



Biofuels_{news}

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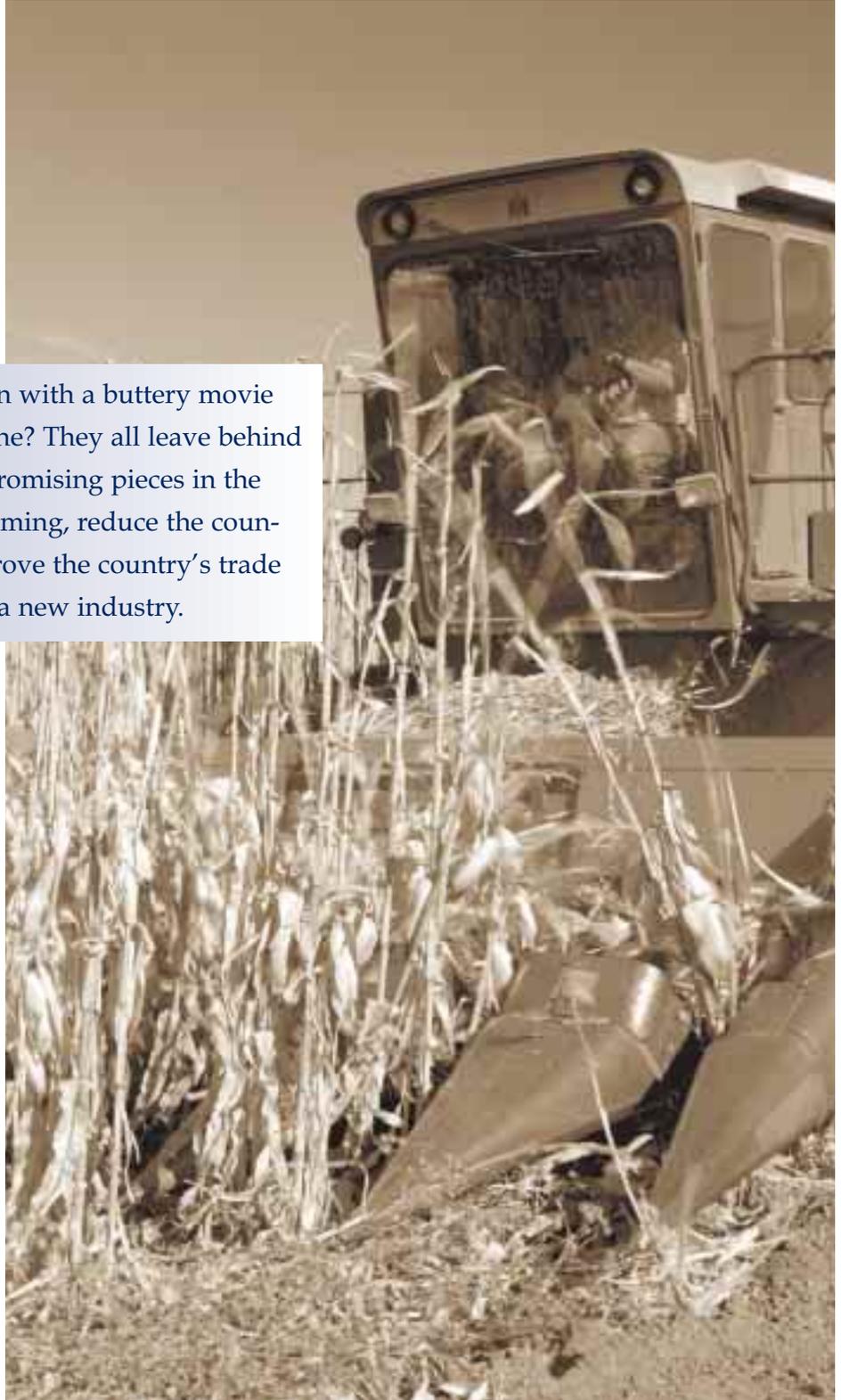
FOCUS ON...

