubber.

He said it takes out the impurities and then allows plain, clean carbon dioxide gas to escape.

The plant releases the carbon dioxide, normally a greenhouse gas which contributes to global warming.

Erhart said they are just releasing what the corn and milo already had, not producing more than what already existed.

He said many ethanol plants capture the gas to use for carbonation in the beverage industry.

Eventually, he said, the Campus plant may buy equipment to save the carbon dioxide.

Erhart said the plant is kept clean, too.

"This plant is spotless," he said.

Modern factory runs with small crew

Automated machines make additive

Walking up to the main entrance at the West Plains Energy ethanol plant east of Oakley, three large round structures butt out of the right side.

To the left, three more bins rise to the top of the building.

The door opens into a plant populated only by the machinery.

Save the few people working in the glass-windowed control room, the plant is empty.

A crew of three is all that's required to run the plant.

Aaron Betz, shift supervisor, said the night shift has just three people watching and adjusting the equipment.

The plant employs about 30 people total, in administrative, shipping and receiving, maintenance and lab staff.

Stationed behind a computer screen, Betz can pull up any floor plan or configuration of plant equipment he needs.

Aaron Betz, shift supervisor at the Western Plains Energy ethanol plant near Oakley, can check on any area of the plant from his desk. Monitors on computerized tanks and equipment alert him to problems and he sends someone out to investigate. The plant is run at night on a crew of three.

Photos by Kathryn Burke/The Goodland Star-News

Long color-coded lines match the long lines of pipes stretched across the plant.

Betz said he can check temperatures, pressures and other variables from his station.

One of the three employees can leave the office and check machinery in person if a problem comes up.

Mike Erhart, chief executive officer and general manager, said during the day shift, a small crew of lab employees takes samples and checks the mash mixture.

They focus on the yeast to ensure it stays alive for the process.

Erhart said technicians will treat any diseases with penicillin.

Lab employees check the mash to ensure they can get the most alcohol out of the mixture, too.

Erhart said the plant runs on tight parameters, making sure temperatures, pressures and other variables stay in check.

"A one-degree change at the front could go up to five degrees at the back," Betz said. "Thing can happen very quickly.

"By the time it gets outside, it's exactly the way it should be."