Biofuels news

Volume 3, Number 1 Spring/Summer 2000

Focus On...

Corn Stover: Colloquies Explore Key Resource for Cellulosic Fuels and Chemicals

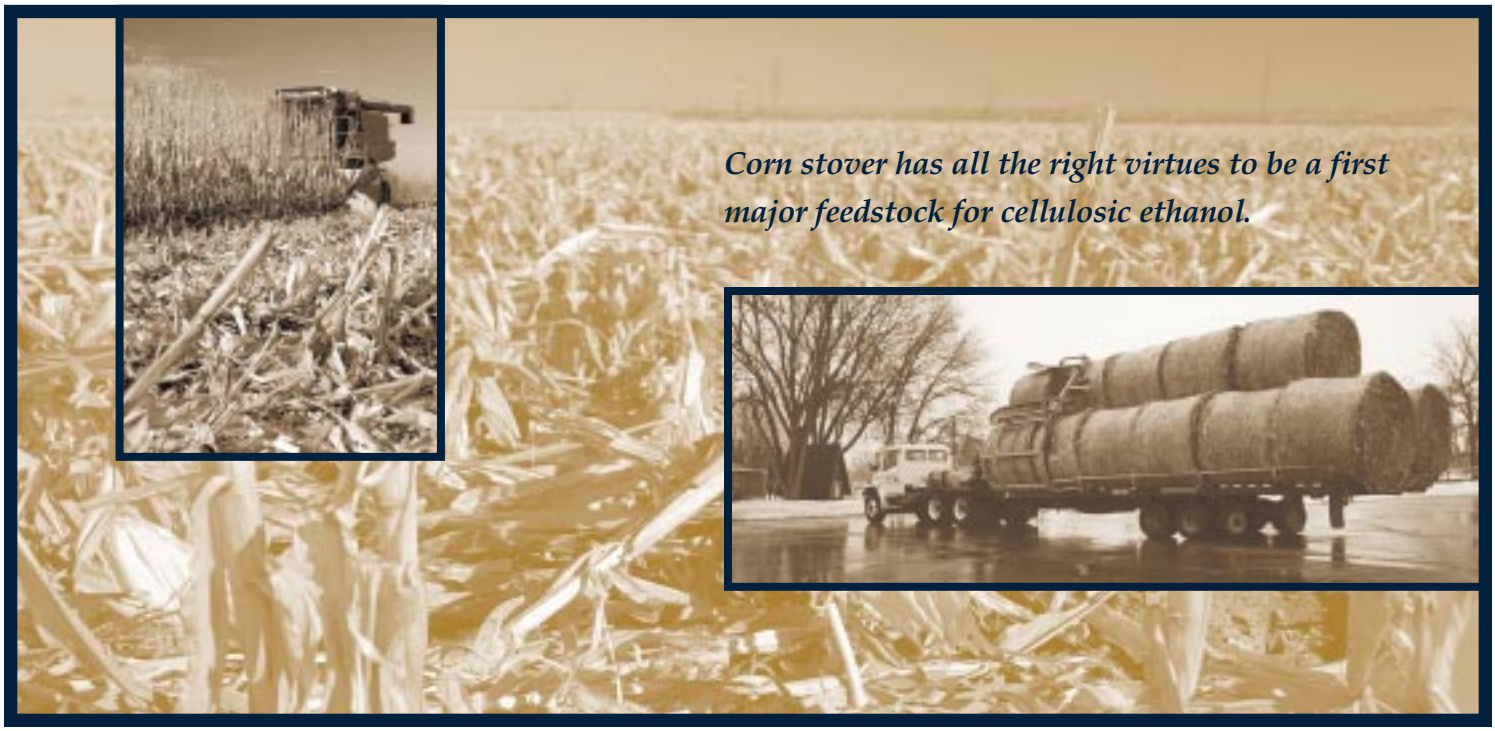
As biomass processing expands beyond just making ethanol for fuel oxygenate from high-value corn kernels, what better resource is there to turn to for cellulosic biomass than the corn stalks, husks, and cobs known as corn stover from which the kernels are taken? Most corn stover is now plowed under, but a significant portion could be easily removed without reducing nutritive or organic value contributions to the soil. Removing stover would actually improve the nutrient balance reducing the need for chemical fertilizer use. Potential corn stover supplies are plentiful near existing corn-to-ethanol refineries.

