



## A History of Biomass Experience and Expertise

The Energy & Environmental Research Center (EERC), with its rich tradition in fossil fuel energy and air-land-water environmental pollution control, has also diversified over the past 20-plus years into one of the premier centers for research in biomass.

It all began in the early 1980s when the EERC conducted a series of research projects involving the utilization of sunflower hulls, wood residue, and sewage sludge for power using both combustion and gasification technologies. This work led to several projects related to biomass-coal cofiring strategies in conventional pulverized coal-fired systems and gasifiers to reduce carbon dioxide emissions and other emissions.

With proven and developing expertise in biomass and with the aid of federally directed funds and cost-share funds from state, commercial, and industrial clients, the EERC developed a nationally recognized program now known as the Centers for Renewable Energy and Biomass Utilization. This program began in 1999 with the support of \$300,000 in funds spearheaded by Senator Byron Dorgan. Those funds were matched with nonfederal cost-share funds from several industrial partners interested in converting California rice straw and wood residues into ethanol.

The EERC's research in developing power and products from biomass continues to grow. At any given time over the last 5 years, the EERC has had over 15 biomass projects ranging from \$3 million to \$6 million in active contracts for projects advancing the



*EERC Research Engineer Chaunbin Liu is optimizing fermentation-based technologies for improving the efficiency of ethanol production.*

utilization of biomass for energy, transportation fuels, and other value-added products. Additionally, this year the EERC was awarded approximately \$5 million from the U.S. Department of Defense's Defense Advanced Research Projects Agency (DARPA) for the development and demonstration of a new domestic bio-jet fuel for the U.S. military.

Some of the other projects that have come from the EERC's Centers for Renewable Energy and Biomass Utilization program include:

- Processing ethanol into hydrogen for solid oxide fuel cell vehicles.
- Developing a two-stage anaerobic digestion method for converting french fry plant waste to methane for bioenergy.

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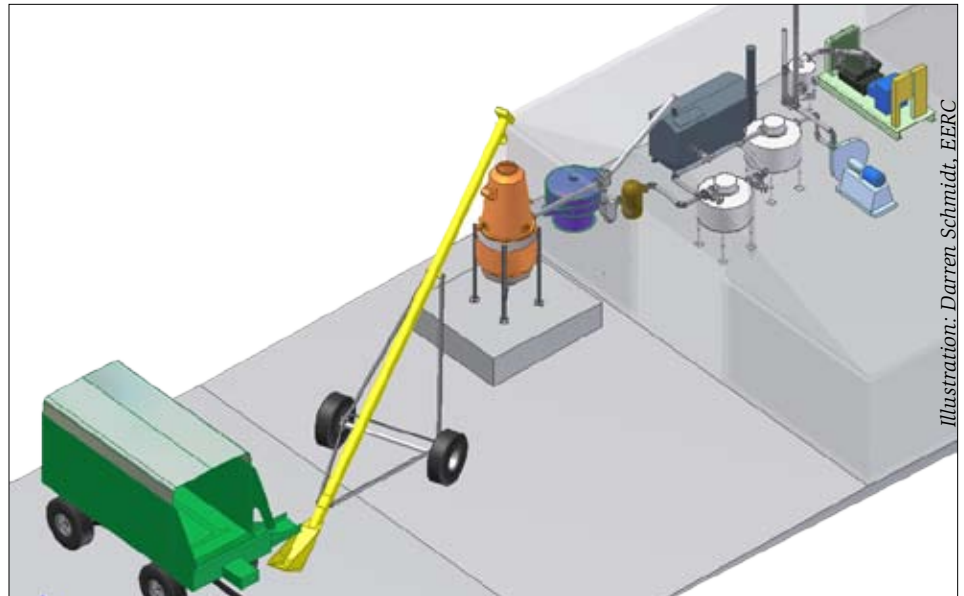
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- Developing, demonstrating, and commercializing a biomass gasification system to produce electricity from agricultural waste.
- Designing numerous state-of-the-art biomass energy power systems for small industries, tribal entities, colleges, and municipalities.
- Advancing the technologies for producing ethanol, cellulosic ethanol, and biodiesel.
- Converting agricultural by-products into value-added commodity chemicals.
- Devising an innovative gas extraction and cleanup process to utilize biogas from the Grand Forks landfill that can generate 1.5 to 2.0 megawatts of electrical power for up to 15 years and lower initial capital investment costs by more than 50% while also lowering overall operation and maintenance costs.

