APR-JUN 2006
VOL. 15, NO. 2

AG INNOVATION NEWS®

The newspaper of the Agricultural Utilization Research Institute

Firing up biogas

pages 4-7

FIRE

ICE

Soy's new toys

page 2

PHOTOS BY ROLF HAGBERG

ALSO IN THIS ISSUE:

AURI's new leader
page 10

Wheat straw cardboard
page 3

Biodiesel goes off-road

PHOTO BY ROLF HAGBERG

AURI helps sponsor first-ever biodiesel ATV tests

BY E. M. MORRISON

Thief River Falls, Minn. — ATVs are getting a 'bio' tryout.

Minnesota farmers have teamed up with Arctic Cat Inc. to perform the first-ever tests of a biodiesel-fueled, all-terrain vehicle.

Growers want to learn how B20 — a blend of 20-percent biodiesel and 80-percent petroleum diesel — performs in Arctic Cat's new diesel ATV, says Waseca farmer Scott Singlestad. He chairs the Minnesota Soybean Research and Promotion Council, a research sponsor. This is B20's first test in a small diesel engine, part of a strong push to expand biodiesel use.

Arctic Cat, a $736-million public company based in Thief River Falls, Minn., makes snowmobiles and ATVs sold worldwide. The manufacturer is just completing development of a twin-cylinder diesel ATV, the first on the market.

Arctic Cat hadn't planned to test the new quad's performance on biodiesel, an alternative fuel made from vegetable oil or animal fat. But when AURI and the Minnesota Soybean Growers floated the biofuels idea, "they were very interested," says Michael Sparby, AURI project director.

Arctic Cat was impressed with B20, says Ole Tweet, vice president of new product development. The blend burns cleaner than conventional diesel, producing fewer carbon dioxide emissions and lower levels of hydrocarbons, carbon monoxide and particulates. That complements Arctic Cat's stewardship goals, Tweet says. "We're trying to reduce the impact of our machines on the environment."

Other pluses: biodiesel is biodegradable, and in some places, it now costs less than petroleum diesel, thanks to federal and state renewable-fuel incentives. Domestic fuels such as biodiesel also contribute to energy independence. Beyond that, Tweet says, Arctic Cat liked the idea of making an ATV that could run on a renewable fuel grown by farmers, who are some of the company's best customers.

B20 versus diesel

Arctic Cat's new off-road vehicle features a 700 cc twin-cylinder diesel engine with continuously-variable transmission, fully-independent suspension, superior pulling capacity, and great fuel economy, Tweet says.

The diesel model is now being field tested to assess emissions, fuel consumption, durability, reliability, power and safety under a wide variety of environmental and weather conditions. The tests are also looking at how B20-fueled vehicles stack up against their petroleum-diesel counterparts.

Funding for the B20 tests was provided by the Minnesota Soybean Research and Promotion Council, Minnesota Corn Growers Association, AURI, and AURI's Center for Producer-Owned Energy.

Arctic Cat expects to have the new diesel model available this summer. It's aimed at markets around the globe "where diesel is the fuel of choice," Tweet says. That includes Europe, where half of passenger vehicles and most off-road vehicles use diesel. Other prospective users are the military, which relies on diesel fuel, and American farmers and ranchers, who are increasingly using B5 and B20 in their farm machinery.

More biodiesel uses

Biodiesel production in 2005 totaled 75 million gallons, a threefold increase from 2004, according to the National Biodiesel Board. Most biodiesel is being added to transportation fuel. But there is strong interest in extending biodiesel uses, says Max Norris, director of AURI's fats and oils lab in Marshall.

For example, biodiesel is being tested in commercial lawn-care equipment, the main U.S. market for small diesel engines, says Kelly Strebig, research engineer at the University of Minnesota Center for Diesel Research. There is growing interest in using biodiesel in small home generators, too, Strebig says. And in the northeast, a B5 blend is being distributed for home heating, according to the Biodiesel Board.

At the opposite end of the scale, "there's lots of interest in using biodiesel in large electrical generators," to cut emissions and air pollution, Strebig says. For example, several power utilities are now exploring the use of biodiesel blends in backup diesel generators, he says.

The marine market is also very interested in biodiesel because the fuel is biodegradable in water, cutting the environmental risks, Strebig says. "That's a huge market." A single Mississippi towboat, for example, uses 100,000 gallons of diesel fuel on a round trip from St. Paul to St. Louis, he says. The U.S. Navy, the world's largest user of diesel fuel, is already using B20 at several facilities.

Adding to the appeal

ATVs, by contrast, won't ever be more than a small niche market for biodiesel fuel, acknowledges Sparby. Annual ATV sales are under one million vehicles, according to a 2005 AURI report, and three-fourths of them are sold in this country, where gasoline-powered vehicles dominate.

Still, Sparby says, expanding into the ATV market "would create valuable exposure" for biodiesel. And B20 is a great selling point for Arctic Cat's new diesel-powered quad, Tweet says, one that "adds to the overall appeal." ■

Photo: Arctic Cat is testing biodiesel in its ATVs, the renewable fuel's first test in a small diesel engine.

The wavy interiors of cardboard could be made from wheat straw or other ag fibers blended with recycled cardboard, but the process needs to be proven cost effective.

Global demand for recycled cardboard could open markets for wheat straw and other wood-pulp alternatives

BY CINDY GREEN

The world can't get enough cardboard.

Even though it is reused more than almost any other product, there is a global shortage of what industry calls OCC, old corrugated containers, which paper mills recycle into new containers. The demand is spurring cost increases that have paper mills looking at fiber alternatives — like corn stalks, kenaf, straw, even hemp.

Why a shortage? The global trade imbalance may be to blame.

Countries such as China export vastly more products to the United States than they import. "They have all these empty containers going back that they can fill with recycled papers," says Larry Newell, manager of Liberty Paper, a Becker, Minn. mill that recycles cardboard into new containers.

The Chinese use the OCC to make cardboard "to put all the stuff we're buying into containers to ship back here," says Michael Sparby, AURI project director. "So the price for recycled cardboard keeps going up." In countries such as China where wood pulp is in short supply, recycled papers are more economical to make than virgin.

To find alternatives to OCC as well as wood pulp, AURI is revisiting a decade-old study that looked at using straw pulp instead of wood to make fine papers. When the original six-year study was completed in 2000, pilot plant trials showed straw paper was "technically feasible but the economics were way out of whack," Sparby says. The return on investment, "to build a $700 million (straw) pulping facility for fine paper was a negative 5 percent. There wouldn't be many companies jumping at that one."

But with pulp costs rising, alternative paper fibers are getting another look by a consortium from the University of Minnesota, state Department of Energy and Economic Development, Legislative Commission on Minnesota Resources and AURI, representing Minnesota wheat growers.