It Takes an Industry

Most of the pieces for an efficient, profitable biomass-to-fuel enterprise are already here, but it will take cooperation, investment, and innovation to complete the puzzle.

What does succotash have in common with a buttery movie snack, or hominy grits with moonshine? They all leave behind a substance that is among the most promising pieces in the puzzle of how to decrease global warming, reduce the country's dependence on fossil fuels, improve the country's trade balance, and create American jobs in a new industry.

Corn stover, the stuff left in the field after farmers ship their crop to market, represents the largest available feedstock in the United States. It is a rich source of potential energy once the cellulose is converted to ethanol. As with many environmentally friendly solutions, the key is economics. When it becomes profitable to turn the corn leavings into usable fuel, the enterprise will attract the industrial investment to build and operate the infrastructure needed to harvest, transport, process, and distribute this alternative energy source. *continued on page 2*



Warren Gretz, NREL/PIX 03555

Warren Gretz, NREL/PIX 04400

The solution hinges on technology. Recent advances in research supported by DOE are moving this environmental vision closer to industrial reality. And corn stover is just the beginning. Other feedstocks, such as wood wastes, paper, hay, straw, sugarcane, and bagasse offer alternative energy opportunities as well. Two things, however, argue convincingly for corn stover as the logical starting place for further development—volume and experience.

U.S. farmers plant about 80 million acres of corn each year, with a potential stover harvest of some 120 million dry tons. This is nearly four times greater than the biomass available from wood waste and paper, the next largest feedstock category. Using the entire harvested corn crop could further reduce new investments in infrastructure, utilities, and overhead to support the conversion process. Plus, more than 90% of the ethanol now produced in the United States comes from corn kernels. Thus, processors are already familiar with production techniques, methods, and equipment, and need only expand to accommodate stover, rather than build anew. These two facts alone significantly reduce the risk producers must take in what is perceived as the highly capital-intensive business of converting cellulosic material into a petroleum substitute.

The first step toward a viable cellulosic ethanol industry is to better understand and clarify each player's role in the process. The farming and forestry communities provide the raw product; enzyme producers formulate the enzymes needed to aid the conversion of cellulose to glucose. The processing industry must then make the investment in the infrastructure and equipment necessary to make the ethanol.

To succeed, the cost of the cellulose-to-ethanol process must become competitive with petroleum distillation and distribution. The catalyst in this formula is to reduce the cost of the enzymes. If the producers are willing to make the necessary research and development (R&D) investments, they will be looking at a \$400 million annual market. First, however, they need a committed customer base and the promise of an attractive return on their investments.

"If enzymes could be readily purchased by a biomass conversion entity at a cost-competitive price, it would be a large advancement for the industry," says David Glassner, technical manager of the Biofuels Program at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. Heightened interest in the corn stover-to-ethanol industry could spur collaborations among the enzyme producers, corn producers and processors, DOE, and NREL to develop more affordable enzymes.

Currently, the cost of enzyme production is approximately \$0.45/gallon of usable ethanol, according to Jim Hettenhaus, president of Chief Executive Assistance, in Charlotte, North Carolina. A recent assessment headed up by Mike Himmel, senior biochemist at NREL, looked at technical strategies to boost enzyme production and concluded that proven tools and techniques used in other enzyme systems could reduce the cost of enzymes to less than \$0.10/gallon of ethanol.



Corn stover bales in Harlan, Iowa

PIX 06017

Improvements in other links of the cellulose-to-fuel chain would offer even further economies-of-scale, and sweeten the pot for those willing to risk the needed investment in infrastructure and R&D. According to Marie Walsh, economist at Oak Ridge National Laboratory in Tennessee, a DOE-sponsored *Ethanol Evolution Study* sheds some light on what's needed on the front end of the conversion process.

The study estimates that corn stover can be delivered to a processing plant at a cost of \$33–\$40/dry ton in regions where corn is a major crop. Each acre of harvested crop produces as many as 1.5 tons of stover. Walsh's estimate is validated in practice by an Iowa plant that uses corn stover for chemical production and pays \$30-35 for delivered raw product.

