Volume 22 – Issue 3

EERC EDGE

Our Edge Is Our People

May/June 2011

*Hoeven addresses the EERC. File photo.*

# Senator Hoeven visits the EERC

The title may have changed, but the face is certainly familiar. The Energy & Environmental Research Center (EERC) received a visit at the end of April from Senator John Hoeven (R-ND). Senator Hoeven was elected to the U.S. Senate in 2010.

Senator Hoeven visited the EERC many times when he was governor of North Dakota from 2000 to 2010. Prior to his election to the governor's office, Senator Hoeven served as the president of the nation's only state-owned bank, the Bank of North Dakota, from 1993 to 2000.

"The Senator and I had a wide-ranging conversation about everything we do here, primarily some of the new technological advances we've been making and how those activities relate to technology and energy needs here in the United States and worldwide," said EERC Director Gerald Groenewold.

Groenewold said one area of discussion was the EERC's increasing focus on oil and gas and on carbon sequestration, especially the role of enhanced oil recovery (EOR) therein. The EERC currently has over 60 staff members working at least part-time in oil- and gas-related programs.

"We also talked about earmarks and how the EERC has always leveraged federally directed funds with cash from the private sector, using those funds as investment capital rather than as entitlement programs. Senator Hoeven is very impressed with that," said Groenewold.

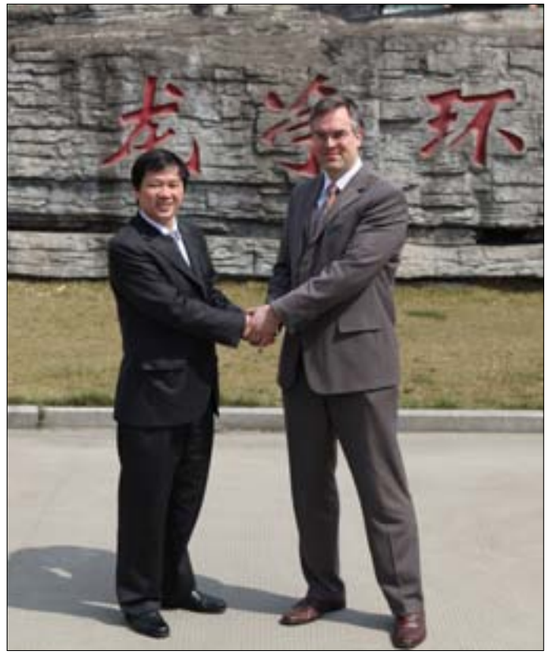
"Senator Hoeven has been supportive of the EERC as a senator and as a governor. I think we can count on him to be a very vocal champion for what we're doing here. He sees this place for what it is—a national model for applied energy and environmental research, which is enhancing our country's opportunity for energy security and creating a very large number of high-quality jobs in North Dakota," said Groenewold.

Freshman Senator Hoeven was named to four Senate committees: Appropriations; Energy and Natural Resources; Agriculture, Nutrition, and Forestry; and Indian Affairs. Groenewold said that Senator Hoeven's committee appointments and background make him a valuable advocate for North Dakota energy. Senator Hoeven will become the state's senior senator when Senator Kent Conrad retires from the Senate in January 2013.

"He's in a strategic position. He's a banker. He understands business. As a governor, he was a very quick study in all issues surrounding the energy industry, one of the cornerstones of our state. So he understands business, he understands banking, and he understands energy. And he's our senator. That's a perfect package," said Groenewold.

–Sandy Van Eck

## Inside




Photos by Longking.

*Huang Wei, Director and General Manager of Fujian Longking Co., Ltd., with Carsten Heide; Ye Zhuang and Stan Miller discuss design aspects of the AFPC technology with Longking staff; Stan Miller, Ye Zhuang, and a Longking engineer on a raised platform at the prospective deployment site.*

# One step closer to deployment

Associate Director for Intellectual Property Management and Technology Commercialization Carsten Heide, EERC Senior Research Manager Stan Miller, and Research Manager Ye Zhuang recently returned from 2 weeks in Xiamen, China, where they supported Fujian Longking Co., Ltd., based in Longyan, Fujian, China, with commercialization of the EERC-developed advanced fine particulate control (AFPC) technology licensed in 2010 by the EERC Foundation to Longking, the leading company in emission control in China.

Longking has identified a tentative site to demonstrate and commercially deploy the technology in China, and Miller and Zhuang reviewed the technical design data for the development of the first installation with Longking. Ultimately, Longking plans to commercialize the technology in the United States and the rest of the world.

"As part of our licensing agreement, there was a transfer of technical information. This visit was a follow-up where Ye Zhuang and I went through the technical design data Longking came up with for a scale-up system based on the information we gave them," said Miller, who invented the technology.

The AFPC uses an advanced technology to remove fine particles from exhaust gases of coal-fired power plants, incinerators, and mineral-processing facilities and can also be used in the pharmaceutical and chemical industries. The technology integrates an electrostatic precipitator (ESP) and a bag filter (two typical emission control technologies) synergistically into the same housing, creating a compact, durable, cost-effective, and highly efficient particulate matter collection system.