“The goal of the Centers for Renewable Energy and Biomass Utilization Program is to develop marketable products from biomass that the real world can use,” said Chris Zygarlicke, Deputy Associate Director for Research. “We showcase our biomass research and products at the yearly biomass workshops held in Grand Forks, North Dakota.”

The Biomass '07: Power, Fuels, and Chemicals workshop will be held May 15–16, 2007, at the Alerus Center in Grand Forks. Information on the workshop can be obtained at [www.undeerc.org/biomass07](http://www.undeerc.org/biomass07) or by contacting LaRae Foerster, Event Coordinator, by phone at (701) 777-5246 or by e-mail at [lfoerster@undeerc.org](mailto:lfoerster@undeerc.org).

For an example of a real-world demonstration of converting biomass into power and heat, see the article on G F Truss in this same issue.



Layout design for the gasification system at G F Truss.

## Biomass Gasifier Demonstration Project at G F Truss

**B**iomass is an exciting industry, especially when one could turn a “waste product” into an energy source. Take a pile of wood chips. If it were left to pile up on a site or in a landfill, it would eventually release greenhouse gases into the air as it decomposes. Turning that pile of wood into power or heat for your home or business as well as selling any excess power to the local utility—all while emitting very low emissions—would be very exciting indeed.

Since the early 1980s, the EERC, along with its partners, has been involved in the testing of various feedstocks, such as wood chips, as well as developing a gasification system to turn those feedstocks into power or fuel.

Recently, Darren Schmidt, EERC Research Manager, contacted G F Truss, located in Grand Forks, North Dakota, about a possible partnership. G F Truss is a family-run business that manufactures wooden roof trusses. Stuart Johnson developed the business and now focuses on strategic planning. His son, Shaun, handles day-to-day operations. Outside their warehouse is a stack of wood chips approximately 300 feet long, 100 feet wide, and 12 feet high left over from 20-plus years of production.

Schmidt offered the Johnsons a deal that they could not pass up: to use a gasifier to produce electricity and heat for the truss building facility, offsetting 100% of the facility’s power use.

The 50-kW biomass gasifier and fuel feed area will be located outside a storage building. Inside the storage building will be the primary gas cleanup and ash-handling station, the secondary gas-cleaning station, and the generator. The process will include taking containers of wood chips from the plant and putting the chips into a grinder to produce even smaller chips. Those chips will then be placed into a bin, transported to the fuel feed area, and put into the gasifier to begin the process of producing electricity.

If the system runs 8 hours a day, 5 days a week, it will consume the daily waste that G F Truss produces. However, if G F Truss decides to run the system 24 hours a day, 7 days a week, it would take care of the plant’s daily waste as well as begin to deplete the yard pile while sending the excess electricity back to the grid to receive revenue from the power utility.

Continued on page 5



EERC Foundation Board Members, January 2007 (identified at right).

## EERC Foundation Board meets for annual meeting

The EERC Foundation Board of Directors met on January 3, 2007, at the EERC to discuss a number of new and ongoing technology transfer and commercialization activities, such as the EERC's newest opportunity for a series of projects under a limited liability corporation agreement in the United Arab Emirates.

The 11-member EERC Foundation Board consists of representatives from business, industry, and energy and environmental entities, regionally and nationally, as well as from UND.

"We are extremely proud to have this level of expertise and experience on the Foundation Board of Directors," says Gerry Groenewold, EERC Director. "These are prominent people in their fields who bring significant leadership skills and perspective to the issues facing the Foundation."

