



# AG INNOVATION NEWS

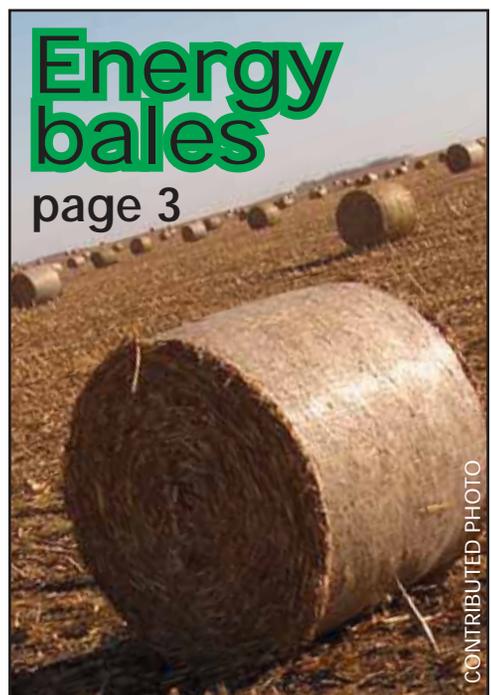
The newspaper of the Agricultural Utilization Research Institute

## Corn tops

Benson  
company  
stitches  
corn-based  
Ingeo shirts  
page 4



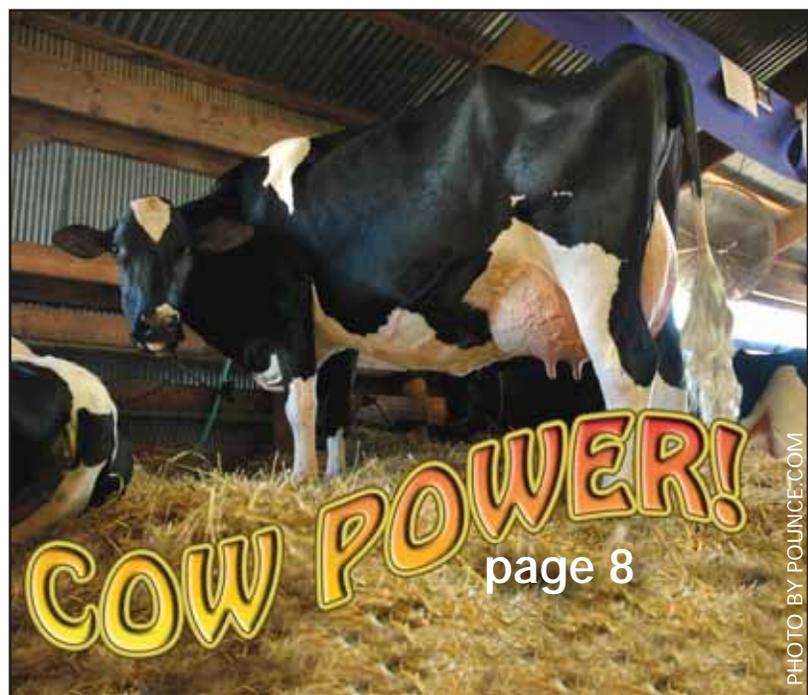
PHOTO BY ROLF HAGBERG



### Energy bales

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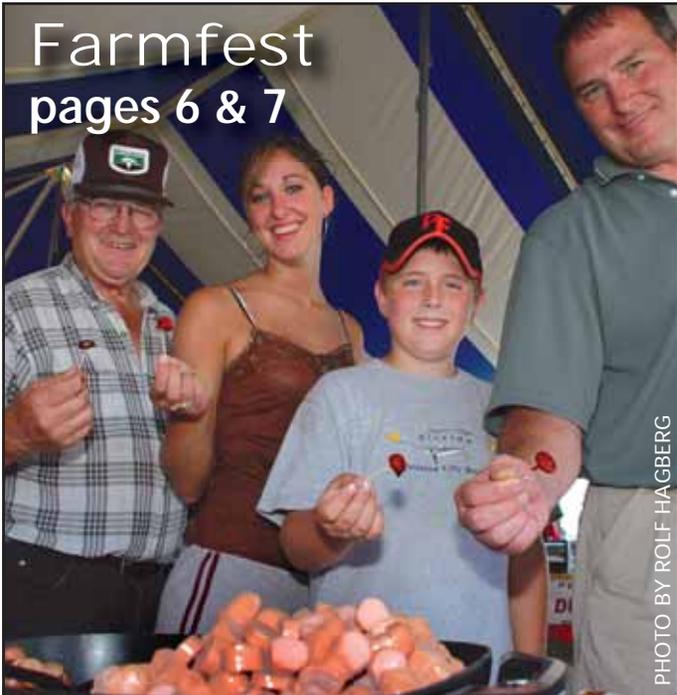
CONTRIBUTED PHOTO



### COW POWER!

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PHOTO BY POUNCE.COM



### Farmfest

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PHOTO BY ROLF HAGBERG



PHOTO BY ROLF HAGBERG

BY EDGAR OLSON  
AURI EXECUTIVE DIRECTOR

Timing is everything. The right time — along with the right place, right idea — can ignite success.

It looks like now is the time for ag-based renewable energy.

Oil prices have reached record highs. Motorists are paying more at the gasoline pump than ever before, and home heating costs this winter are expected to hit us all in the pocketbook. Needless to say, alternative-fuel interest is high, as consumers and industry look for ways to generate more economical power.

# The right time.

2005 has been a banner year for Minnesota renewable energy. Two biodiesel plants began operating here, triggering a mandate that requires all diesel fuel in the state to contain 2 percent biodiesel. Those plants bring Minnesota's biodiesel capacity to more than 60 million gallons per year.

Several more corn-powered ethanol plants opened with still more production capacity being built. By early 2006, Minnesota could be producing more than 500 million gallons of ethanol each year. AURI supports these industries with technical assistance and identifying ways to use additional side streams.

But this may only be the beginning.

AURI is also proud to have helped organize the successful 'Powering the Northland' renewable energy conference in August. This event held in Bemidji, Minn. brought together industry, agriculture, utility and academic leaders from northern Minnesota interested in advancing renewable energy.

A similar event will be held November 16 in Owatonna, Minn. to explore opportunities that will keep Minnesota at the forefront of ag-based power.

The point of these events is to go beyond discussions and drive new ideas that really can make a difference. We've seen the results of collective intelligence in Minnesota's 14 ethanol plants, three biodiesel plants, multiple methane digesters, hundreds of windmills and numerous biomass projects. But we're anxious to take the next step, which could include hydrogen, cogenerating electricity using wind and biodiesel backup generators, and expanding biomass use.

Whatever form it takes, not only is the timing right for renewable energy, it is the right thing to do.



A nonprofit corporation created to strengthen rural Minnesota's economy, AURI helps businesses respond to market opportunities with new and value-added uses for agricultural goods. The Institute builds working partnerships with business innovators, agricultural groups and researchers, and provides technical support to clients conducting new product research and development.