"Through this consortium, we were put in touch with Liberty Paper … they are working with technology to blend wheat straw with recycled cardboard to make new cardboard," Sparby says.

Liberty Paper in Becker, Minn. makes corrugated cartons, tubes and specialty bag papers from recycled corrugated containers. "We make about 165,000 tons of finished product a year … keeping 200,000 tons of OCC out of the landfills," annually, Newell says.

Liberty Paper is one of a dozen divisions of Liberty Diversified Industries of New Hope, Minn., a major manufacturer. The paper division is one of only two mills in Minnesota that recycles corrugated containers. "We don't chop trees down to make wood pulp — that's a whole different process. We're 100-percent recycled."

But recycled paper "is a commodity as well and very volatile in the marketplace," Newell says. "We want to find some alternative material that can be made into paper substrate that has some stability to it. Both the inside and outside of a corrugated box is designed for strength, not appearance like fine papers."

Of all the alternative fibers Liberty Paper has looked at, "wheat is the best suited because of its fiber characteristics … and there is an abundance of it in Minnesota." The straw-OCC blend would likely be used in the cardboard's wavy interior where it needs to be durable and the straw flecks won't affect appearance.

The cost of the wheat straw, baling and transportation would still be less than the price of recycled cardboard, Sparby says. But other hurdles have to be overcome, such as storing straw year-round and the economics of launching a new process. Because breaking down straw fibers is different than using OCC, new equipment has to be installed.

AURI, with the University of Minnesota, is preparing to analyze all of Minnesota's wheat varieties for fiber length, durability and other paper-making attributes.

If wheat-straw paper making is feasible, "theoretically, a new $80 million plant in northwest Minnesota would use a hundred thousand tons of straw a year, mixed half with recycled cardboard," Sparby says.

"It could be a direct $3 million value-added to the wheat growers." ■

Having a gas with biomass

High natural-gas prices spark interest in small-scale biomass gasification

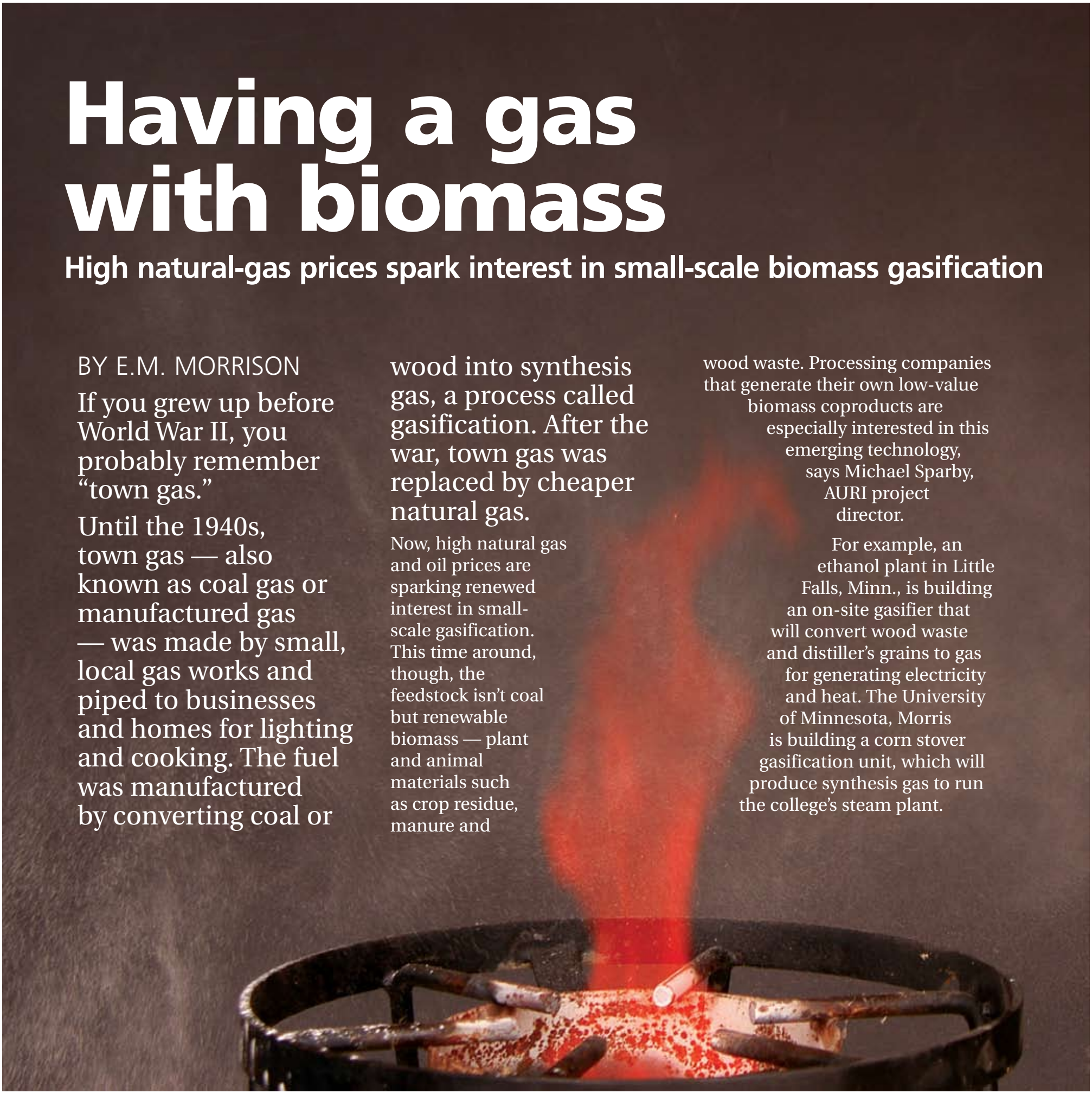
BY E.M. MORRISON

If you grew up before World War II, you probably remember "town gas."

Until the 1940s, town gas — also known as coal gas or manufactured gas — was made by small, local gas works and piped to businesses and homes for lighting and cooking. The fuel was manufactured by converting coal or wood into synthesis gas, a process called gasification. After the war, town gas was replaced by cheaper natural gas.

Now, high natural gas and oil prices are sparking renewed interest in small-scale gasification. This time around, though, the feedstock isn't coal but renewable biomass — plant and animal materials such as crop residue, manure and wood waste. Processing companies that generate their own low-value biomass coproducts are especially interested in this emerging technology, says Michael Sparby, AURI project director.