With help from U.S. Department of Energy national laboratories, the U.S. Department of Agriculture, universities, and private industry, great strides have been made recently in technology for hydrolyzing and fermenting both cellulose and hemicellulose to create an inexpensive-feedstock sugar platform to produce ethanol and other valuable chemicals from cellulosic materials such as corn stover.

An Iogen Corporation biomass-to-ethanol demonstration plant in Ottawa, Ontario, will produce ethanol from corn stover, wheat straw, and switchgrass. Scheduled to start up in the next few months, the Iogen plant is generating considerable excitement. Its success will be a big step in moving cellulosic ethanol from something expected in the future to a very real technology that is here today.

Because DOE sees stover as a strategic resource for making fuels and chemicals, its Biofuels Program sponsored a series of colloquies in early 2000 to help identify key issues to consider in facilitating development of corn stover processing for conversion to ethanol. The four colloquies each brought together representatives of the various stakeholder industries that would be involved in corn stover processing. Taking advantage of the stakeholders expertise, the discussions went through all phases of the production process to identify

continued on page 2



Corn stover has all the right virtues to be a first major feedstock for cellulosic ethanol.

NREL/PIX 04391, 02268, 06017

concerns, opportunities, and key progress needed. Stakeholders included:

- Biomass suppliers
- Life science companies
- Agri-pulp suppliers
- Process engineers
- Chemical processors
- Fuel ethanol producers
- Corn refiners
- Agriculture machinery manufacturers
- Enzyme suppliers.

To avoid limitations on discussion because of competition concerns, each colloquy had only one representative per stakeholder sector. In addition to 7 to 10 stakeholder participants, the colloquies included spectators from the USDA and DOE and its laboratories and from members of the environmental, grower, financial, or economic development communities. The four colloquies were: February 9 in Cedar Rapids, Iowa; February 16 in Bloomington, Illinois; February 23 in Lincoln, Nebraska; and March 8 in Minneapolis, Minnesota. The report on the colloquies will be available on the Biofuels Web site http://www.ott.doe.gov/biofuels/ by early August 2000.

Colloquy participants were pleased to be asked their opinions and several commented that they were surprised by how much interest in stover processing there was from the other stakeholder sectors. Indeed, all of the sectors appeared ready to proceed. Growers see an opportunity to become more profitable without government subsidy. Process engineering companies see expanded markets that they could serve well. Estimates of stover that could be made available without nutrient loss or erosion concern are sufficient to support a very large industry. Several companies appeared eager to bring the next plants on line if Iogen's venture is successful.

Experience may be necessary to determine whether new collection equipment should be developed. Growers said that they needed specially designed equipment and that this would significantly reduce collection costs. Equipment manufacturers said that they were reluctant to invest in new equipment design until the existence and size of the market is proven. They said they feel that existing equipment models should be adequate and suggested that equipment now sold in Europe for forage collection may be suitable. Comments from colloquy participants suggest that the biggest hurdles for a stover-to-ethanol industry are cost-effective enzyme production and keeping the cost of collection and processing cost low enough to achieve a marketable product price. On the other hand, enzyme producers were excited by the prospect of an enzyme market second only to detergents.

continued on page 4

Genencor Subcontract Could Reduce Enzyme and Therefore Bioethanol Cost

The U.S. Department of Energy (DOE) has awarded a one-year, $7-million subcontract to Genencor International for research into developing less expensive enzymes that will reduce the cost of converting plant material into fermentable sugars—and remove a key barrier to development of a corn stover-to-bioethanol industry as identified by the recent DOE colloquies.