The EERC Foundation was formed in late 1992 as a separate, nonprofit

corporation existing solely to support the commercialization activities of the EERC. By careful design, the EERC Foundation is not part of the EERC or part of UND. The rights to intellectual property developed by the EERC are transferred to the EERC Foundation, which then licenses the rights to developed technologies and fosters relationships with strategic industrial partners that invest in commercializing those technologies. Revenues from commercialized technology support the Foundation's commercialization efforts, reward the technology inventors, and are invested in viable projects under development at the EERC. The move to commercialize EERC technologies did not happen overnight, however.

"I said at the outset it would take 10 years for the EERC Foundation to mature and start seeing commercial deployment of EERC technologies," says Groenewold. "It took 9½."

One of the guiding principles of the



Pictured left to right:  
**Gerald Groenewold**, Director, Energy & Environmental Research Center\*  
**Tim O'Keefe**, Executive Vice President and CEO, Alumni Association and UND Foundation  
**Michael Swenson**, President and CEO, Xcel Energy-Wisconsin, Eau Claire, Wisconsin  
**John MacFarlane**, Chairman of the Board, Otter Tail Power Company, Fergus Falls, Minnesota  
**Howard Dahl**, President and CEO, Amity Technology, Fargo, North Dakota  
**Tom Hamilton**, former Executive Vice President of Pennzoil Company and President of Pennzoil Exploration and Production Company, Houston, Texas  
**Thomas Bechtel**, TFB Consulting Services, New Bern, North Carolina, and former Director of the Morgantown Energy Technology Center

Not pictured:  
**Patrice Elliott**, President, Wells Fargo Bank, Billings, Montana  
**Robert Gallager**, Vice President for Finance and Operations, University of North Dakota\*  
**Hal Gershman**, President, Happy Harry's Bottle Shop, Grand Forks, North Dakota  
**Charles Kupchella**, President, University of North Dakota\*  
 \* Nonvoting ex officio members.

Foundation is a maxim of Thomas Edison's that says "Don't invent something nobody wants." The Foundation takes its role seriously in commercializing technology that society both needs and wants.

To date, over 20 technologies developed by the EERC either have been licensed or are moving toward commercial licensing.

The Global market for environmental technologies alone will reach \$586 billion by the year 2008, according to the U.S. Department of Commerce, and the EERC Foundation's role is critical in bringing EERC-developed technologies to market. The relationship between the EERC and the EERC Foundation has been a positive force in furthering the goals of the EERC to develop much-needed new environmental technologies and to bring them into use by industry. The EERC sees similar opportunities in energy technologies.

—Sandy Van Eck

# New employees



**June Novacek** is a Research Information Associate at the EERC, where she works in the Front Desk area to provide a variety of office

and product finalization services, including producing documents, fielding incoming telephone calls, providing initial contact for EERC visitors, serving as a Center-wide contact and reference point, and providing information dissemination services. Novacek reports liking “the variety of daily challenges” the EERC presents. One of the things that interests her most about working at the EERC is its cultural diversity.

Prior to her position at the EERC, she was a Program Assistant at the UND Television Center, performing similar administrative tasks. Novacek has been at UND for over 10 years. She holds a degree from Aaker’s Business College.

Born and raised on a farm near Reynolds, North Dakota, Novacek has two teenaged daughters, one attending high school and the other attending community college. The family also has a dog named Ace. Novacek and her daughters like spending summertime at the lake and wintertime taking in UND athletic functions, particularly hockey and basketball. In addition to playing softball and spending time with family and friends, one of Novacek’s favorite pastimes is watching her daughter play high school hockey.



**Steve Wilmoth** is a Research Engineer at the EERC, where his work in the Mercury and Related Sampling Group (MARS) focuses on mercury

control projects involving the development, setup, and operation of continuous emission monitoring systems. Wilmoth’s professional interests include a branch of artificial intelligence known as fuzzy-neural control and solid-state energy conversion.

“What I like about working at the EERC is the opportunity to work in research and the caliber of the people working here,” Wilmoth says.