For example, an ethanol plant in Little Falls, Minn., is building an on-site gasifier that will convert wood waste and distiller's grains to gas for generating electricity and heat. The University of Minnesota, Morris is building a corn stover gasification unit, which will produce synthesis gas to run the college's steam plant.



Other state groups are looking seriously at gasification. A Williams, Minn., grass seed cooperative recently tested seed-chaff gasification. Instead of going to a landfill, the chaff could be used to generate electricity for the seed cleaning plant. Minnesota's sugar beet industry has started talking about gasifying beet pulp, Sparby says. The soybean crushing sector, which already co-fires hulls, is also asking about gasification. A local Indian tribe is considering wood gasification, and a small Minnesota town is studying a plan to gasify corn stover to make methane for an industrial park.

What's behind this swelling interest in biomass gasification?

"Burgeoning world demand for natural gas, accompanied by sharply-rising prices," says engineer Cecil Massie, a renewable energy systems expert at Sebesta Blomberg, a Roseville, Minn. engineering firm that specializes in energy utilities. "That's creating opportunities for these other fuels."

The average annual price of natural gas delivered to commercial customers rose 42 percent between 2000 and 2004, according to the Energy Information Administration (EIA). In 2005, prices soared, hitting an average of $14.61 per thousand cubic feet in October — up 60 percent from the previous October. For 2006, the EIA is forecasting that commercial natural gas prices in the Midwest will range from $11.56 to $13.31 per thousand cubic feet.

Cheaper to make syngas

At those prices, manufacturing synthesis gas from renewable biomass is cheaper than burning natural gas, Massie says.

Last year, for example, AURI and Sebesta Blomberg helped the city of Morris project the costs of a municipal gas utility that would produce methane from corn-stover gasification. The proposal called for the city to invest $9 million to produce 500 million cubic feet of pipeline-quality gas for use by the local ethanol plant and other light industry. The study estimated that the city could manufacture methane for $10.44 per million British thermal units. That's nearly 30 percent less than the average 2006 contracted price, according to Massie.

The economics of renewable syngas production look "attractive when competing with natural gas," says Darren Schmidt, research manager for the University of North Dakota's Energy & Environmental Research Center (EERC), a national leader in biomass energy systems. That's especially true for facilities that already have gas boilers and infrastructure, which could be retrofitted for syngas, he says. In addition, Massie says, syngas supply and price would be more predictable and stable than natural gas.

Small systems most promising

Schmidt and Massie say biomass gasification is best suited for relatively small power systems — between about 5 kilowatts and 5 megawatts.

That's because biomass is a widely-dispersed, bulky, low-energy fuel, which is very expensive to collect and transport. "It's not economical to haul biomass more than about 20 miles," Massie says. Small gasification systems could be customized to use whatever biomass was available in the immediate area. And the power could be consumed on site.

"Where you really gain an advantage is when you have a manufacturer that produces its own biomass waste stream," Schmidt says — especially if it costs money to dispose of the waste. For example, EERC is working with a Nevada roof truss manufacturer, which is building a 300-kilowatt gasification system. The plant will gasify its leftover wood scraps, generating its own renewable power to run the manufacturing operation.

In Minnesota, biomass gasification has great potential "for every one of our ag processing plants," Massie says. "All of them produce coproducts that earn very little money." He says materials such as barley, oat and soybean hulls, beet pulp, distiller's grains, vegetable processing residues and mill waste often sell for "far less money than the value of the energy they could produce for the plant."

Future outlook

Minnesota is set to become a leading producer of dedicated energy crops, too, says AURI's Al Doering. Hybrid poplars (the state already has 25,000 acres), willows and switchgrass could all support a biomass gasification industry, says Doering, who is doing a market analysis of Minnesota gasification opportunities.

Eventually, renewable syngas will be converted not only to power but to chemicals, just as natural gas is today. "That's where you're going to get the greatest added value," Schmidt says. In the next few years, biomass gasification technology will come into its own, Schmidt says, and "within 10 years, you'll see lots of demonstration plants in place." ■

> The economics of renewable syngas production look "attractive when competing with natural gas."
>
> — *Darren Schmidt*

Gasification 101

BY E. M. MORRISON

What is gasification?

Gasification is a thermochemical reaction that occurs when organic materials are heated to high temperatures without much oxygen. Think of it as slow, precisely-controlled combustion. This process generates a flammable gas known as producer gas, or synthesis gas, which is composed primarily of carbon monoxide and hydrogen. Synthesis gas, also called syngas, provides about one-sixth the energy of an equal volume of natural gas.

What are the parts of a gasification system?

A gasification system consists of:

- a reactor, in which air, or air and steam, is forced through an incandescent fuel bed, producing gas,
- a scrubbing system to clean impurities from the manufactured gas, and
- a burner or engine and generator to convert the syngas into energy.

What is syngas used for?

Synthesis gas is used like natural gas to generate heat or electricity. It may be burned directly in a furnace or cleaned and used in more efficient power systems, such as gas turbines or internal combustion engines connected to electrical generators. Syngas is also processed into chemicals, fertilizers and liquid fuels.

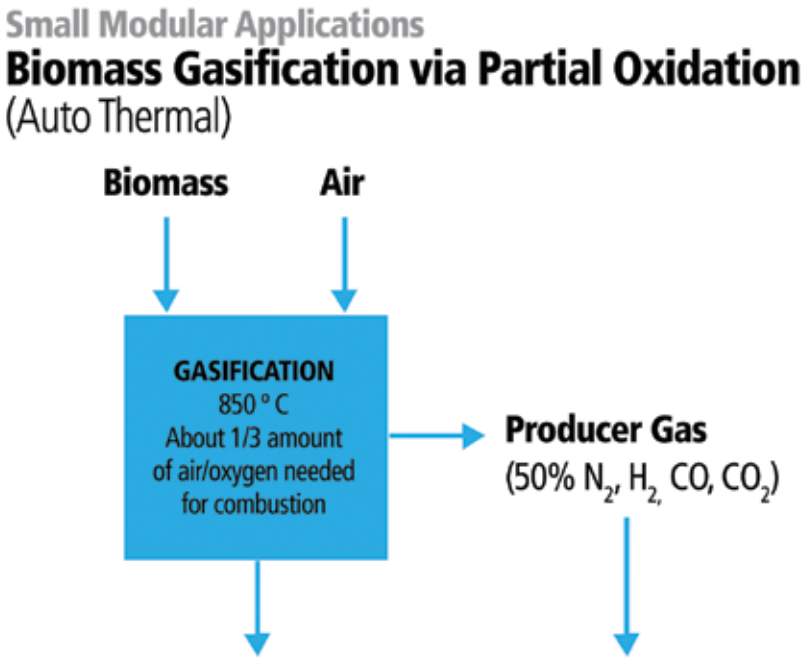
In the future, experts say, renewable syngas will be used as a feedstock for manufacturing ethanol and biopolymers, and for making hydrogen for fuel cells.