AURI programs are available to legally-organized businesses or cooperatives with projects that have the potential to create new uses or new markets for Minnesota agricultural commodities. AURI assistance is designed for the early stages of a product's life cycle, while an element of feasibility is yet to be determined.

Project proposals are evaluated on the following criteria:

- Innovation/uniqueness
- Market viability
- Use of Minnesota commodities
- Number of farmer-producers impacted
- Amount of value added from further processing
- Economic impact
- Cost savings

Programs are designed to assist with:

- Identifying emerging value-added opportunities
- Developing innovative commodity-based products
- Developing production processes for feasible products
- Promoting products developed with AURI technical assistance
- Providing resources to bring new products and processes to the marketplace

Assistance may include:

- Access to AURI's scientific and business staff
- Access to laboratory and pilot plant facilities
- Product development and feasibility testing
- Process evaluation and improvement
- Technology transfer and applied research
- Business needs evaluation
- Links to available resources
- Potential for grant funds to qualifying applicants

AURI provides resources proportionate to the project's impact. Smaller-impact projects may be eligible for technical assistance only, while projects with industry-wide impact may be eligible for financial assistance.

## AURI Facilities

AURI operates several laboratories:

- Coproducts Utilization Laboratory and Pilot Plant, Waseca
- Fats and Oils Laboratory, Marshall
- Meat Laboratory, Marshall

## AURI Offices

**Headquarters**  
P.O. Box 599  
Crookston, MN 56716  
1-800-279-5010

**Southeast Office**  
P.O. Box 251  
Waseca, MN 56093  
(507) 835-8990

**Southwest Office**  
1501 State Street  
Marshall, MN 56258  
(507) 537-7440

For staff e-mail addresses, visit AURI on the Web: [www.auri.org](http://www.auri.org)

## AURI Ag Innovation Quiz

- How many Btu's can Earthtech Energy pellets produce per hour?
  - 500
  - 8,000
  - 17,000
- What is the annual biodiesel production capacity in Minnesota?
  - less than 1 million gallons
  - about 10 million gallons
  - about 60 million gallons
- The 50 megawatts of electricity that will be produced at the Fibrominn poultry-litter power plant could power how many homes?
  - 50
  - 5,000
  - 50,000
- How many jobs are dependent upon Minnesota's ethanol industry according to the Minnesota Department of Agriculture?
  - 1,000
  - 5,300
  - 750
- Why is NuSun sunflower oil showing great promise?
  - farmers think sunflowers are pretty
  - it's trans-fat free and may reduce cholesterol
  - it's easy to spell
- Why are corn stalks considered a biomass fuel with great potential?
  - they are widely available
  - they have significant energy value
  - they are relatively inexpensive
  - all of the above
- Ingeo fiber is used in shirts and blankets. What is it made from?
  - trans fatty acids
  - soy methyl esters
  - corn polylactic acid
- What is the gas collected from anaerobic digesters?
  - ethanol
  - methane
  - butane



PHOTO BY POUNCE.COM

ANSWERS:

1) b 2) c 3) c 4) b 5) b 6) d 7) b 8) b

## ABOUT AG INNOVATION NEWS



Dan Lemke, communications director  
Cindy Green, managing editor  
Rolf Hagberg, photography  
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Address correspondence or subscription requests to:

Dan Lemke  
Ag Innovation News  
P.O. Box 251  
Waseca, MN 56093  
Telephone: (507) 835-8990  
[dlemke@auri.org](mailto:dlemke@auri.org)



# A massive opportunity

Redwood County farmer sees energy future in crop leftovers



CONTRIBUTED PHOTOS

A Woodford Custom self-loading bale wagon moves some of the 14,000 corn-stalk bales that the Redwood Falls company harvests each year. Most of the bales are sold for cattle bedding but owner Eric Woodford says the biomass could be an economical energy source.

BY DAN LEMKE

*Redwood Falls, Minn.* — Every fall, Eric Woodford makes dozens of house calls to deliver bundles of joy throughout southwest Minnesota. In Woodford's case, the bundles come wrapped in nylon net and weigh in at a cool 1,250 pounds.

For 10 years, Eric has operated Woodford Custom, Inc., a custom baling business, from his rural Redwood Falls farm. His crew harvested 14,000 corn-stalk bales last year, primarily for cattle feedlot bedding. They also produce thousands of hay bales each season.

The biomass harvesting has been profitable. But Woodford sees more potential in "corn stalks for other uses like bio-energy, ethanol and paper."

## Value in the field

Woodford says there is an abundance of unused crop residue that could be an inexpensive energy source.

Most corn stalks are plowed back into the soil for their nutritive value and to enhance soil tilth. However, there is often more residue than the soil requires, Woodford says. This residue could be harvested like a second crop.



For example, it takes roughly 150 pounds of corn stover to generate one million Btu — equal to the Btu-value of 11 gallons of propane, Woodford says. With propane selling for around \$1.15 per gallon, a \$25 bale of corn stalks weighing 1,250 pounds has an equivalent Btu value of more than \$100. The value increases as the cost of propane and other fuels goes up.

"If you compare the value of a bale of stalks as a fuel source versus its nutrient value, it's much better as a fuel," Woodford contends. "Plus if it's burned, the potassium and phosphorous are not lost and can still be land applied as fertilizer."

Woodford has talked to several biomass users about supplying corn stalks as an energy source. He has also worked with turkey growers who are interested in using stalks to heat their production barns.

Woodford is working with AURI and the Center for Producer-Owned Energy to further evaluate the feasibility of using biomass to heat barns and other large-scale agricultural buildings. Woodford is also researching gasifying stover for heat and electricity.

"There's no question biomass has value," says

Alan Doering, who heads AURI's coproducts lab in Waseca. "The key is finding ways for the producer to be paid a fair value for the stover while still keeping it affordable for the consumer."

## Changing perceptions

Woodford's custom-baling operation has grown from one tractor and baler that he owned in 1995 to his current four balers, multiple tractors — including one capable of reaching 45-mile-per-hour speeds — large field rakes and a self loading bale wagon that can load and transport 600 bales in a day. The specialized equipment is necessary because the harvest window is short.

But the window for corn-stover and other biomass, while just cracking open, could be wide open in the future.

"More growers are showing interest in biomass because they're interested in saving money and utilizing more of what they produce," Woodford says. "They want to control their costs and have a hand in their own destiny." ■

*For information on other biomass available in Minnesota visit: [www.biomassexchange.org](http://www.biomassexchange.org).*

# Clothed in CORN

## A Benson textile manufacturer is stitching shirts made from corn polylactic acid

BY CINDY GREEN

**Benson, Minn.** — Don Lenz wants to put a shirt on the back of every corn farmer in America — a shirt that may have origins in the farmer's back 40.

Lenz owns Future Products, Inc. a custom-textile-manufacturing plant in west central Minnesota that has started making casual shirts from Ingeo™, a patented fiber made from corn polylactic acid.

"Most people don't believe these shirts are made from corn," says Dan Lemke, AURI communications director. In early August, Lenz displayed his Ingeo shirts in AURI's exhibit tent at FarmFest near Redwood Falls. (see story, page 6) Visitors told the shirts were corn-based "would have this look of disbelief on their faces," Lemke says. "Then Don would tell them the story."