Cheaper enzymes could lead to "biorefineries," producing fuels, chemicals, and other materials from renewable biomass, including agricultural and forestry residues. These enzymes are needed to unlock the carbon in plants, as oil refineries today unlock the carbon in petroleum, to produce a wide variety of products.

The potential of bioenergy is huge. President Clinton's Bioenergy Initiative, announced in August 1999, calls for tripling the use of bio-based products and bioenergy in the next decade. This could create billions of dollars in new income for farmers and rural America. At the same time, it would reduce greenhouse gas emissions by tens of millions of tons of carbon equivalent.

Genencor's research plan suggests a way to reduce the cost of enzymes to about 5 cents per gallon of ethanol produced.

The Genencor research will build from DOE's development of a body of technology for using certain enzymes to convert wood chips, corn stalks, and other biomass "waste" to ethanol. Genencor, headquartered in Palo Alto, California, is a top supplier of enzymes (biocatalysts) for the cleaning, grain processing, and textile industries.

According to a DOE analysis, if the enzymes needed to convert biomass to ethanol can be bought for less than 10 cents per gallon of ethanol produced, the cost of making ethanol could drop as low as 75 cents a gallon—close to competitive with the current cost of producing a gallon of gasoline. Genencor's research plan suggests a way to reduce the cost of these enzymes to about 5 cents per gallon of ethanol produced.

Research into low-cost enzymes and bringing the cost of ethanol to around 75 cents a gallon are among the primary technology goals announced by DOE in November, 1999, when Assistant Secretary Dan Reicher outlined the department's Bioenergy Initiative plan of action.

In the Spotlight

State Workshops Advance DOE-Ethanol and RBEP Goals

Following up on seven highly successful state workshops during 1999, the 2000 Ethanol Workshop Series will bring workshops to an additional eight states to help catalyze efforts to promote bioethanol production and to develop new markets for ethanol as the industry grows. Jointly sponsored by the U.S. Department of Energy Biofuels Program and its Regional Biomass Energy Program, the workshops seek to help expand the role of both corn ethanol and cellulosic ethanol in the economies of the particular states.

The full-day workshops are tailored to the individual states, with agendas and invitees selected by local organizing committees. Typically, however, they will cover the current status of ethanol production in the state during the morning, highlighting issues such as impacts on air quality and groundwater and the availability of feedstock material. The afternoon sessions generally start with a focus on the opportunities for producing ethanol from cellulosic material such as stover and other agricultural residue rather than corn kernels. All of the workshops focused on actions needed, assigned responsibility for those actions, and set up steering committees to coordinate them.

Regional Biomass Energy Program Co-Managers Michael Voorhies and Ann Hegnauer both remarked that they were "very impressed with the success of the workshops. Word is getting out about them and important progress is coming from them." As an example, recent Wisconsin passage of legislation for ethanol production tax credits can be almost directly attributed to actions taken following the 1999 Wisconsin workshop and two states have already set up follow-up workshops. With regard to planning for cellulosic ethanol production, Voorhies said, "the workshops are playing a critical role—identifying resources, locations, and barriers to overcome now, rather than waiting for the technology to be ready."

Attendees typically include a mix of about 50 policy makers, growers, economic development program managers, energy and environmental officials, existing ethanol producers, and other stakeholders. Presenters might be drawn from the state economic development, energy, and environmental program managers along with technical experts on ethanol production and cellulosic ethanol technology.

The Ethanol Workshop Series has featured many inspiring speakers. Pictured from top to bottom are Eric Vaughn of the Renewable Fuels Association, Ralph Groschen of the Minnesota Department of Agriculture, and Joe Haines of the Ohio Department of Agriculture.

The first workshop of the year 2000 program was held in Portland, Oregon in April, 2000, for both Washington and Oregon. Timber residue and wheat straw were identified as the key resources and internal use and shipment to California as the key markets. Pinpointed actions identified and assigned included work with the state legislatures and selection of best plant locations. At the May Ohio workshop in Columbus, corn starch and corn stover were identified as the key resources and internal use and shipment to the Northeast as the key markets. Virtually everyone at the June Colorado workshop signed up to work on future activity.