What materials can be gasified?

Any carbon-based material can be gasified: coal, petroleum, oil refinery wastes, wood, mill and forest product residues, crops and crop residues, manure, agricultural processing coproducts, municipal solid waste, sewage sludge, tires, even plastics. A Georgia carpet mill is gasifying carpet scraps to run its plant. Today, coal is the most common gasification feedstock, accounting for most of the syngas produced in the United States.

Why gasify biomass instead of burning it directly?

Most biomass power today is, in fact, produced by burning the fuel in a furnace to produce steam. But many types of biomass — distiller's grains and rice hulls, for instance — are difficult to burn. Gasification can convert nearly any kind of biomass to syngas. Syngas can also be purified and filtered to remove tar, particulates and chemical contaminants. So it burns much more cleanly than the solid fuel it's made from, reducing emissions.



SOURCE: U.S. DEPARTMENT OF ENERGY WEB SITE

Syngas can be used in more efficient integrated power systems called combined cycles, which couple combustion turbines and steam turbines to produce electricity. The efficiency of these systems can reach 60 percent — double the efficiency of direct-fired steam generators. Greater efficiency lowers the energy unit cost.

Synthesis gas can also be transformed to methane, which can be piped to distant users and substituted for natural gas.

Does gasification have other benefits?

Promoters say biomass gasification could strengthen rural economies and cut reliance on foreign oil. Substituting renewable fuels for fossil fuels benefits the atmosphere. And the ash left after biomass gasification makes good fertilizer.

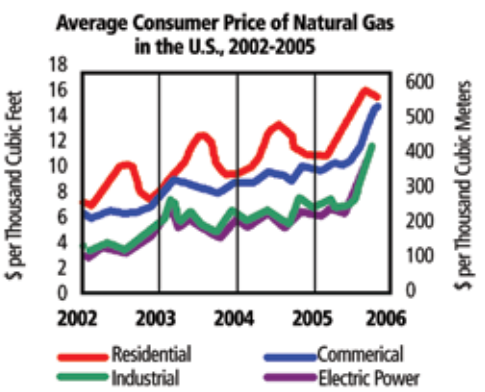
Is gasification a new technology?

Coal and wood gasification was first developed in the 1800s to manufacture "town gas" for lighting and cooking. In the 1940s, town gas was replaced by natural gas and centrally-generated electricity. After World War II, gasifiers were used to make chemicals and fertilizers from a variety of low-cost feedstocks, including coal and petroleum residues.

In the 1970s, gasification use began expanding in response to rising energy prices, and in the 1990s, world syngas capacity doubled. Now some 400 large-scale gasifiers worldwide are converting low-value coal and petroleum-based feedstocks into higher-value chemicals, fuels and electricity. The United States has about 20 large coal and petcoke gasification plants, which produce 15 percent of the world's syngas.

Is biomass gasification used in the United States today?

Interest in biomass gasification first began in the 1970s, and a variety of biomass gasification methods have been developed. Although the technology is still emerging, dozens of small-scale biomass gasifiers are in use around the country, generating about two percent of the nation's syngas supply — mainly from forest products, pulp industry residues and municipal solid waste.



SOURCE: U.S. DEPARTMENT OF ENERGY WEB SITE

What is the outlook for increasing U.S. biomass gasification?

Cheap fossil fuels have limited the economic competitiveness of biomass fuels, which are expensive to collect, transport and store. But that may be changing. Adoption of biomass gasification technology is being encouraged by higher oil and natural-gas prices, public demand for renewable energy, large supplies of biomass feedstocks and more stringent environmental regulations. Some recent examples:

- A pilot wood gasification plant is supplying 12 megawatts of electricity to Burlington, Vt., augmenting the city's existing power plant.
- In Salt Lake City, a pilot power plant is gasifying municipal solid waste, manure and agricultural residues to produce hydrogen for fuel cells.
- In Raleigh, N. C., clean wood residues are being gasified to produce fuel for a power utility.

What are the most promising types of biomass gasification?

Small biomass gasification systems hold the most commercial promise, because it is not cost effective to transport large amounts of bulky biomass over long distances to a central power plant. Systems are now being devised for manufacturing and processing plants, schools, farms and industrial parks.

Many experts say that agricultural processing plants will be the first to adopt gasification. These operations generate their own biomass coproducts, which are often low in value and could be profitably converted to energy. ■

Sources: United States Department of Energy, Energy Information Administration, University of North Dakota Energy and Environmental Research Center, Sebesta Blomberg & Associates, Inc.

Biomass bonanza

Agricultural residues and wood wastes are a plentiful, untapped energy resource

Every year, Planet Earth produces a deep well of untapped energy, but it's not oil.

It's renewable biomass — plant and animal materials that represent an energy resource of about eight quadrillion British thermal units a year, in the United States alone. That's a tiny fraction of the estimated 100 quadrillion Btu of energy consumed in this country every year. Still, it's three times the amount of biomass that the country uses now, according to the University of North Dakota Energy & Environmental Research Center (EERC).

The U.S. Department of Energy estimates that at least 500 million dry tons of biomass are now available annually in this country. American agriculture generates nearly half the total stocks; the wood and forest industries produce another third. Major biomass resources include:

- •Crop residues, 24 percent
- •Municipal solid waste, 21 percent
- •Animal manure, 18 percent
- •Mill waste, 16 percent
- •Forest, urban and industrial wood waste, 14 percent.

Minnesota generates more than 24 million tons of collectible biomass a year, making it the fourth leading biomass state behind Texas, California and Iowa, according to the EERC. Crop residues and manure account for three-fourths of Minnesota's annual biomass production, and forest and mill waste make up most of the rest. "Minnesota has a lot to offer in the way of biomass feedstocks," says Al Doering of AURI's coproducts lab in Waseca.

The state's biomass resources include:
Crop residues, 13.2 million tons
Manure, 4.5 million dry tons
Forest, mill, and urban wood waste, 4.4 million tons
Municipal solid waste, 2.3 million tons

Today, the U.S. uses biomass to produce about 2 percent of its total energy. Wood and crop residues are burned as fuel for steam-and-electricity cogeneration in the industrial and ag processing sectors. The electricity industry also cofires wood and other biomass for power generation, often in conjunction with coal. And increasingly, crops such as corn and soybeans are being converted into liquid transportation fuels — ethanol and biodiesel.