### Revolutionary fiber

"In my opinion, this is a new generation of material in the marketplace," the only exciting new fabric since tencel, Lenz says. "It looks like cotton — but it doesn't shrink, pill, stain or wrinkle ... and it's more comfortable than polyester. You could wash it, spin it out, and you don't have to put it in the dryer."

Lenz says the fabric absorbs moisture then allows it to migrate. "Cotton absorbs, but it's like a sponge; it holds moisture. The body's way of cooling itself is to sweat. If it stays on the body, it's not releasing heat."

U.S. Representative Collin Peterson of Detroit Lakes can testify to Ingeo's performance, Lenz says. "He put our shirt on in Montevideo and he said at the end of a day in the sun, he was still dry and comfortable. Then he put on his own cotton shirt the next day and said at the end of the day, 'I was smelly and sweaty and exhausted.'"

Ingeo is produced by converting corn into sugars that are fermented and converted to a polylactic acid called PLA. The PLA is then extruded into Ingeo fibers.

The fiber's patent is held by Cargill and manufactured at its NatureWorks division's new \$320 million Nebraska plant, Lenz says. "We've not had any complaints about this fabric. I credit Cargill because they've done a tremendous job putting this together — it took them 10 years."

### Right for the times

"This is the right time to launch (Ingeo), Lenz says. "Ten years ago, we didn't want for anything — we had plenty of resources, plenty of oil. But now we have the Iraq war and high oil prices ... It's a new biodegradable fabric that doesn't use an oil base."

Since Future Products makes some military gear, Lenz says he sat army officials down and said, "This should be in your training program because it will produce a higher-quality soldier at the end of the day. This will move moisture out and they'll stay cooler."



PHOTO BY POUNCE.COM

Don Lenz shows off the 100-percent corn Ingeo shirt made by Future Products, his Benson, Minn. textile-manufacturing plant.

down to what we could manage and still have something that looked good without a lot of investment in the early stages."

Fortunately, the Ingeo fiber didn't require purchasing special equipment. "It is like every other fabric we work with. We didn't have to adjust the machines ... same needle, same thread."

"This also belongs on the backs of firemen who do a lot of sweating and carry heavy gear ... and on policemen with all their vests and gear."

### Ingeo intrigue

In early 2004, a Minneapolis Star-Tribune article about Faribault Mills blankets made with Ingeo piqued Lenz's interest. He visited the plant and was impressed that the fiber did not have to be washed, like wool does, before it's spun.

His next stop was the Cargill headquarters in Minnetonka, where he gathered more information and made arrangements to purchase Ingeo fibers.

He then contracted with a North Carolina yarn maker and a Connecticut company to knit sample goods and was pleased with the results.

"We decided to launch a program," to make Ingeo products but moved carefully in selecting fibers and end products. "There are lots of things involved (in manufacturing a new product), and it can get expensive." Each product line requires "a different yarn size, and each time you change a yarn size, you have to buy a certain amount of yarn."

Lenz selected a white lacrosse knit for golf shirts and a jersey knit for t-shirts — both 6.4 ounce (per square yard). "We narrowed it

### Agri-marketing

Future Products has been marketing the shirts to corn-grower groups in Minnesota, Michigan, Iowa, the Dakotas, Nevada, Tennessee and Kentucky. "We've had a good response — maybe I expected a little more support right away, but they are getting the word out," Lenz says.

He is also negotiating with major agri-business companies, such as Pioneer Seed in Ames, Iowa, about manufacturing the shirts for employees.

An added bonus has been the interest of the environmental community, Lenz says. Last March, at a biotech conference in Orlando, he sold t-shirts with the silk-screened emblem, "This shirt is made from corn" for \$14.50 each and "they moved in two days." He also had success selling t-shirts at the recent dedication of the University of Minnesota-Morris biomass plant.

Cost wise, an Ingeo shirt wholesaling for \$14.50 is a bigger investment than a \$7



PHOTO BY ROLF HAGBERG

This display shows various stages of Ingeo-fiber production, starting with converting corn into sugars that are fermented and converted to a polylactic acid, which is then extruded into Ingeo fibers.

heavyweight cotton shirt of the same style. But it is considerably less “than the \$39 you’re going to pay for a high-performance fabric like Aquatech. Ours has all the same wicking properties — plus we have the softness and feel of cotton. ... It’s got the best of both worlds.”

## Service-driven success

Future Products has been in the textile business since 1985 as a contract manufacturer. “Anything people want, we make to order,” Lenz says. “We learned early on that you can’t compete with China, so we don’t try.”

“I can beat the Chinese on delivery any day of the week, and on small production runs I’m pretty competitive.” Because it can’t compete with cheap labor overseas, Future Products stays away from high-labor garments, those that have snaps, zippers and other embellishments.

“I can’t always buy high-run equipment, like an automatic pocket machine, because I don’t do as much volume.” Rather, the company customizes special runs with embroidery and silk-screen designs.

“We design everything from the bottom up — everything on the computer.” Shirt pieces can even be cut by computer, he says.

“We do products for the auto industry, uniform companies, Pittsburgh Transit Authority, toll booth people. We make reflective ware — for MnDOT’s construction people” and some tactical gear for the military, city police and early response teams. Because the clothing is made in the USA, it’s popular with unions, Lenz says.

Future Products has also started doing some global business, splitting production between Benson and overseas plants.

“If a customer says, ‘Don, I need 10,000 uniforms for Dunkin Donuts, and I’m working with a company in China, but I never have enough of one size,’ I’ll buy all the material at once — some of it here — design it here, and produce 9,000 in China.”

Then when the company runs out of a particular size, Future Products will fill in, making the final 1,000 in Benson. However,

only products manufactured here with U.S. fabric can be labeled “made in USA.”

## By the hour

Future Products employees 80 people — 60 of them machine operators. “We look at the number of hours we can generate with every operator working 40 hours a week — 2400 hours of production — at 100 percent. If a jacket requires one hour of labor, we can make 2400 a week — or 4800 if it only requires a half hour.” Price is determined by labor hours.

The minimum-order requirement is set by how much fabric has to be purchased in one lot to make a custom line. “We can produce as little as 150 pieces — if we can buy a small amount of material. But if a customer needs a certain color and fiber and we have to buy 1200 yards of it,” the customer must guarantee purchase of the entire amount, even if all the shirts are not manufactured at once.

For small runs, the per-piece price is impacted by the pattern cost, which may run \$600 to \$700. “If they want 100 pieces, but the design cost is \$700, it may not be worth it.”

## From spinning to stitching

Future Product’s next major step may be bringing all the PLA and Ingeo production to the Benson facility, rather than contracting with East Coast companies to spin, dye and knit the fabric. Lenz determined that outstate contracting adds “81 cents per item for freight” to a garment’s cost.

AURI helped sponsor a study on the economic feasibility of vertically integrating all the production in Benson. “The feasibility study says we need to consume 100,000 yards of Ingeo per year to make it feasible. ... I do foresee that in the future. It sounds like a lot of fabric but it’s not.”