Although he’s a new full-time employee, Wilmoth served as a Research Instrumentation Technician at the EERC summers since 2002 while he was an engineering student at UND. Prior to working at the EERC, he worked for Longview Fibre Company of Grand Forks as an industrial mechanic. Wilmoth also worked for American Wood Products, making red cedar lawn furniture and other wood products, and he owned and operated a professional maintenance and floor care company for about 10 years.

It was while working at Longview Fibre that Wilmoth realized he needed to go back to school in order to do the work he wanted to do. He now holds an A.A.S. in Industrial Electronics from Northwest Technical College and a

B.S. in Electrical Engineering from UND.

A native of Toledo, Ohio, Wilmoth traveled widely as a young man, working in construction and ranching and even for a carnival for a time. He discovered he really liked the northern Minnesota area and was able to find work in North Dakota, where he’s been settled for the last 30 years.



**Nathan Fiala** is a Research Engineer at the EERC, where his work focuses on emissions control and hydrogen fuel research. Although

he’s recently become a full-time employee, Fiala worked as a student at the EERC on two separate occasions, once in a microbiology lab and another time working on database development of nuclear cleanup technologies. “I like working at a place knowing that the things we are researching and developing are worthwhile endeavors,” says Fiala. “The EERC is a place where creative freedom is encouraged, which is one of the reasons I wanted to work here. I am excited to begin developing my own interests into proposals and seeing how far I can take them.”

Fiala holds a B.S. and is pursuing an M.S. in Mechanical Engineering, both from UND. Fiala’s principal areas of interest and expertise include gas turbine heat transfer and aerodynamics, computational fluid dynamics, and hydrogen fuel technology. Prior to his position at the EERC, he served

as a Graduate Research Assistant in the Department of Mechanical Engineering at UND, where he coauthored three publications on gas turbine engine heat transfer and aerodynamics. He also worked on a consulting project for an aviation instrumentation company.

In addition to hobbies like golfing in the summer, playing hockey in the winter, and running year-round, Fiala likes to read, watch movies, camp, and fish. Fiala and his wife, Amy, also enjoy going out to movies, throwing a Frisbee for their 10-month-old black lab, and spending time with their families. They enjoy all UND sports, especially cross country, as Fiala ran cross country for UND. They moved into their first house last spring, so they've been enjoying making it a home for themselves and their first child, due on Valentine's Day.

-Sandy Van Eck



Shaun Johnson, G F Truss, and Darren Schmidt, EERC, stand by one of the automatic saws in the production area of G F Truss. Schmidt holds wood chips that will provide energy for the truss-building facility while helping to dispose of its waste products.

Currently, the slab for the gasifier has been completed, and equipment will be installed shortly. Schmidt and the Johnsons are hoping that the system will be in operation by the end of March.

The demonstration conducted at G F Truss will provide critical information on commercial development and service for EERC partners and product customers.

-Trish McGuire

**MARK YOUR CALENDARS!**

**BIOMASS '07**

Power, Fuels, and Chemicals Workshop

**May 15-16, 2007**  
at  
**The Alerus Center**  
1200 42nd Street South  
Grand Forks, North Dakota

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**For more information:**  
[www.undeerc.org/biomass07](http://www.undeerc.org/biomass07) or (701) 777-5246

## SNAPSHOTS:



The National Center for Hydrogen Technology.

- John Hendrikson, Associate Director of Business and Operations, reports that construction on the National Center for Hydrogen Technology facility is "progressing nicely toward the scheduled completion in May."
- EERC employees increased their 2006 United Way contributions by 29% over the 2005 campaign. In all, they contributed \$7607 to support health and human service programs throughout the Grand Forks, North Dakota, and East Grand Forks, Minnesota, region. This amount is almost 10% of all UND contributions.



