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Gasification may be key to U.S. ethanol

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The government awarded \$385 million in grants last week aimed at jumpstarting ethanol production from nontraditional sources like wood chips, switchgrass and citrus peels. What's surprising is that half of the six projects chosen will use a process first discovered almost a century ago to turn coal into a gas.

President Bush set a goal in his State of the Union address of producing 20 percent of the nation's fuel supply from renewable resources by 2017. Much of those supplies will come from the conversion of corn into ethanol, fueled by a boom in new ethanol plant construction that's already under way.

But Thursday's forecast from the Agriculture Department that half of this year's U.S. corn crop will be consumed by ethanol producers has raised red flags. Critics say surging demand for corn could push up prices of everything from corn-sweetened soft drinks to meats, since corn is a common feed ingredient for livestock.

That helps explain why the Energy Department is placing a big bet on a process called gasification. Long hailed as a more environmentally friendly way to turn coal into electricity, the process might also provide a faster and eventually cheaper way to produce ethanol from a variety of renewable sources collectively known as biomass, some scientists say.

For corn-based ethanol plants, the process of producing ethanol is as simple as brewing beer: sugars are extracted from the corn kernels and then enzymes are added to ferment it into alcohol. But biomass feedstocks don't easily give up their starches, so more expensive steps are needed to ferment cellulose in high-pressure chambers that have limited amounts of oxygen, according to Lanny Schmidt, a University of Minnesota chemical engineer.

Energy Secretary Samuel Bodman pegged the current cost of gasification as being about twice as much as the average \$1.10 per gallon cost at corn-based ethanol plants.

A gasifier turns plant material into a synthesis gas consisting mostly of carbon monoxide and hydrogen. The "syngas" then could be turned into a variety of fuels including ethanol, hydrogen and environmentally friendly versions of diesel or gasoline, Schmidt said.

"These gasifiers are some high-tech stuff with high pressures and some more complexities," he said. "But they're probably more versatile at the end of the day to modify them as the demand and supplies change."

Gasification is a fairly simple process, based on chemistry developed in the 1920s, said Robert Brown, an Iowa State University chemical engineering professor and director of the school's Office of Biorenewables Programs.

The syngas produced during gasification mixes more readily with chemical catalysts, so it could be more easily turned into other fuels, chemicals and materials. Just add steam and you could produce hydrogen to power a fuel-cell vehicle, Brown said.

Of the six companies awarded U.S. Department of Energy grants, three will use versions of fermentation technology. But two others will use gasification and one will use a hybrid of both technologies:

- Alico Inc., a LaBelle, Fla.-based agribusiness company, would get up to \$33 million to turn yard waste, wood waste and citrus peel into syngas, which would then be converted into ethanol, electricity and hydrogen.

- Range Fuels Inc., of Broomfield, Colo., would get up to \$76 million for a plant near Soperton, Ga., to convert timber scraps into syngas to make ethanol and methanol.

- Abengoa Bioenergy, a St. Louis-based division of Spain's Abengoa SA, would receive up to \$76 million for an 11.4 million gallons-per-year plant in Colwich, Kan., that would use both biochemical and thermochemical processes to convert corn stalks, wheat straw and switchgrass.

The Energy Department helped demonstrate the viability of gasification in the mid-1990s when it awarded Georgia-based FERCO \$9.2 million to help build a power plant running on wood chips. By 2001, the \$18 million plant in Burlington, Vt., was generating more than 200 megawatt-hours of electricity a day.

To compete in the marketplace, companies will have to make sure their feedstock supplies are consistent, do more research into catalysts that turn syngas into fuels, and develop better materials to contain the thermochemical reactions, according to the Energy Department.

The syngas would have to be cleaned and conditioned to remove contaminants, which is an expensive task. Energy officials say companies will have to bring down those costs if they're to compete in the market.

Mark Paster, a U.S. Department of Energy technology development manager who's studying ways to turn biomass into hydrogen, said both fermentation and gasification "are very viable and both routes continue to be researched and developed."

Paster said biomass helps reduce greenhouse gasses, so any method that can reach commercial viability will be better than one based on fossil fuel.

"There may not be a single winner, just like there's no winner in how we produce electricity," he said. "We do it in a variety of ways."