“We’re pretty tuned in to what we’re doing here.” ■

For more information on Future Products and Ingeo shirts, call 320-843-4614, or visit [www.renewapparel.com](http://www.renewapparel.com)

## Elsewhere in ag utilization

BY DAN LEMKE  
CARTOON © UNCLE HYGGGLY / POUNCE.COM

*Editor’s note: As a service to our readers, we provide news from around the globe on new uses for agricultural products. Please note that ARS is the research arm of the USDA.*

### Spinning straw to liquid gold

The world’s first commercial plant to convert straw to ethanol is under construction in Spain and set to open the fall of 2006. While most U.S. ethanol plants are fueled by corn and most in Europe use cereal grains, this will be the first to produce ethanol from cellulose.

From: Soyatech.com, August 8, 2005

### Rooting out cancer

Soft, downy fibers make cotton balls attractive, but cancer researchers are interested in the hairy roots. The compound gossypol, extracted from cotton roots, leaves, seeds and stems, may guard against certain types of cancer as well as snuff out costly farm pests. USDA ARS researchers have been able to grow root clumps in a laboratory, making it easy to extract and test the gossypol. The compound has shown impressive antifungal, antibacterial and anticancer effects.

From: USDA-ARS, July 14, 2005



### A poop magnet

USDA ARS chemists have turned chicken manure into a prized filtering product used to clean up polluted water. By charring the waste in an oxygen-free environment, scientists can produce a sponge-like material ideal for mopping up pollutants. The charred poultry litter is especially adept at grabbing heavy metals from wastewater, including copper, cadmium and zinc. Scientists have made charred-waste pellets, granules and powders to accommodate a variety of filtering structures, from water tanks to columns.

From: USDA-ARS, July 7, 2005

## Good and moldy

You can’t fight fire with fire, but you can fight mold with mold, researchers are discovering. Aflatoxin, a natural carcinogenic produced by certain molds found in grains, is prevalent in hot, arid regions. The toxin is believed to be responsible for Africa’s high liver cancer rates, and it killed hundreds of thousands of turkeys in Brazil during the 1960s. From the toxic mold, University of Arizona researchers have been able to propagate mold strains that produce no toxins on grains or corn. The non-toxic strain spread on cotton fields was able to almost entirely supplant the toxic molds.

From: Soyatech.com, August 8, 2005



## Better eat your broccoli

Broccoli compounds that have been shown to halt the growth of breast, prostate, colon and stomach cancer cells now appear to slow the growth of bladder cancer. Ohio State University researchers report that compounds called isothiocyanates hindered the growth of bladder-cancer cells, with the most profound effect on the most aggressive cancers they studied. Ohio State and Harvard studies found men who ate two or more half-cup servings of broccoli per week had a 44 percent lower incidence of bladder cancer than men who ate less than one serving per week.

From: Foodnavigator.com, July 29, 2005

## Fueling up at the local cafe

High fuel prices have prompted an underground movement in Australia to cook-up backyard biodiesel. Motorists are collecting used vegetable cooking oil from fish and chip shops, converting it to biodiesel and putting it in their vehicles without engine modifications.

Using store-bought chemicals, these clandestine refineries are skirting Australian law, which requires fuel makers to test biodiesel to make sure it meets government standards. Plus, the motorists are avoiding paying fuel excise tax. Most say the emissions from their diesel vehicles now smell like restaurants. The backyard-fuel chemicals are toxic, but proponents say making biodiesel is as easy as baking a cake.

From: Sydney Morning Herald, August 7, 2005

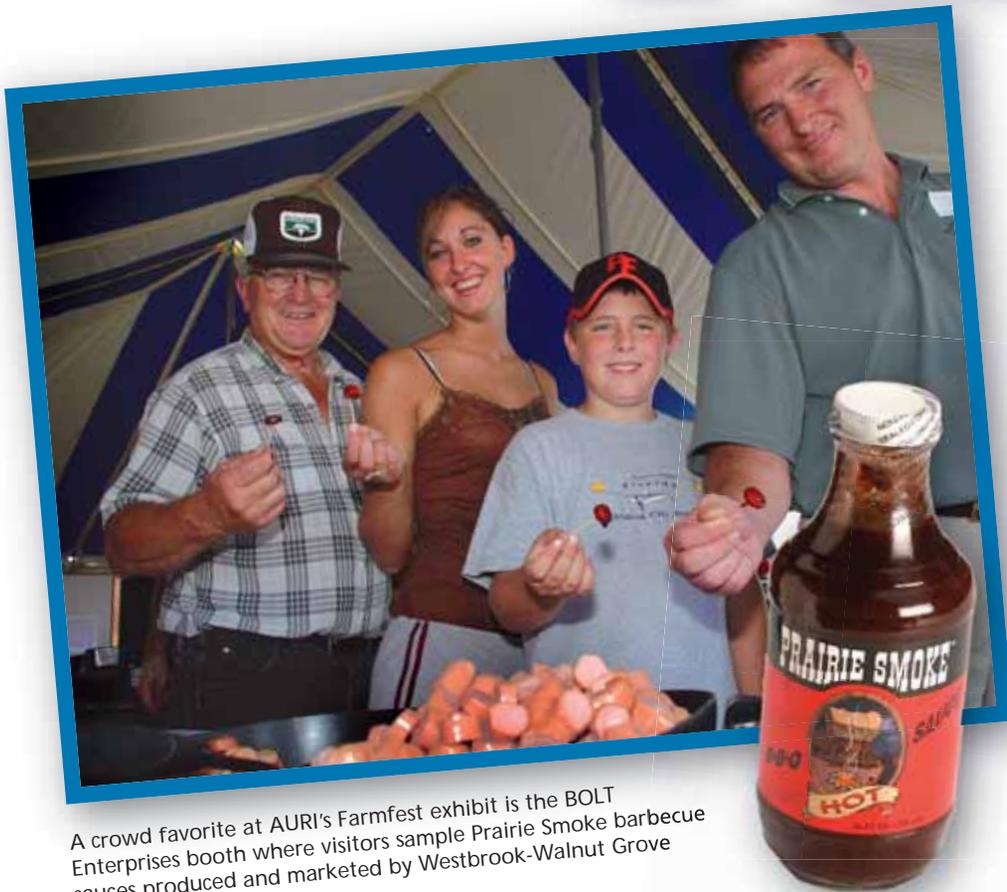


PHOTO BY ROLF HAGBERG

Future Products’ corn-PLA-based ReNew apparel has the same wicking quality as high-performance sports fabrics but also the soft feel of cotton.

Special section:

# Farmfest



A crowd favorite at AURI's Farmfest exhibit is the BOLT Enterprises booth where visitors sample Prairie Smoke barbecue sauces produced and marketed by Westbrook-Walnut Grove High School students.