*Prairiegrass band members rehearse their harmony for the Prairiegrass Bluegrass Festival on February 10, 2007. From left: Bonnie Hallett, Bruce Elseth, Ed Olson, Paul Tandberg, and Darren Schmidt.*

## Prairiegrass

Two EERC researchers have an interesting hobby that has nothing to do with their day jobs. EERC Research Manager Darren Schmidt and Senior Research Advisor Ed Olson, who work in biomass energy by day, moonlight in a Red River Valley bluegrass band that is garnering rave reviews playing such events as Grand Forks' First Night and the Prairiegrass Bluegrass Festival at the Empire Arts Center in Grand Forks.

The band, named "Prairiegrass" for its Midwest bluegrass sound, started about 4 years ago. Schmidt and Paul Tandberg, the husband of EERC Research Manager Charlene Crocker, met at a picnic and decided to try playing together. They found that Schmidt's banjo playing and Tandberg's lead vocals and roots in folk guitar complemented each other. They soon expanded the group to include Paul's friend, Bruce Elseth, a guitarist from Newfolden, and Bonnie Hallett, a Grand Forks Symphony violinist who plays fiddle, from Thief River Falls. The group practiced at

the EERC the first year. Nearly 2 years ago, Schmidt discovered another banjo player with great harmony vocals right here in the EERC in Ed Olson and asked him to join the band.

"We all really came together just because we wanted to play," says Schmidt, "not perform. It's just fun to play. But at some point, after friends and family listened to us and encouraged us, it made sense to perform. We started to want to share the music with a wider audience. It's gratifying when the audience enjoys it."

Although Schmidt and Tandberg, and sometimes Elseth, played at community events in the Newfolden, Minnesota, area early on, the full five-member Prairiegrass band debuted at First Night in Grand Forks 2 years ago. The group meets weekly to practice, and since First Night, they've played at numerous community and church events and even held a regional bluegrass festival at the Empire Arts Center last May. They played at First Night again this New Year's Eve and held the second Prairiegrass Bluegrass Festival at the Empire Arts Center on

February 10 with two other regional bluegrass bands.

While Prairiegrass has performed gospel music at several church events, the band has its roots in bluegrass music. Bluegrass music is considered an American form of folk music based in Appalachia with its roots in English, Irish, and Scottish traditional music as well as influences from jazz and blues.

Bluegrass was named after Bill Monroe, generally thought of as its "founding father," and his 1940s band, the Bluegrass Boys, which, from 1945 to 1948 included vocalist/guitarist Lester Flatt and banjo player Earl Scruggs. Flatt and Scruggs later went on to form the Foggy Mountain Boys. Bluegrass music became more commercially popular after the success of the Coen brothers' 2000 movie, "O Brother, Where Art Thou?" and the subsequent "Down from the Mountain" bluegrass music tour.

Ed Olson might be said to have "backed" into bluegrass music. Olson, who also sings weekly in the Valley Chordsmen Barbershop Chorus and a barbershop quartet, seems genuinely

amazed by his love for music as an adult. He was never in a band growing up and dropped out of chorus in the ninth grade, joining again in his senior year. It really wasn't until he bought a "cheap guitar" in Mexico on a graduate school vacation and taught himself to play that he felt like a musician. After that guitar met an untimely end, Olson found himself in a pawnshop in Minneapolis, where the only instrument he could afford was a \$15 banjo. With that banjo and a Pete Seeger book, he taught himself "frailing," one of the traditional, clawhammer banjo playing styles, where one strikes the strings with the back of the fingers.

Olson was a fan of folk music and listened to groups like the old Kingston Trio, which used a banjo in a "fake" frailing style. When Olson was at Caltech in Los Angeles in the early 1960s, he discovered the folk music hall called the Ash Grove, which began as a folk coffee house in 1959 and in the 1960s became one of the major musical venues on the entire West Coast, influencing musicians of all genres—bluegrass, pop, jazz, and rock as well as folk. The Byrds, Jim Morrison, Ry Cooder, and countless



*Ed Olson and the longneck banjo he bought in 1966. This type of banjo was popular at the time in string and dance bands when keyed in E flat but found a new life in folk and bluegrass music when tuned in G.*

other younger musicians listened to and learned from the likes of Bill Monroe, Muddy Waters, Maybelle Carter, and Doc Watson. It was at the Ash Grove that Olson heard bluegrass music for the first time, and one of those first bluegrass players was the legendary Earl Scruggs.