Of course, abundance of stover and proximity to processing facilities play a major role in delivery costs. If the cost of raw feedstock can be lowered by improvements

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in collection and handling equipment, the ethanol investment opportunity will become even more attractive to investors. Others suggest forming traditional farmers' co-ops as an additional means of shaving costs. The incentive is certainly there: a facility processing 2,000 dry tons currently represents a \$30 million annual market for a product largely considered waste.

Even though DOE is currently funding R&D of new enzymes and other measures to lower conversion costs, the solution must ultimately emerge from the private sector. DOE's Office of Fuels Development will be issuing a Request for Proposals to provide partial funding for studies to evaluate the cost of expanding processing facilities for cellulosic ethanol production. The studies will help identify economic opportunities for processors and enzyme manufacturers, and alternatives to improve feedstock collection and transportation.

The environmental advantages of converting feedstocks to fuel are relatively obvious. But the importance to national security is underscored by a March 10, 1998, letter to Senate Majority Leader Trent Lott. The letter was signed by General Lee Butler, U.S. Air Force; Robert McFarlane, former national security advisor; Admiral Thomas Moorer, former chairman of the Joint Chiefs of Staff; and James Woolsey, former director of the Central Intelligence Agency.

In part their letter stated: "...The first step in this [commercialization] process will center on reducing the cost and increasing the supply of ethanol as the feedstocks for its production are substantially expanded beyond the edible portions of corn to include biomass that is many times less expensive—e.g. corn stover and other agricultural, forest, and urban wastes. By early in the next century, if we can capitalize on recent laboratory and pilot plant breakthroughs and move toward commercialization, we can be producing a very substantial share of our transportation fuel from biomass...."

Clearly, the issue of biomass fuels is not solely a "green" concern, but one that spans the interests of industry, labor, international economy, agriculture, national defense and security, and every consumer in the United States. It is equally clear the solution lies in cooperation between these diverse (and occasionally adversarial) groups.

At least at this juncture, it appears the potential to develop an economical and profitable corn stover-to-ethanol conversion industry is the logical first step. For more on enzyme costs, see the Chief Executive Assistance web site: www.ceassist.com/economic.htm.



*Amounts produced that currently have no commercial use.



ON THE FEDERAL FRONT

Private-Sector Groups Support Ethanol Incentives

A dedicated coalition of private-sector elements presented a united front to the U.S. Congress recently to protect the ethanol tax incentive provision of the second Intermodal Surface Transportation Efficiency Act (ISTEA2). The original 1991 legislation, which provides federal funding for highways, included a provision for an ethanol tax incentive. A proposed amendment by Senator John McCain (R-AZ) would have stricken the

incentive, the chief subsidy mechanism to encourage a private biomass-to-ethanol industry.

In a 71-26 vote, the Senate reinstated the incentive at the urging of the private-sector group. The effort involved the American Bioenergy Association, Biomass Energy Research Association, National Corn Growers Association, Governors' Ethanol Coalition, Clean Fuels Development Coalition, and others. ISTEA2 ultimately passed the Senate with a 96-4 vote on March 12, and was sent to the House.

In addition, Representative Ray LaHood (R-IL) sponsored the Cleaner Burning Fuels Act of 1998 (HR 2489), which would extend the ethanol tax incentive program through 2007. Representative LaHood has mustered

significant bipartisan support among 70 of his colleagues. Meanwhile, Senator Richard Durbin (D-IL) is sponsoring S 1008, a companion piece to the House bill.

In an urgently worded letter to Senate Majority Leader Trent Lott, a group of former high-ranking government officials, including a chairman of the Joint Chiefs and a national security advisor (see "It Takes an Industry," p. 1) weighed in on the side of the legislation by strongly supporting the importance of converting biomass to usable fuel.

In part, the letter stated: "Sitting on only 3% of the world's reserves while using 25% of the world's oil, nothing could be more short-sighted than for Americans to abandon the incentives for producing transportation fuel from sustainable sources." The letter concludes with: "We would close, however, by pointing to the key importance of the national security considerations....Those reasons alone are enough to lead us all to urge in the strongest possible terms that the ethanol tax incentives be extended through 2007."