AURI showcased innovations in ag-based products and renewable energy at Farmfest 2005, an annual agricultural fair held in early August near Redwood Falls, Minn. Thousands of visitors streamed through AURI's exhibit tent to look, learn and get up-close and personal with what's happening in value-added agriculture. The three-day outdoor show gives AURI the opportunity to showcase its client-service work — usually hidden in the lab or at a client's business — and its collaboration with other agricultural groups. Under the canopy of its large 40 x 60 foot exhibit tent, AURI also invites clients to display their products; several are featured here.



AURI Communications Director Dan Lemke, left, has planned and operated AURI's Farmfest exhibit for the past 11 years and this year was joined by Karen Zimny, the institute's new communications assistant.



A visitor checks out samples of corn-based Ingeo fabric made by Faribault Woolen Mills.



From right to left, AURI Executive Director Edgar Olson chats with Robert Nelsen and Howard Hamilton of Environmental Dust Control about Dustlock, a soybean-based road dust control product.



Joel Haskard, right, of the Clean Energy Resource Teams provides information on renewable energy to a visitor. Haskard and CERTs have collaborated with AURI on several projects including a biomass exchange website.

PHOTOS BY ROLF HAGBERG



Many AURI visitors were intrigued by innovative uses for agricultural coproducts, once considered waste. Here a visitor checks out Golden Lyk protein blocks for livestock made from distiller's grains.

*About 8,000 visitors stopped by AURI's tent at Farmfest 2005 that featured dozens of new uses for ag products.*

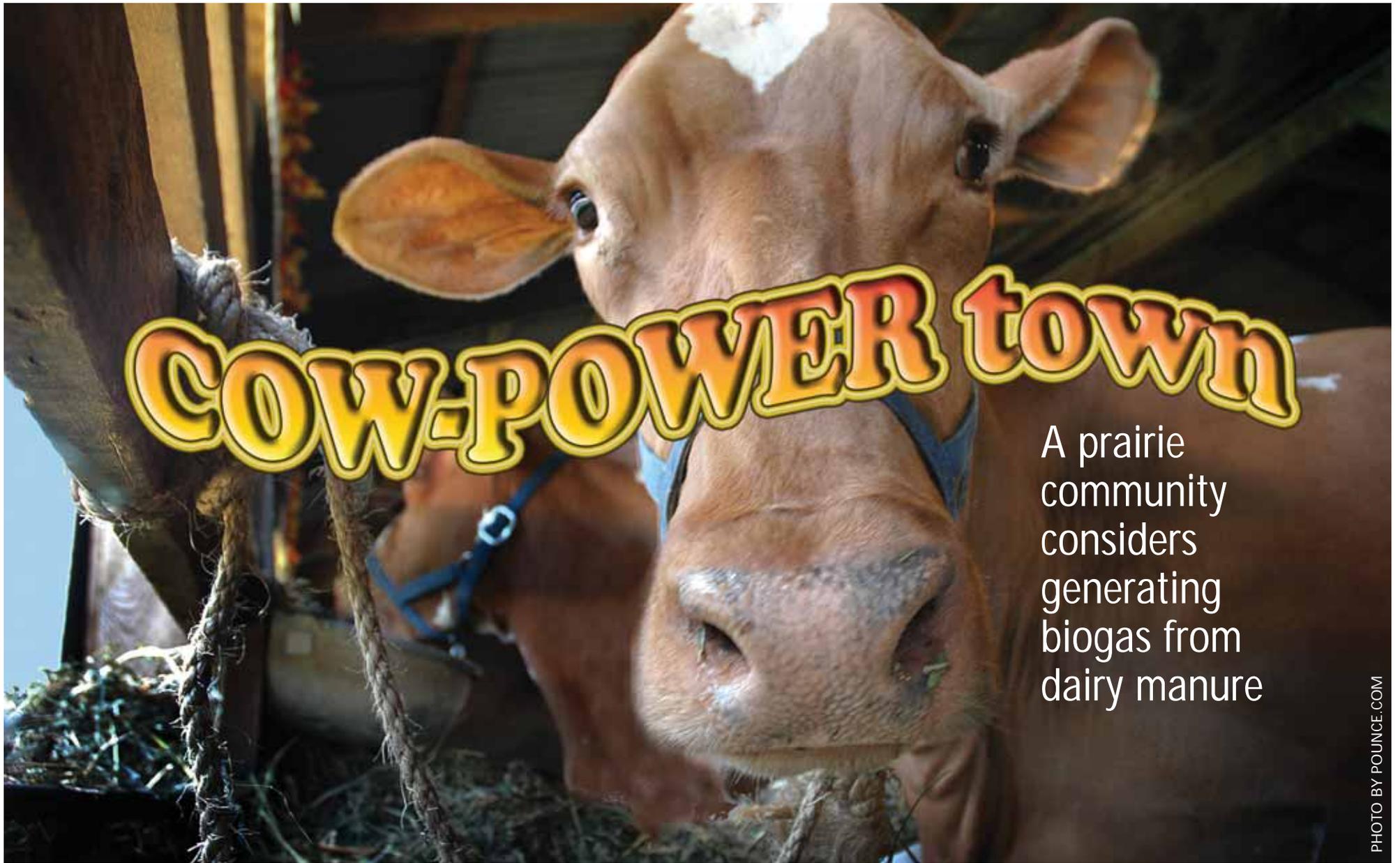


BOLT Enterprise's Jodi Cooley, left, and Jenna Jarmer (also pictured on cover) hold up corn-based shirts made by Future Products of Benson (see story pg 4). The Ingeo shirts displayed in AURI's tent were also worn by staff at the Minnesota Corn Growers tent.



Young and old were challenged to test their "ag IQ" by playing the AURI Ag Millionaire interactive computer game, which educates as well as entertains contestants with questions on Minnesota agriculture.

# AURI ENERGY CENTER NEWS



A prairie community considers generating biogas from dairy manure

PHOTO BY POUNCE.COM

BY E.M. MORRISON

*Morris, Minn.* — A west-central Minnesota community may become a new kind of cow town.

Morris officials want to build an anaerobic cattle-manure digester at a nearby dairy farm. The digester would produce methane, a renewable fuel that could be transported to town and sold to local industries. AURI's Center for Producer Owned Energy and Minnesota soybean and corn growers associations provided funds to help Morris, population 5,000, take a closer look at municipal methane.

The concept "is not entirely new," says Ed Larson, Morris city manager. Some cities, for example, pump methane from decomposing garbage in landfills, using it to generate electricity. "With a large dairy farm nearby, the opportunity is there to make methane," Larson says. "The City Council was interested, so we said, let's explore it and see if there's a marketable product."

The project calls for building an anaerobic

manure digester and methane transportation system at West River Dairy, a farm about eight miles southwest of Morris. Run by the Fehr family, the farm is one of the largest milking operations in the state. Its 5,000 dairy cows produce eight million cubic feet of manure a year.

The same process that eons ago produced natural gas from ancient plants can be used today to make methane, a natural-gas component, from cattle manure.

The manure flows into a digester — essentially a tank or covered basin — where bacteria break down the organic material, making methane as a byproduct. The methane is drawn off and used like natural gas for heating or to run engines that produce electricity or mechanical power. Like natural gas, methane can be transported to distant users in pressurized tanks or pipelines.