"I fell in love with what he [Scruggs] was doing," Olson says, and he still considers Scruggs his biggest bluegrass influence today.

While Olson has a couple of other banjos now, including a 1920s Orpheum 4-string tenor banjo with a carved heel, it's the longneck banjo he bought in 1966—his first "decent banjo"—that he still plays today in Prairiegrass.

When asked what he would like to see for the band in the future, Olson jokes a bit.

"Nashville?" he laughs. "Not to make money, but to have fun. We'd really just like a nice following of good crowds."

Darren Schmidt, as modest as Ed Olson about his musical beginnings, claims not to be a natural musician. He's played different instruments, but he's had to work really hard at it. His musical inspiration came more from rock bands than from folk or bluegrass music. Schmidt discovered a love for bluegrass music, though, having gone to college in West Virginia and working soon after at the Research Triangle Institute in North Carolina, where bluegrass music was a staple at community picnics and many other public events. A big influence on Schmidt was Public Radio's "West Virginia Mountain Stage," which featured traditional bluegrass groups like the Osbourne Brothers in addition to Jerry Garcia's more progressive bluegrass music sound.

"This was the middle of the state, the mountains—this was Bill

Monroe and Earl Scruggs country," Schmidt says.

Schmidt taught himself to play the banjo his first year out of college while living in Raleigh, North Carolina. Schmidt likes playing banjo because he can play backup as well as melody. To him, it's "much more interesting to play than guitar." Schmidt attends a bluegrass camp every summer at Cross Ranch State Park in western North Dakota and has even written a few songs.

It's somewhat ironic that despite having lived in bluegrass music country, Schmidt met bluegrass great Ralph Stanley—three generations of Stanleys, actually—2 years ago after their show in Fargo, North Dakota.

Schmidt would like to see bluegrass music have more of a presence in the Red River Valley and eastern North Dakota. While there's some bluegrass in Minot and Bismarck, North Dakota, Schmidt says that you have to go east of here in Minnesota to find bluegrass music. He says there's a bluegrass jam in Fosston once a month, bluegrass in Bemidji, and quite a bit in the Twin Cities, where there's a restaurant that features bluegrass music every weekend.

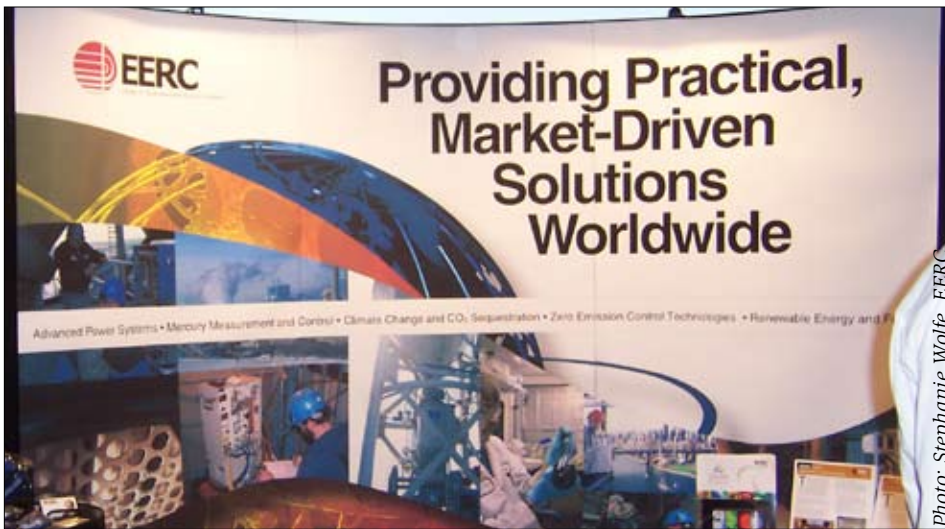
"Around here, bluegrass is not really on the radar," Schmidt says. "Hopefully, we can help change that in the next couple of years."