Governors Support Biofuels

One of the strongest and most effective supporters of ethanol as a significant transportation fuel in the United States is the Governors' Ethanol Coalition (GEC), which represents 21 states. Indiana Governor Frank O'Bannon chairs the group for the 1998 calendar year; Kansas Governor Bill Graves is vice-chair.

The GEC's long-standing goals, originally formulated in 1992, are to "...increase the use of ethanol based fuels, to decrease the nation's dependence on imported energy resources, improve the environment and stimulate the national economy." Additionally, the coalition seeks to "...encourage ethanol fuel production and use through research and market development efforts; and to make investments in infrastructure to support expansion of the ethanol market."

These goals will provide the underpinning for sessions at the next GEC meeting, to be held in conjunction with the 14th Annual Fuel Ethanol Workshop International, slated for July 7-10 in South Bend, Indiana.

Bob Harris, Nebraska Governor Ben Nelson's representative to the GEC, says, "The coalition is looking to build partnerships to work with other states and countries to increase production of ethanol from renewables and waste materials in their own regions." As part of that effort, the GEC has embarked on an international initiative, which now includes representatives from Brazil and Sweden. It anticipates expanding its scope with invitations to the premiers of all Canadian provinces to strengthen and develop international relationships. Shortly before the South Bend meeting, the GEC will participate in an ethanol summit in Mexico City. The goal of that gathering will be to encourage the use of ethanol and ethyl tertiary butyl ether (ETBE) as oxygenates in some of Mexico's gasoline.

For more information on the workshop, call Bryan and Bryan at 719.942.4353. For further information on the GEC, call Bob Harris (402.471.2867), Cheryl DeVol-Glowinski (317.232.8939), or Niles Parker (317.232.8970).



Frank O'Bannon

Woolsey Calls for Action

An enthusiastic panel of keynote speakers opened a recent Renewable Fuels Association conference in Albuquerque, New Mexico, each underscoring the importance of extending the ethanol tax incentive through 2007. Keynoters included James Woolsey, former director of the Central Intelligence Agency, U.S. Senators Chuck Grassley (R-IA), and Tom Daschle (D-SD), and U.S. Representative Jim Nussle (R-IA). The theme of the conference was Positioning Ethanol, ETBE and E85 for the 21st Century.

Many of the participating organizations at the conference echoed the tax-incentive message expressed by the speakers. These included the Governors' Ethanol Coalition, National Ethanol Vehicle Coalition, National Corn Growers Association, and others, who opened their presentations with support of reauthorizing the Intermodal Surface Transportation Efficiency Act (ISTEA2).

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DID YOU KNOW?

Many new reports and publications are available!

The Quincy Library Group has just completed the Northeastern California Ethanol Manufacturing Feasibility Study, which focuses on the use of trees removed from the forests for biomass to be converted to fuel ethanol. The study is available on the Quincy Library Group web site at www.qlg.org/public_html/act_acp/ethanol/feasibility.htm, or call Sally Neufeld at NREL at 303.275.3803.

The Governor's Ethanol Coalition has published its ethanol market study, *Drivers' Awareness, Attitudes, and Usage of Ethanol-Blended Fuel*, which discusses environmental and engine performance benefits that would encourage drivers to use ethanol-powered vehicles. For more information, call Ward Lenz, Iowa Department of Natural Resources, at 515.281.7018.

Argonne National Laboratory, Center for Transportation Research, released its study *Fuel-Cycle Fossil Energy Use and Greenhouse Gas Emissions of Fuel Ethanol Produced from Midwest Corn*. The study finds that the corn-to-ethanol fuel cycle for Midwest-produced ethanol used as both E85 and E10 outperforms that of conventional and reformulated gasoline with respect to fossil-based energy use and greenhouse gas production. For more information call the National

The Front Range Forest Health Partnership has produced the Phase I Feasibility Study to determine the environmental and economical feasibility of using wood wastes from forested and urban areas to produce fuel ethanol. For more information, contact Paula Volkin, project manager, Front Range Forest Health Partnership, 303.554.9530.