The plan's feasibility is being assessed by Sebesta-Blomberg, a Roseville engineering firm that specializes in energy utilities. The study led by senior engineer Cecil Massie, a renewable energy expert, will evaluate

technical issues such as gas production and transportation, manure management, construction and operating costs, financing, and biogas marketing.

Morris, home to state and federal agricultural research stations, as well as a University of Minnesota campus, is the site of several green-power demonstration projects, including wind energy and biomass gasification. (See "Green Power on Campus," July 2005 *Ag Innovation News*.)

The municipal-methane idea grew out of a 2003 report from the Energy Environment Research Center in Grand Forks, N.D., which surveyed the Morris area's alternative-energy resources. The report pointed to opportunities for making biogas from abundant local livestock manure. A biogas utility would be a good fit for a city, the report suggested, because cities have access to economic-development grants, low-interest loans and other public financing, which could help the economics pencil out. Renewable energy could also be a selling point for cities trying to attract new manufacturing.

When the ethanol plant in Morris expressed interest in buying methane, "we decided we should pursue it," Larson says.

Anaerobic digesters have long been used in Europe and Asia. But in this country, cheap fossil fuels have discouraged using digesters to make renewable fuel. However, Cecil Massie predicts that rising natural gas prices and increasing world demand for electricity will make biogas generation more attractive.

The technology is beginning to interest large-scale livestock farmers, says Massie, who reports that at least 18 commercial-size digesters are under construction on Midwest farms. For livestock growers, Massie says, the benefits include reduced manure odors and more useful fertilizer. Research suggests that anaerobic digestion makes the nutrients in animal waste more accessible to plants, he says.

Just as important, Massie adds, biogas offers farmers the chance to harvest what he calls a third crop: not only food and fiber, but fuel. ■

## Crop stokin'stoves

New stove fuel pellets are made from agricultural residues

BY E. M. MORRISON

*Minneapolis, Minn.* — This winter, entrepreneur Gregg Mast invites you to curl up in front of a nice, cozy crop-residue fire.

Mast's start-up company, Earthtech Energy, Inc., has devised fuel pellets made entirely from agricultural residues. Earthtech Energy Biomass Fuel Pellets, a substitute for wood pellets, will be test marketed this fall. The new fuel for pellet- and corn-burning stoves is set to appear in hearth stores early next year. AURI helped the company develop the ag pellet, which is the first for home pellet stoves.

Mast, 29, started Earthtech Energy a year ago, equipped with a brand new MBA, personal savings and a lifelong passion for the environment. When he was growing up in Blooming Prairie, Mast's dad heated his 6,000-square-foot business with a corn stove and he has used a biomass-pellet stove to heat the family home. This got father and son thinking: could stove pellets be made from crop residues — renewable biomass that would otherwise be wasted?



Earthtech Energy, with AURI's help, devised fuel pellets made from agricultural residues rather than wood. Made for corn and pellet-burning stoves, the new pellets should be in hearth stores early next year.

### Testing, testing

AURI has done extensive research on the heating values of agricultural biomass. Al Doering, manager of AURI's coproducts lab in Waseca, worked with Mast to pelletize and test more than 25 types of agricultural residue in dozens of combinations. The pellets had to burn efficiently, sustain a good flame, hold together during handling, and meet standards for density, moisture, ash and emissions, Doering says. The biomass pellets also had to cost roughly the same as wood pellets, which typically retail for about 8 cents a pound.

Earthtech's R & D included test burns in many of the residential pellet and corn stoves now on the market. "We think this is a great product," Mast says. Earthtech's proprietary biomass pellets burn cleanly in both agitating and non-agitating appliances, giving off little odor, according to Mast. The fuel pellets produce about 8,000 Btu's of heat per hour, matching the output of premium wood pellets, he says.

The biomass pellets are now being "beta-tested," as Mast (a member of the wired generation) puts it, by Midwest stove dealers. "We're soliciting feedback. We feel confident our product will be well-received." Mast expects to begin manufacturing and distributing the pellets by year end.

AURI helped the company source raw materials and locate a contract manufacturer.

Eventually Mast hopes to put up his own manufacturing facility.

### Emerging market

To begin with, Earthtech Energy plans to market its product through retail stove and hearth stores in the Midwest, Great Lakes, New England and Mountain states, where alternative-heating system markets are growing the fastest.

More than 600,000 North American homes now use pellet stoves, fireplace inserts or furnaces, according to the Pellet Fuels Institute, an industry trade group. Pellet-burning appliances resemble wood or gas stoves, but are specifically designed to burn small, compacted fuel pellets, which look like rabbit feed.

Pellet stoves are more convenient to operate than conventional wood stoves or fireplaces and produce much less air pollution. In fact, pellet stoves are the cleanest solid-fuel-burning home heating appliances, according to the U.S. Department of Energy.

Pellet-stove sales rose more than 250 percent between 1999 and 2003, the Institute reports. And pellet fuel consumption has jumped by one-fourth during the last three years.

To encourage energy independence, the 2005

Renewable Energy Security Act authorized financial incentives for the purchase of pellet appliances. The industry could also benefit from the rising cost of natural gas and other traditional heating fuels, Doering says. "The price of fossil fuels will drive this industry to grow."

Pellet fuel heating is still an emerging industry, however. The first residential pellet-burning stoves were introduced in 1983. Today, there are about two dozen pellet stove-makers and about 70 North American pellet mills. The pellet-fuels industry last year produced about 900,000 tons of pellets, worth \$150 million.

But no single supplier has a dominant share of the pellet fuels market, Mast says, and there is little product differentiation or brand loyalty. So that makes it a good time to launch a new and distinctive pellet, Mast says. "The market is not mature enough to require players to struggle over market share with each other, but instead, the continuing expansion of the market helps the industry as a whole."

### Annually renewable

Earthtech's biomass fuel pellets have several advantages over competing wood pellets, Mast says. They are renewable in 180 days,

in contrast to wood, which takes years or decades to regenerate. The supply and cost of agricultural biomass is more stable than wood, too, he says. A 40-pound bag of biomass pellets will retail for the same or less than wood pellets, Mast says. And unlike wood pellets, biomass pellets can be burned in corn stoves, too.

### Start-up story

While he's getting Earthtech Energy off the ground, Mast continues to work full time in the financial services industry. He runs the company out of his Minneapolis home, with advice from his father, a retired businessman, and help from several other enthusiastic young entrepreneurs who believe in the product. The ambitious Earthtech team aims to sell about 16,000 tons of fuel pellets in 2006.

Mast is committed to sustainable energy and the environment. Earthtech Energy's mission is to use "earth's abundant raw materials and innovative technology" in a product that offers "environmental, ecologic and economic benefits." He adds, "It is a rare occasion when a company can make a significant contribution to our environment." ■

For more information visit [www.earthtechenergy.com](http://www.earthtechenergy.com).