Schmidt gives credit to nonprofit venues like the Empire Arts Center for featuring new musicians and artists like Prairiegrass, which are not yet commercial successes.

"Where else can you see a band that just doesn't draw 400 people?" he asks. "It would be too risky if it were for profit."

Prairiegrass does play some original music from the group members, Schmidt says, but in performance, they mostly play music the audience knows and loves. They now have a CD for sale for \$10. Contact Darren Schmidt at dschmidt@undeerc.org

—Sandy Van Eck



The EERC booth on display at the 10th Annual Electric Utilities Environmental Conference and Expo in Tucson, Arizona.

## Booth on the Move . . .

It's all in the marketing, they say. The EERC's savvy Marketing team, headed by Deb Haley, Associate Director, Marketing, Outreach, and Administrative Resources, strategically positions the EERC in the public eye at national and regional conferences and events in research areas critical to the EERC's interests and expertise.

In mid-January, EERC Director Gerald Groenewold, Associate Director Tom Erickson, and Deputy Associate Director Chris Zygarlicke took the EERC booth to the State Capitol in Bismarck, North Dakota, for "Renewable Energy Day," sponsored by the North Dakota Renewable Energy Partnership. This event was part of the media blitz for the EERC's Centers for Renewable Energy and Biomass Utilization and was an opportunity to meet with legislators about the EERC's over 20 years of experience and expertise in this area.

Later in January, the EERC was right out in front at the 10th Annual Electric Utilities Environmental Conference (EUEC) and Expo in Tucson, Arizona, with 11 EERC researchers attending (and most presenting at) the conference. As a result, several companies approached the EERC about mercury sampling, asking "How soon can you start?" Additionally, the EERC may have a potential \$0.5 million to \$1.5 million contract with a major energy company in Arizona.

"These national and regional shows have the potential to turn into real contract dollars," says Marketing team member Derek Walters, EERC Communications Manager.

EERC booth appearances this spring:

- February 22, 2007 – The EERC will represent UND at the North Dakota University System Showcase in the Great Hall of the Capitol Building in Bismarck, North Dakota. This will be a great opportunity to showcase UND and the EERC to state legislators and officials as well as visitors to the Capitol.
- March 6–8, 2007 – The EERC will be represented at the POWER-GEN Renewable Energy & Fuels conference in Las Vegas, Nevada. The EERC has had a booth at this conference for the past 3 years. "There's been an overwhelming response from this conference," says Walters. "This is the perfect target market for us, allowing us face-to-face contact that would never happen with a print ad."
- March 13–15, 2007 – The EERC will be at the International Water Institute's 3rd International Water Conference to be held at the Alerus Center in Grand Forks, North Dakota.

- March 19–22, 2007 – The EERC will attend the National Hydrogen Association (NHA) Annual Conference 2007 with Hydrogen Expo US in San Antonio, Texas. The EERC is a member of the NHA, and several EERC researchers will present at this conference as well.
- May 7–10, 2007 – Tera Buckley, EERC Marketing Research Specialist, will attend the World of Coal Ash Conference in Covington, Kentucky. The conference is being held in conjunction with the annual meeting of the Coal Ash Resources Research Consortium®.
- May 15–16, 2007 – EERC staff will be well represented at Biomass '07: Power, Fuels, and Chemicals Workshop in Grand Forks, North Dakota. Sponsored by the EERC Centers for Renewable Energy and Biomass Utilization, the U.S. Department of Energy, and BBI International in collaboration with the North Dakota Department of Commerce Division of Community Services State Energy Program, the workshop will host attendees from research, industry, government, and academia to discuss issues crucial to the success of renewable energy and biomass.

–Sandy Van Eck

## EERC EDGE

The EERC Edge is published for employees of the Energy & Environmental Research Center at the University of North Dakota. Send comments and story suggestions to Trish McGuire, Editor, (701) 777-5025 or [tmcguire@undeerc.org](mailto:tmcguire@undeerc.org).

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