Alternative Fuels Hotline at 800.423.1DOE, or David Loos of the Illinois Department of Commerce and Community Affairs at 217.785.3969.

DOE's Energy Information Administration (EIA) has published the *Annual Energy Outlook 1998 with Projections through 2020*. This projection looks at the carbon emissions from energy consumption, and predicts the growth of E85 through the year 2020. This work also examines the need for market penetrations of more efficient equipment and less use of carbon-intensive fuels. For more information call EIA at 202.586.8800, or visit the web site:

www.eia.doe.gov/forecasting_index.html.

DOE's National Renewable Energy Laboratory has published *The Ethanol Heavy-Duty Truck Fleet Demonstration Project*, which evaluates ethanol-fueled truck progress. Archer Daniels Midland is one company that operates the new E95-fueled trucks. For a copy of the final report see the web site:

www.afdc.doe.gov/demoproj/hdv/htitle.html.

The National Corn Growers Association's (NCGA) 1998 *The World of Corn* has just been published in a color, reader-friendly format. "Readers will see right away why *The World of Corn* is the authoritative annual report on America's top crop," says President Ryland Utlaut in NCGA's *News of the Day*.

Contents include current acreage and harvest statistical data, usage, exports, values, research, consumption trends, and more. *The World of Corn* is available on the NCGA web site: www.ncga.com.



Errata: In the Winter 1998 issue of Biofuels News, phone numbers for two Regional Biomass Energy Program representatives were incorrect. The correct numbers are:

Northwest Region Contact: Jeff James 206.553.2079
Western Region Contact: Jeff Graef 402.471.3218

Industry representatives also stressed the importance of continued progress of biomass-to-ethanol commercialization, and opening up ethanol markets, especially in California. DOE's John Ferrell and David Rodgers, as well as John Sheehan of the National Renewable Energy Laboratory and Jerry Hadder of Oak Ridge National Laboratory, made presentations on the biofuels front. Other speakers detailed in-progress technology developments, including sugar, wood waste, and rice straw ethanol conversion methods.

Ferrell discussed the Office of Transportation Technology's

program objectives, current partners, and potential partnerships within the Biofuels Program. He also reviewed the Biofuels Program's 1999 budget request, which could grow more than \$19 million. The program includes ethanol production, biodiesel, feedstock development, and regional biomass energy programs.

In his keynote address, Woolsey stressed the influence of biofuels development on American security, global climate change, and third-world dependence on oil. He said that DOE's *Five Laboratory Carbon Reduction Study* "...makes it quite clear...that the fuel of

interest with respect to this global warming insurance, is ethanol derived from cellulosic biomass."

Woolsey closed his speech by expressing support for "...extending the tax credit for renewables; making the blenders' credit non-taxable and available to drivers; promoting ETBE, E85, and flexible fuel vehicles; creating a joint team in the government to move toward biorefineries, to help a broad range of products be produced from biomass; supporting Governor Nelson's Fuels for America Program; and more research and development on genetic engineering."

Upcoming Conferences and Events

4th National Clean Cities Stakeholder Conference & Exposition

May 31–June 3, 1998 Washington, DC

Contact: Clean Cities Hotline 800.CCITIES

1998 Corn Utilization and Technology Conference

June 1–3, 1998 St. Louis, Missouri

Contact: Amy Mercer 314.275.9915 ext. 118

14th Annual Fuel Ethanol Workshop International & Tradeshow

July 7–10, 1998 (date change from last issue)

South Bend, Indiana

Contact: Bryan & Bryan 719.942.4353

Governors' Ethanol Coalition Meeting

(Held in conjunction with the Fuel Ethanol Workshop)

June 7, 1998 South Bend, Indiana

Contact: Niles Parker 317.232.8970

BioEnergy '98 "Expanding Bioenergy Partnerships"

October 4–8, 1998 Madison, Wisconsin

Contact: Fred Kuzel 312.407.0177