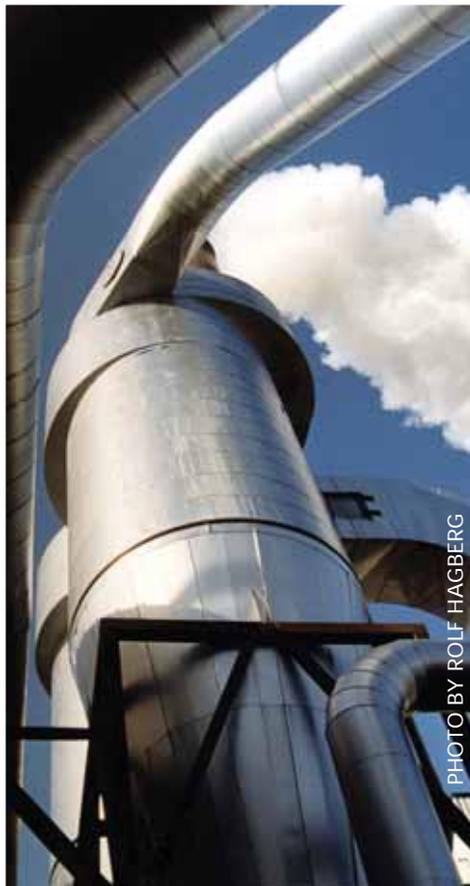


PHOTO BY ROLF HAGBERG

## Fueling ethanol up north

Farmers near Fergus Falls hope to build the region's first ethanol plant

BY E.M. MORRISON

*Fergus Falls, Minn.* — The ethanol boom may be heading north.

Otter Tail Ag Enterprises, LLC hopes to build a 40- or 50-million-gallon ethanol plant near Fergus Falls. "This is a growing industry, and there is a geographic opportunity here," says Elbow Lake farmer Jerry Larson, chairman of Otter Tail Ag Enterprises. "We think we can duplicate the success of ethanol plants in the southern half of the state."

The effort to bring ethanol processing to the region began earlier this year, led by "a group

of agricultural and Main Street visionaries" from Otter Tail County and the surrounding areas, says Larson, a founding director of Morris and Benson ethanol companies.

The group just completed a feasibility study and is now putting together a business plan. Funds for the planning phase were provided by AURI's Center for Producer Owned Energy and the Minnesota Corn Growers Research and Promotion Council, which wants to extend ethanol processing to the northern corn belt.

The proposed dry-grind plant requires a \$50-million-plus investment, according to the industry's average new-construction cost estimates. The facility would process about 17 million bushels of corn a year, which should benefit all area corn farmers, Larson says. "History tells us that an ethanol plant adds 4 to 9 cents to the price of every bushel of corn harvested in the region." The facility would also produce 145,000 tons per year of low-cost, high-protein animal feed, benefiting the local livestock industry.

It makes sense to process more corn locally, Larson says. About one-sixth of Minnesota's one-billion-bushel corn crop is made into ethanol. Still, half the crop leaves the state, and with it, Larson says, go manufacturing opportunities and jobs.

Otter Tail Ag's venture would create two dozen skilled jobs and would also generate substantial related business activity, says Tom Melin, assistant director of AURI's Energy Center. According to one industry estimate, 80 percent of revenue generated by an ethanol plant is spent within 50 miles of the facility.

Minnesota's 13 ethanol plants generate \$1.3 billion in economic activity and provide 5,300 ethanol-related jobs, according to a January 2005 report from the Minnesota Department of Agriculture. Three more ethanol plants now under construction will bring the state's ethanol production capacity to 550 million gallons by year end.

Minnesota manufactures nearly 15 percent of the nation's ethanol, which will top 3.8 billion gallons this year — up from just 175 million gallons in 1980.

Larson, vice-president of the Minnesota corn council and a past member of the National Corn Growers Business Development Team, expects the ethanol market to continue growing. This year Minnesota lawmakers set ambitious renewable energy goals — doubling the ethanol required in gasoline to 20 percent by 2012. "Minnesota is a leader in setting renewable energy standards. We're an example for the rest of the states," Larson says.

The national Energy Policy Act of 2005 mandates the annual use of 7.5 billion gallons of ethanol by 2012. And state and federal governments continue to offer ethanol subsidies.

These policies are encouraging new ethanol ventures, Larson says: "We've had major support for ethanol — from our governor and legislature, from our national political leaders, from consumers and taxpayers, and from agriculture." ■



PHOTO BY DAN LEMKE

In July, bagpipers led visitors to the ground-breaking of Fibrominn LLC in Benson, which will be the nation's first power plant to generate electricity from poultry litter when it's completed in 2007. The traditional bagpipers are part of Scotland's 78th Fraser Highlanders Regiment, from the home region of Rupert Fraser, chief executive officer of Fibrowatt LLC, which owns Fibrominn and three other poultry-litter plants in England.

## Powering up litter

Construction begins on nation's first poultry-litter-powered electrical plant

BY DAN LEMKE

*Benson, Minn.* — After more than five years of discussions, public meetings, planning and permitting, construction has begun on the nation's first power plant to generate electricity from poultry litter.

In late July, several hundred people attended a ceremonial groundbreaking for the Fibrominn plant, which should be fully operational in early 2007.

"This is the only proven commercial development in manure management since the manure spreader," says Litchfield farmer Greg Langmo.

Langmo first contacted Fibrowatt in 1998. The British company owns Fibrominn LLC and operates three poultry-litter-fired plants in England. Langmo, a turkey producer, was looking for manure-handling options. "To have a commercially-viable, sustainable

alternative to (manure) land application is huge."

The Fibrominn facility will use about 500,000 tons of turkey litter from nearby barns to annually produce 50 megawatts of electricity — enough to power 50,000 Minnesota homes.

At the groundbreaking, Minnesota Governor Tim Pawlenty said turning byproducts into energy is not only good for rural Minnesota's economy and job growth, "it's good environmental policy, good for national security and it is also good energy policy because it's diversifying our sources of energy."

While the plant will primarily burn turkey litter, other agricultural biomass could be used. Langmo, now Fibrominn's fuels manager, says clean biomass such as grain, straw, ag-processing coproducts and animal bedding could be used under the plant's permit.

This is the only proven manure-management development "since the manure spreader."

— Litchfield farmer Greg Langmo.



AURI's Alan Doering, who has tested a multitude of potential biomass fuels, agrees that "not only the turkey producers could benefit; other producers may have the opportunity to provide ag-based fuel."

The \$140 million project is expected to provide 30 on-site jobs as well as \$8-10 million in local spending each year.

The Benson facility is the first of its kind in the United States and will be the largest biomass plant in the nation when completed. Langmo expects the plant to be test fired in December 2006 and fully operational a few months later.

Fibrominn will use the same technology as U.K. plants. Poultry litter, transported from barns in covered trucks, is kept in a storage building before it is burned to produce steam that powers a turbine and generator to produce electricity.

Xcel Energy has a contract with Fibrominn to purchase 50 megawatts of electricity. Wayne Brunetti, the company's board chair, says Fibrominn will help Xcel "become the largest provider of renewable energy in the country."