The Energy Information Administration's 2006 Annual Energy Outlook projects that biomass electricity generation will double over the coming decade, to about 50 billion kilowatt-hours by 2016. That's about one percent of the projected 4,807 billion kilowatt-hours of total generation.

In this country, biomass-energy use has been low because of cheap fossil fuels, Doering says. Feedstock cost is a main barrier. Biomass's energy value is low per ton, and it is thinly distributed across a wide area, making it expensive per Btu to collect and transport. Costs range from $30 to $60 per dry ton, according to EERC estimates.

The federal government has set a goal of developing a biomass collection industry capable of delivering one billion metric tons of biomass fuel a year by 2050. The near-term target is 150 million metric tons a year by 2010, at a price of $30 per ton or less.

AURI and others are working on efficient methods to harvest, transport and store biomass feedstocks, Doering says. "As fossil fuel prices increase and the cost of handling biomass commodities decreases, their use as energy becomes feasible." ■

Ag-powered options

Corn-stover biogas may be the best energy alternative for Morris industry

BY DAN LEMKE

Morris, Minn. — Is it economical to power an industrial park in Morris with a) manure digested into methane, b) corn stover combusted into electricity or c) biogas generated from stover and other biomass? The three options were evaluated by a recent AURI study and the most viable appears to be c) biogas.

A biomass gasification system installed at the Morris industrial park would use 69,000 tons of corn stover, roughly 25 percent of Stevens County's stover production. The system could produce about 507,000 million metric Btu or decatherms at a cost of $10.44 per decatherm, compared to the $14.50 that industry pays for natural gas.

Producers and local businesses are interested, says Michael Sparby, AURI project director. "Where it goes from here is still unknown, but all options are open. The study showed the technical and economic viability from a broad view. There would need to be more specific questions asked and specific structures put into place before any of these options were actually developed."

Sparby says local economic developers are putting a together a task force to move the project forward.

The Sebesta Blomberg engineering firm of Roseville, Minn. conducted the analysis and determined that a methane digester at a 5,800-cow dairy farm would produce about 108,000 decatherms at a cost of $10.59 per decatherm. An on-farm digester with a 12-mile pipeline to the city of Morris would cost an estimated $6.5 million. The gasification system would produce about five times more biogas for only $2.5 million more.

Producing electricity by burning biomass doesn't appear to be viable as capital costs would likely exceed $20 million for construction. The plant would likely need 10 cents per kilowatt to be economically feasible. The average price per kilowatt is 4 to 5 cents.

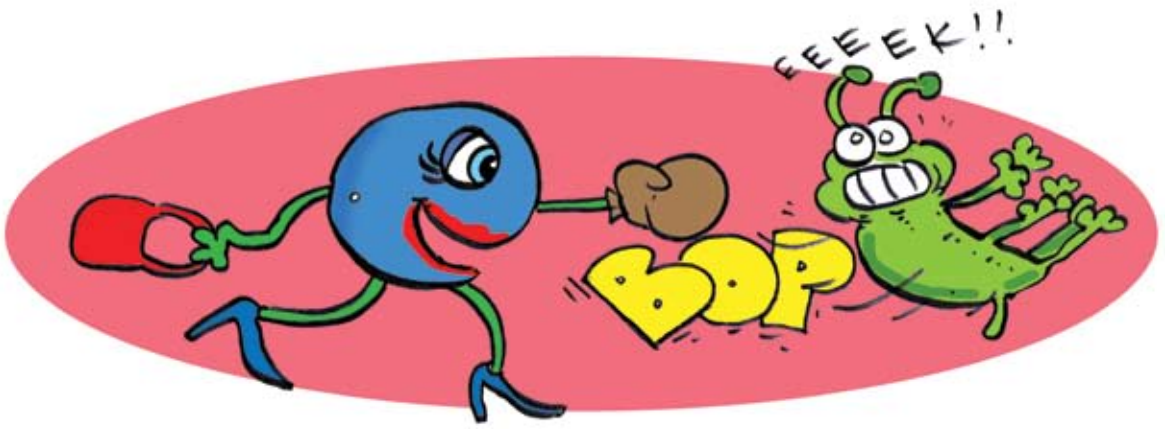
The Morris DENCO ethanol plant is a potential biogas user as it consumes about 760,000 decatherms annually and could use up everything the gasifier produced.

"The continuous availability of corn stover is yet to be determined," Sparby says, "but other feedstocks could be identified … like distiller's grains or other biomass available long term." ■

Elsewhere in ag utilization

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.

BY DAN LEMKE



Beautyberry banishes bugs

An old-time remedy for thwarting mosquitoes could be the next breakthrough in bug repellent, USDA-ARS researchers in Mississippi have discovered. For generations southern farmers have used crushed leaves from the American beautyberry to keep biting insects away from horses and mules. Scientists have isolated several insect-repelling beautyberry compounds, which tests show are as effective in preventing mosquito bites as DEET, the world's most-used insect repellent. Ironically, DEET was also developed by the ARS and the U.S. Army decades ago.

Source: USDA-ARS, January 31, 2006

Flax jeans

The already-cool denim jean is getting cooler. Researchers have created a cotton-flax denim that wicks perspiration in summer heat. Flax fibers improve the denim's ability to pull perspiration away from the body, and the blend is more permeable than standard denim fibers, allowing air to ventilate the fabric. The denim blend was designed by USDA-ARS scientists in South Carolina.

Source: USDA-ARS, November 17, 2005

Hi-Fi for health

Soluble oat fiber called beta-glucan has been shown to reduce LDL or "bad" cholesterol in blood. North Dakota State University scientists and the ARS have developed "HiFi," a spring oat variety that contains 50 percent more beta-glucan than traditional oats.

Source: USDA-ARS, February 6, 2006

Shining sun on HIV

German scientists at the University of Bonn have discovered that a sunflower substance prevents HIV from reproducing in cell cultures. Researchers isolated an antitoxin that sunflowers produce to ward off fungal attacks. The antibodies inhibit the reproduction of pathogens and researchers found they had the same effect on HIV cells in test cultures. The discovery could lead to a cost-effective treatment, but clinical trials are not yet completed.

Source: Soyatech.com, January 31, 2006

Apples to the rescue

An estimated 1.5 million people around the world suffer from peanut allergies. New research shows that apples may be key to reducing the nuts' allergenicity.

USDA-ARS scientists in New Orleans discovered that adding a natural apple compound — polyphenol oxidase — to chopped-peanut extracts alters the allergenic properties of some peanut proteins.

Source: USDA-ARS, February 15, 2006

A better red

Who knew color could be good for you? An Israeli company is manufacturing a tomato-based food coloring called Tomat-O-Red that uses lycopene, the carotenoid that gives a tomato its red color. Lycopene is a powerful antioxidant abundant in red tomatoes and processed tomato products that may help prevent prostate cancer, other cancers, heart disease and other serious diseases.