The remaining 2000 workshops are:

- Michigan (Lansing, August 15—follow-up to 1999 workshop)
- Alaska (Ketchikan, August 29—follow-up to 1999 workshop)
- Indiana (Indianapolis, September 12)
- New York (Albany, September 14)
- Pennsylvania (Harrisburg, September 19)
- South Carolina (Columbia, September 21)
- Texas (Austin, September 27).

The Ethanol Workshops are organized for DOE by consultants Bryan & Bryan Inc. of Cotopaxi, Colorado. A Web site they set up for the workshop program (http://www.bbiethanol.com/doe.htm) includes agendas and registration forms for upcoming workshops. Or call the Regional Biomass Energy Program at 202-586-8014 to ask about an already scheduled workshop or to set one up for your state.

The colloquies reiterated the immediate opportunity at dry-mill ethanol plants for additional processing of distillers' dry grains (DDG). Extracting sugars from the cellulosic material in DDG can increase ethanol production by 6%, providing an excellent opportunity to gain experience processing cellulosic material on a small scale without major investment or process redesign. The colloquies also affirmed potential substantial cost savings and environmental benefits from using fiber from corn stover as "agri-pulp" to substitute for hardwood pulp in paper manufacture.

DOE Ethanol Program Manager Gerson Santos-Leon said, "We see four main questions as to whether a strong corn stover-to-ethanol industry can develop.

1) What conditions are necessary for growers to collect the stover?
2) What conditions are necessary for stover to be stored and delivered?
3) Can the process for producing ethanol from stover be economic?
4) Are there adequate markets for the ethanol?

The colloquies helped confirm positive answers to the first two questions. There seems to be good consensus that a price of $25 to $50 per ton for stover could generate very large quantities of stover within 50 miles of a processing plant. The colloquies also made it clear that demonstration of economic processing is the key step at this time, so a lot of eyes are on the Iogen project. With regard to the last question, policy issues such as how California and New York replace MTBE, possible changes to the Clean Air Act oxygenate requirement, and the fate of the proposed renewable fuel mandate may be overriding factors. However, the colloquies did warn us that we need to consider local markets. Regional surpluses can develop even with a good overall market, so co-products will become increasingly important considerations."

Did You Know?

Upcoming Conferences and Events

Sixth Diesel Emissions Reduction Workshop
August 20-24, 2000 San Diego, CA
Contact: Andreene Witt 865-241-6217

The 3rd Annual Ag Fiber Technology Showcase
October 4-6, 2000 Memphis, TN
Contact: AgroTech Communications, Inc. 901-309-1668

Short-Rotation Woody Crops Operations Working Group, Third Biennial Conference
www.esf.edu/outreach/conted/conferences/woodycrops.htm
October 10-13, 2000 Syracuse, NY
Contact: ESF Continuing Education 315-470-6891

New Crops/New Uses Joint Annual Meeting
October 15-17, 2000, St. Louis, MO
Contact: Rob Myers 573-449-8638

9th Biennial Bioenergy Conference—Bioenergy 2000
October 15-19, 2000, Buffalo, NY
Contact: Christine Caffo 202-624-8464

23rd Symposium on Biotechnology for Fuels and Chemicals
May 6-9, 2001, Breckenridge, CO
http://www.nrel.gov/biotech_symposium/ or Liz Willson 303-384-7750

page 4

DOE/GO-102000-1095 Past issues and other related information are available on the Biofuels Program Web site http://www.ott.doe.gov/biofuels/

Produced for the National Biofuels Program, Office of Fuels Development, U.S. Department of Energy, 1000 Independence Ave., S.W., Washington, D.C. 20585-1121.

Biofuels news

National Renewable Energy Laboratory
National Alternative Fuels Hotline
1617 Cole Blvd, MS: 1633
Golden, CO 80401

NONPROFIT
U.S. Postage
PAID
Permit No. 258
Golden, Colorado