Turkey litter has approximately one-third the heating value of coal. After burning, the ash will be reduced to about 5 percent of the litter's original volume and can be land applied as fertilizer. ■

## ENERGY News Briefs

### Brewster biodiesel overflows mandate

*Brewster, Minn.* — Fuel flowing from Minnesota's newest and largest biodiesel refinery will increase Minnesota's overall capacity to 60 million gallons per year. That's well over the 8 million gallon requirement needed to trigger a state biodiesel mandate. As of September 29, every gallon of diesel sold in Minnesota must contain at least 2 percent biodiesel.

The Minnesota Soybean Processors, which has operated a soybean-crushing plant near Brewster for over a year, began producing biodiesel in early August. The MnSP refinery

will use 50,000 bushels of soybeans a day and produce about 30 million gallons of fuel annually at full capacity. It will use about half the oil produced by MnSP's soy-crushing facility.

"It's been our dream as farmers to make our own fuel," says Ron Obermoller, a Brewster farmer and MnSP board member. Established in 1999, MnSP boasts more than 2,500 members from Minnesota, Iowa and South Dakota.

Max Norris, AURI director of projects

and technology, began working with the cooperative more than six years ago. "This is true value-added ... producers are taking what they grow, processing it and moving it up the value chain — from soybeans to oil to biodiesel."

MnSP joins two other Minnesota biodiesel processors: FUMPA Biofuels in Redwood Falls and SoyMor of Albert Lea. These "lead adopters" in biodiesel processing, Obermoller says, "have the greatest chance of making profits." ■

### Transportation driving hydrogen-energy development

Alternative energy opportunities highlighted at northern Minnesota conference.

BY DAN LEMKE

*Bemidji, Minn.* — Hydrogen, the world's most abundant element, could be the energy carrier of the future, said Rolf Nordstrom, director of the Upper Midwest Hydrogen Initiative of the Great Plains Institute. He spoke at the "Powering the Northland" conference in Bemidji in July.

Nordstrom said that while the United States already produces about 9 million tons of hydrogen for oil refining, fertilizer production and the space program, the real hydrogen-development driver could be transportation.

Foreign oil demand is rapidly increasing, Nordstrom said. "We import 55 percent of our oil today and that's projected to increase

to 70 percent by 2025. ... There aren't many alternatives to gasoline in the transportation sector."

Hydrogen is in water, fossil fuels and all organic matter. Not only can it be generated from nonrenewable sources such as natural gas, coal and gasoline, but also from renewable sources such as biomass and ethanol. Besides transportation fuel, it is being developed for battery fuel cells.

Hydrogen was just one of the topics highlighted at the energy conference, attended by more than 100 economic developers, government leaders and utility representatives from Northern Minnesota and North Dakota. The conference also addressed future energy demand, transportation

biofuels such as ethanol and biodiesel, biomass gasification and power cogeneration.

The intent was to show "what's possible in renewable energy and showcase projects that are already running or in development," says Michael Sparby, AURI project director. "This is a step in bridging the gap between agriculture and industry through producer-owned energy."

The conference was sponsored by AURI and its Center for Producer-Owned Energy, Bemidji Bio, USDA, the Joint Economic Development Commission, Bemidji State University, U. S. Rep. Collin Peterson and the Department of Employment and Economic Development. ■

### SoyMor named Ag Innovator of the Year

*Albert Lea, Minn.* — Not many producer-owned cooperatives can boast opening two major facilities within a year. But SoyMor opened both a 25-million-gallon biodiesel refinery and lecithin fractionation facility this year, earning it the 2005 AURI "Ag Innovator of the Year" award.

SoyMor's work "is remarkable ... a prime example of producer-driven innovation," says Edgar Olson, AURI executive director. "They operate one of the largest biodiesel refineries in the country. They're also using cutting-edge technology to process soybean-derived lecithin into high-value components."

The SoyMor cooperative based in Albert Lea has almost 700 members. In June, it unveiled its \$25 million biodiesel plant,

which will process about 18-million bushels of soybeans per year — or about 1,700 acres of soybeans per day — into renewable fuel. Plant construction began last September and biodiesel production in July. The refinery is expected to employ 35 to 40 people with an annual payroll of more than \$1 million.

Shortly after the refinery was built, SoyMor added a lecithin fractionation facility. Lecithin is a byproduct of soy-oil processing that can be refined and used as a powdered ingredient in cake mixes, cookies, crackers, rolls, breads, donuts and many instant products. Lecithin can also be found in beverages, margarines and even infant formulas.

The Ag Innovator of the Year award is presented annually to an AURI client

demonstrating exceptional innovation in a product or process that has successfully entered the marketplace and uses significant amounts of agricultural commodities. The award was presented at a luncheon in Albert Lea on July 21.

"Value-added opportunities like this are important not only to the agricultural industry, but Minnesota's overall economy," Olson says. "SoyMor's activities will have a major impact on farmers in the region, not just its members."

SoyMor is the fourth recipient of AURI's annual award that has honored Pet Care Systems of Detroit Lakes, Mississippi Topsoils of Cold Spring and Minnesota Soybean Processors of Brewster. ■

# NuSun shines in human-health trial



PHOTO BY POUNCE.COM

## Sunflower oil hybrid is trans-fat free and may reduce LDL cholesterol

BY DAN LEMKE

*Bismarck, ND* — Recent tests on the heart-health benefits of NuSun sunflower oil are showing glowing results.

Lower in saturated fat than typical linoleic sunflower oil, NuSun does not need hydrogenation to be shelf stable. Hydrogenation creates trans-fatty acids, which may be associated with raising serum cholesterol levels.

In a recently-completed clinical study by Pennsylvania State University, 31 men and women with elevated cholesterol levels followed three diets — one that substituted two tablespoons of NuSun oil per day for the saturated fat in a typical American diet, another that substituted olive oil and a third structured like the average American diet.

Head researcher Penny Kris-Etherton from Penn State said the study shows “that the substitution of just a small amount of a healthy oil like NuSun for saturated or trans fats can significantly impact heart health.”

NuSun-diet participants showed a nearly 5 percent reduction in total cholesterol and an almost 6 percent reduction in low-density lipoprotein or LDL cholesterol. The other two diet groups showed no reduction. The United States Food and Drug

Administration will require that trans-fat content be listed on all processed-food labels beginning in January 2006. “Manufacturers don’t want to show a large percentage of trans fats so that opens opportunities for oils like NuSun,” says AURI scientist Max Norris. The Penn State study is part of long-term research supported by AURI.

NuSun oil performs well in extremely high cooking and frying temperatures and has excellent shelf-life characteristics, Norris says. Many major food companies have already begun using NuSun oil in such commercial products as Frito-Lay SunChips, Pepperidge Farm Goldfish and even a variety of Crisco shortening. But NuSun opportunities are not limited to food manufacturers.

“To meet consumer demands for healthier options while dining out, restaurants and food chains are looking for highly-stable, trans-free oil alternatives to improve the health profile of the foods being served,” says National Sunflower Association Executive Director Larry Kleingartner.

Minnesota currently grows about 60,000 acres of sunflowers. In 2003, NuSun varieties were planted on 55 percent of total oilseed sunflower acres. Those acres are likely to increase as demand for NuSun oil rises. ■