Approved for sale in the United States, Europe and Japan, the all-natural pigment can be used in either food or beverages, providing both a red color and healthful benefits.

Source: Foodnavigator.com, February 22, 2006

Soy sun block

A biodegradable sunscreen derived from soybean oil could soon be on store shelves. An Illinois company has been granted the exclusive license from the USDA-ARS to market SoyScreen. The product's sun-blocking properties come from an antioxidant found in rice, oats and other plants that is chemically bound to soybean oil. The sunscreen will not wash off from swimming or sweat, and it is non-polluting.

Source: USDA-ARS, November 3, 2005

Thyme tames odor

All manure stink may need is a little thyme. Researchers at the U.S. Meat Animal Research Center in Nebraska have discovered that thymol effectively curbs manure odor in livestock operations. The active component found in thyme oil can be extracted from plants like thyme and oregano. Slow-release thymol granules applied to cattle feedlots reduced concentrations of odor-causing volatile fatty acids and pathogens like coliform and E. coli bacteria. Researchers noted even more prolonged odor-control effects in swine facilities.

Source: USDA-ARS, December 16, 2005

'Bad News Bears' invent soy car

Americans have finally invented a soybean-fueled car that gets more than 50 miles to the gallon. But it's not being rolled out by a major automaker — the biodiesel car was designed by kids. A West Philadelphia High School auto shop program built the car from rummaged parts and wiring configured while the students, some with failing grades, developed their mechanical skills. The after-school project took more than a year and in February the car was featured at the Philadelphia Auto Show. Teacher Simon Hauger questioned why big automakers are still in the early stages of marketing hybrid cars. "We made this work. … We're not geniuses. So why aren't they doing it?"

Source: CBS News, February 17, 2006

Udderly sweet relief

Injecting sugar into cows' udders to prompt an immune-system response may be better than antibiotics at battling mastitis. The inflammation of cows' mammary glands costs producers an estimated $2 billion annually in animal and dairy-production losses.

USDA ARS researchers in Beltsville, Md., found that injecting cows with a yeast sugar was more effective than antibiotics at one-twelfth the cost. Scientists injected 40 non-milking Holsteins with the sugar and 40 with antibiotics. When they began lactating, only five cows injected with the sugar experienced the infection compared to 16 of the antibiotic-treated animals. Researchers deduce the sugar mobilizes white blood cells to attack mastitis pathogens.

Source: USDA ARS, February 13, 2006

Minnesota's liquid gold

Tests show syrup from ethanol production may nourish soils

BY DAN LEMKE

Waseca, Minn. — Minnesota may be sitting on an abundant, low-cost, high-nutrient fertilizer that's easy to handle and available statewide. Better yet, it may reduce costs for farmer's and one of state's fastest-growing industries.

This mystery liquid isn't actually all that mysterious. It's just syrup — a soluble coproduct of dry-mill ethanol plants. Typically the syrup is sprayed on distiller's grains, another ethanol coproduct, and dried for livestock feed.

Recently AURI initiated research to evaluate the liquid soluble as a land-applied fertilizer. "Most ethanol plants are looking for markets for the syrup because it is has relatively low value," says Al Doering, who heads AURI's coproducts lab in Waseca, Minn. "It's a liquid, we're in the middle of hog country, and farmers are used to handling liquid manure. We made the association and decided to test the syrup for its fertilizer value."

Doering sent syrup samples to several independent labs and the AURI fats and oils lab in Marshall. Tests showed exceptionally high levels of nitrogen, potassium and phosphate — the NPK needed to fuel high-yielding crops.

Laboratory tests show the syrup contains 24 to 29 percent solids and is lower in pH than swine manure. Per 1,000 gallons, the syrup contains about 80 pounds of nitrogen, 89 pounds of phosphate, 63 pounds of potash (potassium), and about 8 pounds of sulfur — all higher than swine manure.

As with manure and commercial fertilizers, not all these nutrients are available to crops. But based on assumed nutrient availability, 1,000 gallons of syrup, with a $23 value, equals the same amount of commercial fertilizer, valued at $42, at current market prices.

Using solubles for fertilizer may save energy, as the syrup doesn't have to be dried by the ethanol plant. Plus, the fuel used to produce and transport commercial fertilizers could be reduced.

"It's worth looking at because we're adding value to the syrup, potentially reducing the agronomic input costs to farmers, reducing drying time and costs for the distiller's grains and returning a natural product to the soil as a fertilizer," Doering says. "But we're still early on and need to look at the economics to make sure it's feasible … there are variables like transportation and application costs."

Doering says the initiative's second phase will likely involve university test-plot research including yield trials, nutrient availability, plant absorption and soil sample analysis. ■

AURI Ag Innovation Quiz

1. What is carding waste?
- a. Something you discard in Texas Hold 'Em
- b. Low-value wool processing fibers
- c. Paper scraps from the Hallmark company

2. Which Minnesota company is testing a biodiesel powered off-road vehicle?
- a. Polaris
- b. Crestliner
- c. Arctic Cat

3. What is "town gas?"
- a. Fuel purchased in a metro area
- b. Fuel produced by local gas works prior to WWII
- c. Kerosene

4. What is a decatherm?
- **a**. A million metric Btu
- b. A 10-sided biomass stove
- c. An extinct dinosaur whose bones were found in the Midwest

5. What is the most common fuel used for gasification?
- a. Biomass
- b. Plastic
- c. Coal

6. Woolch has been tested on what produce?
- a. Pomegranates
- b. Grapes
- c. Strawberries

7. How much of the United States total energy comes from biomass?
- a. 2%
- b. 10%
- c. 25%

8. What fuels can be gasified?
- a. Plant materials only
- b. Any carbon-based material
- c. Water

9. What do AURI staff and friends wish to offer retiring executive director Edgar Olson?
- a. Thanks for a job well done
- b. A happy retirement
- c. An appreciation for his efforts
- d. All of the above

Answers: 1. b 2. c 3. b 4. a 5. c 6. c 7. a 8. b 9. d

Spaeth named AURI executive director

BY DAN LEMKE

Crookston, Minn. — Fifteen years ago, Teresa Spaeth left suburban Indianapolis for rural Mahnomen to help take over her husband's family farm. Today she is totally immersed in agriculture and rural life. Her expertise and devotion to rural economic development led to Spaeth's appointment as AURI's executive director in February. The position started March 5.

Spaeth was unanimously selected by the AURI board of directors to succeed Edgar Olson, who retired after more than eight years as AURI's executive director. "I feel honored that the board selected me to carry on AURI's traditions," Spaeth says. "Minnesota agriculture can be assured we will continue to strengthen value-added agriculture across the state."

An Indiana native, Spaeth met her husband Andy in Indianapolis, where he was studying commodity training. "He decided he wanted to come home and take over the family farm," Spaeth says. They now raise corn, soybeans, wheat, barley and sunflowers.

Her interest in value-added agriculture piqued while working as comptroller at Minnesota Dehydrated Vegetable in Fosston, Minn. In 1998, she joined AURI, then earned an MBA from the University of North Dakota. "I focused on rural and business development, did some research in best practices and wrote my master's thesis on rural value-added agriculture," Spaeth says. At the same time, she was enrolled in a Southwest State University rural leadership program.

Spaeth.

In 2003, Spaeth left AURI to head the Small Business Development Center at Bemidji State University, but returned as AURI director of programs and finance in 2004.

Spaeth says when she first joined AURI, project funding was structured like a loan program where applications were accepted or denied. Now, evaluating projects is a hands-on approach where clients work with AURI teams, including business and scientific staff. Before a project is funded, the team evaluates both the project's market and technical feasibility.

Though AURI focuses most of its efforts on a project's technical merits, it is critical to understand a project's chances of surviving a competitive marketplace, Spaeth says. "Maybe you can make a baseball bat out of wheat, but if nobody wants to buy one, why make it?" For market feasibility, AURI contracts with a Southwest State University marketing center in Marshall.

Value-added agriculture, "is on a great upward trend," Spaeth says. "I think the bio trend is going to be interesting for a long time to come."

While producers were once the main bio-product promoters, "Now the rest of the world is waking up and they're starting to say, 'Hey, there is something to all this renewable stuff.' "Everything is fair game, whether bio-energy, nutraceuticals or using coproducts," Spaeth says. "What's connecting rural and urban now is value-added agriculture."

"We are at a point where advanced, technological thinking is intersecting with agriculture to open up a world of opportunities."

AURI will continue what it does best: providing hands-on technical services, feasibility assistance and laboratory access, Spaeth says. "We are focused on not duplicating what someone else is doing," so AURI connects clients with other resources — whether a university researcher, small business development center, marketing consultant or other specialist.

"There isn't anyone on staff who doesn't have a passion for value-added agriculture and Minnesota," Spaeth says. "We've built something that takes everyone's dedication and uses it to make us a better, more effective organization."

"We welcome Teresa to her new position; she has our full support," says AURI Board Chair Al Christopherson. "The organization has earned a high level of credibility and we expect that growth will continue under her leadership." ■

AURI profiles of leadership

BY DAN LEMKE

Since 1989, when it became a nonprofit corporation, AURI has been governed by a board of directors representing commodity groups, farm organizations, the state legislature and agribusiness. These stakeholders — all leaders in their organizations, guide AURI's success.

While much of the board's work is out of the spotlight, the members' combined experience and expertise helps chart AURI's course, providing Minnesota producers with value-added opportunities for commodities.

Each member has his or her own reasons for serving on the Board. In the next few issues we will profile these leaders to acquaint readers with those who help guide AURI.

Al Christopherson

Although Al Christopherson recently retired as Minnesota Farm Bureau president, a position he has held since 1988, he is tirelessly continuing his work in value-added agriculture.

Christopherson.

Christopherson has served on the AURI board since 1989 and has been board chair since 2001. He also raises corn, soybeans and hogs on his farm near Pennock, Minn. Christopherson says value-added development is essential to a healthy agricultural industry: "We can and must seek out new markets and uses for agricultural products … AURI is the vehicle to accomplish that mission," he says

In the future, "I see AURI continuing much of what we've been doing, but a number of the efforts will center around alternative sources of energy," Christopherson says. Animal-waste uses and health products made from farm crops are other emerging areas of opportunity, he notes. Developing new products is a valuable service, Christopherson says, but perhaps more important is the expert analysis and opinions on a project's feasibility that AURI staff provide to businesses and individuals.

Jerry Kruger

Jerry Kruger of Warren, Minn. has represented the Minnesota Wheat Council on AURI's Board for more than 11 years. He owns and operates a diversified farm in northwestern Minnesota, raising wheat, soybeans, canola and sunflowers.

Kruger says AURI's flexibility in responding to changing and emerging opportunities is key to the organization's success, as is promoting Minnesota's economy.

Kruger.

"AURI's greatest value is in keeping value-added dollars in Minnesota that would otherwise go somewhere else," Kruger says. "AURI is the place to go for answers to technical, applied research or business questions for those who are trying to add value to Minnesota-grown products."

AURI's focus on renewable energy has significant development potential, Kruger says. He also points to projects like Swheat Scoop cat litter, produced by Pet Care Systems of Detroit Lakes, as examples of AURI's best work. Pet Care Systems converts poor-quality wheat into an environmentally-friendly product superior to others on the market. AURI's coproducts lab in Waseca helped formulate and test the litter.

Whatever the opportunity, Kruger says AURI will play a valuable role "assisting stakeholders in exploring and pursuing new value-added opportunities as they emerge."

James Willers

Jim Willers is among the newest voices on the AURI board of directors. Willers, who grows corn, soybeans and hay with his brother near Beaver Creek, also serves as secretary of the Minnesota Soybean Research and Promotion Council. He has represented the MSRPC and Minnesota Soybean Processors on AURI's board for nearly two years.

Willers says AURI's unique services offer a distinct advantage for the state. "AURI can do a hands-on assessment to determine if a market for a product exists or not."

Like all of the Board's nine members, Willers says there is merit in providing assistance to value-added ventures because those opportunities help create jobs and keep people living in rural Minnesota.

Willers says renewable energy from ag products will continue to be important, as will new uses for coproducts. As a representative of the soybean industry, Willers is particularly interested in biodiesel and new uses for glycerin, which is a coproduct of biodiesel refining.

Willers.

Good timing

BY EDGAR OLSON
FORMER AURI EXECUTIVE DIRECTOR

The time is right. After more than eight years as AURI executive director, it's time for me to turn over the reins of this fine organization, move to the next chapter of my life and enjoy retirement.

I leave AURI in a position of strength. By focusing on our core strengths of technical and feasibility assistance, product development and applied research, AURI fills a vital role for developing value-added opportunities in Minnesota.

The road hasn't always been smooth, but it seldom is. The path we've taken has helped us

PHOTO BY ROLF HAGBERG

learn and made us who we are.

We've learned how to be better partners with others who have the same goals. We regularly connect with our stakeholders and partnering organizations to match our activities with their priorities. This way we are able to positively impact as many producers as possible.

We've learned to better focus our strengths and provide services not offered elsewhere. AURI often collaborates with the Minnesota Department of Agriculture and the University of Minnesota. While MDA is a regulatory and marketing organization, the University provides education and bench-top research information. AURI provides technical assistance and applied research for existing or emerging businesses. Working with others who bring expertise and resources to the table can return exponential results.

While we've learned many things, what's exciting about an innovative organization is learning doesn't stop. New technology develops. Discoveries are made. Intriguing questions are asked. It all spawns further innovation that leads to new opportunities.

AURI will be there to support and develop those ag-based innovations. But someone else will be at the helm because, for me, the time is right.

Godspeed.

ABOUT AG INNOVATION NEWS

Dan Lemke, communications director
Cindy Green, managing editor
Rolf Hagberg, photography
Design by pounce.com

Published by the Agricultural Utilization Research Institute to inform the food, agriculture and business communities and the general public about developments in ag-based products.

For information on AURI, call 1-800-279-5010 or visit our Web site: www.auri.org

Out-of-state subscriptions are $10 per year; Minnesota subscriptions are free. To save AURI mailing and printing costs, order an electronic version at www.auri.org/news/subscrib.htm

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

PRINTED WITH SOY INK
Trademark of American Soybean

Edward Ellison

Ellison.

Ed Ellison, a retired farmer from Herman, has been on the AURI Board for 12 years. Ellison served on the Cenex Harvest States board for 21 years and now represents CHS as an agribusiness representative on the AURI Board. He also continues to help his two sons farm.

Ellison broadly views all Minnesotans as stakeholders, but particularly agribusinesses, commodity groups and producers. He says AURI's three offices in rural Minnesota and its concentrated efforts in renewable energy and value-added opportunities are making a difference.

"I believe that AURI has done a good job of providing a 'one-stop shop' for analysis of technical and market feasibility, product development, applied research and access to laboratory facilities," Ellison says. "AURI has done all this on a very small budget, so the return on investment to the Minnesota economy is fantastic."

Ellison points to projects like Swheat Scoop, Mississippi Topsoils, Minnesota Soybean Processors and SoyMor as examples of innovation that AURI has assisted. But he adds it may be just as valuable when start-up or emerging businesses stop or change plans after AURI staff analyze the project, saving the business time and money.

Rep. Greg Davids

Rep. Davids.

Rep. Greg Davids is new to the AURI board, but not to Minnesota agriculture. An eight-term state representative, Davids is a farm owner and financial services provider from Preston, Minn.

Among his legislative responsibilities, Davids chairs the House Agriculture and Rural Development committee. He has authored several bills involving value-added agriculture, including legislation requiring that ethanol make up 20 percent of the gasoline sold in Minnesota by 2013. Like others on the AURI board, Davids sees renewable energy as a huge opportunity for Minnesota agriculture.

"I believe this is really an area where AURI can add value," Davids says. "We need to become less dependent on oil and more independent using our own resources. AURI can lead that research."

Davids is particularly interested in new uses for biomass, which he says is underutilized.

"This is an area where everyone can win," Davids says. "We've really just touched the tip of the iceberg … we can grow the corn for ethanol, soybeans for biodiesel and utilize stover as well.

"Minnesota is already a leader (in renewable energy development), but that doesn't mean we can rest on our laurels. We have to work even harder."

■

AURI GUIDE TO SERVICES

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

AG INNOVATION NEWS
The newspaper of the Agricultural Utilization Research Institute

P.O. Box 599
Crookston, MN 56716
Change Service Requested

Non-profit
Organization
U.S. Postage
PAID
Permit No. 14
Detroit Lakes,
MN 56501

berry BLANKETS

Waste wool and wood fiber make a garden-friendly mulch

BY DAN LEMKE

Morris, Minn. — Wool blankets have been keeping humans warm for centuries. Now they will help grow berries.

The Minnesota Lamb and Wool Producers Association is marketing Woolch, a wool mulch for fruit and vegetable plots and landscaping.

The plush, gray blanket is made from carding waste: low-value fibers often discarded after raw wool is cleaned and separated for spinning.

"We have a waste product that does an excellent job on weed control and moisture retention," says Sherry Stirling, MLWPA secretary and Woolch project coordinator. "When you're done with it, the wool mulch can be plowed into the soil where it adds nitrogen, helps to aerate the soil to prevent compaction and is 100-percent biodegradable."

In 1991, the West Central Research and Outreach Center in Morris started testing wool-mulch blankets, which proved effective in controlling weeds, promoting plant rooting and maximizing fruit yields. But the wool had to be trucked to Texas to be needle-punched into blankets, resulting in a $2,000 per acre mulch cost — too high for the market.

In 2004, AURI connected MLWPA with Mat, Inc. of Floodwood, Minn., to create a more cost-effective mat. After several attempts, the winning design turned out to be a pressed blend of waste wool and wood fiber. It had the first blanket's characteristics but at a fraction of the cost.

"It turns out the best wool to use was carding waste because of the fiber length," says Alan Doering, a scientist at AURI's coproducts lab in Waseca. "That's good news because they are able to source carding waste from Faribault Woolen Mills. Now there's a market for the waste wool and the Lamb and Wool Producers are able to produce a blanket that's cost competitive."

The new blanket was tested for weed control in strawberries at WCROC in 2004 and 2005. Results showed it as effective as hand weeding and possibly better than standard herbicides.

"There are less than a handful of herbicides that are approved for use on strawberries," says Steve Poppe, WCROC horticultural scientist. "The wool mulch did what it was supposed to do. Strawberry yields from the test plots were comparable to standard methods."

Since the wool mulch can be left on plants for two years, it not only helps control weeds and hold moisture, it saves labor. Only the initial planting and mulch placement is labor intensive, then it requires little maintenance. And the mulch is in place during June and July when strawberries must be kept weed free and laborers are busy picking fruit.

Besides strawberries, Stirling says Woolch would work well in tomatoes, specialty crops, landscapes and home gardens.

"Nobody likes to weed gardens," Stirling says, "but weed control is a huge issue for anyone who raises strawberries, herbs or does any type of truck farming. Unlike plastic sheeting, which has to be taken up and disposed of when it's done, the Woolch can be plowed back into the soil."

Woolch is available in rolls that can be cut to fit. An 80 x 5 foot roll costs just under $80. ■

For more information on Woolch visit www.mlwp.org or call Patricia Anderson at (952) 447-4184.

Steve Poppe, a horticultural scientist in Morris, Minn., started testing wool-mulch blankets in strawberry trials in 1991. Though the blankets were too expensive for full-scale production, a new blend of waste wool and wood fiber called Woolch is proving to be cost-effective weed control for strawberries, tomatoes and specialty crops.