"The AFPC technology is unique—this is not a conventional ESP or baghouse design in series, so one must understand the principles behind it thoroughly before designing it for another plant. On this trip, we passed along our experience with our AFPC design, so when Longking designs its scale-up, it will have a guideline to accommodate the unique conditions of its plant. Because each plant will have specific conditions, the design will be adapted accordingly," said Zhuang.

"Longking is taking a very deliberate stage-gate process approach to commercialization here. It wants to make sure it understands the technology and utilizes all of the knowledge the EERC has developed over the years in order to scale the technology and adapt it to different environments. For its initial design, Longking intends to build in enough flexibility and margin for error so that, over a broad range of operating conditions, the system will perform successfully, said Heide. "Longking is a very solid enterprise that is willing to invest in this technology and take the necessary time to make it a success."

Longking plans to first build a 50–60-MW unit, which Heide said is a logical scale-up size to reduce risk, and it will use this as the demonstration platform for rolling out the commercialization through at least one more larger unit at another appropriate site before employing the technology at full scale.

The EERC is also exploring options to further develop the relationship with Longking. Heide, Miller, and Zhuang met with the vice mayor and other officials of the Longyan city government to discuss the economic improvement of low-rank coal applications, coal ash utilization, and mercury control in a variety of global applications.

"Longking's goal is to be on the leading edge of technologies. That is why it licensed the AFPC. Longking wants something that outperforms what's currently available. For new coal-fired power plants in China, it wants to install the best technologies available worldwide, leapfrogging to the technologies of the future," said Heide.

Air pollution, especially particulate pollution, is a major concern in all of the industrial cities throughout China and many other parts of the world, but Heide, Miller, and Zhuang saw evidence of improved air quality in many areas of China. They all agreed that, although China has a long way to go to reach its air quality goals, there is a serious commitment to improving it.

"Our Longking hosts were especially welcoming. It is a very good relationship. We're positive and look forward to moving to the next level of our collaboration," said Heide.

–Sandy Van Eck

*Josh Strege stands by the FT reactor.*

# FT reactor converts coal and biomass into liquid fuels

The EERC is combining decades of experience in gasification with expertise in fuel upgrading to domestically produce synthetic liquid fuels from coal and biomass, hopefully reducing our dependence on foreign oil. EERC gasifiers convert coal and biomass into synthesis gas (syngas). A series of sorbents and chilled vessels cleans this syngas, and the syngas is then fed to the pilot-scale Fischer–Tropsch (FT) reactor.

Inside the FT reactor, gas molecules recombine over a catalyst to form liquid hydrocarbons. The experimental FT reactor produces more than a gallon a day of liquids and can be upgraded to achieve higher production rates. With temperature and pressure limits of 570°F and 1000 psig, the FT reactor can generate either distillate fuels, such as jet fuel and diesel, or alcohols, such as mixed alcohol and methanol, from syngas.

Research at the EERC is focused on overcoming the technical and economic challenges of this technology to enhance overall energy security in the United States.

To date, the FT reactor has processed over 10,000 standard cubic feet of gas from a variety of coal and biomass types, including subbituminous, lignite, switchgrass, dried distiller grain solids (a by-product of ethanol production), and olive pits. The EERC has upgraded coal-derived FT liquids to a variety of fuel products using technology similar to the EERC-developed process for producing renewable fuels from crop and algal oils.

Because the entire FT unit is compact and skid-mounted, it can be readily moved to any of the different gasification systems located at the EERC, or it can be loaded onto a truck and coupled to an off-site gasifier. The FT reactor could also be used for converting natural gas to liquid fuels. This flexibility makes the FT reactor system a valuable tool for testing catalysts under a wide variety of scenarios.

–Josh Strege

# Mentoring future scientists

*Nikhil Patel (at right in photo) discusses a student's presentation at the 61st Annual North Dakota State Science and Engineering Fair held at the University of North Dakota April 7–8. Competitors included 160 students from across the state.*

*Judges included EERC Research Scientists Charlene Crocker, Paul Pansegrau, and Patel and EERC Senior Research Manager Dan Stepan.*

Photo by Bob Dambach.

*The Prairie Public crew and Dan Daly (second from left) board the plane to India. In the foreground is Barb Gravel, production manager and videographer. Behind Dan are Poonam Girdhar, intern and India guide, and Dave Geck, videographer and editor.*

# Behind the scenes: The making of a documentary

*Here is Part 2 of EERC Research Manager Dan Daly's experience behind the scenes creating the Plains $CO_2$ Reduction (PCOR) Partnership documentary "Global Energy and Carbon: Tracking Our Footprint," which premiered on Prairie Public Television and is available at www.undeerc.org/PCOR or youtube.com/undeerc. Part I appeared in the March/April issue.*

"Ten!" I exclaimed, counting the syringes lined up like darts on the counter. "Why so many?"

After a bevy of injections to prevent conditions like yellow fever, hepatitis, and typhoid, it was time for THE TALK from the doctor: "Don't drink any tap water; don't walk barefoot; don't stand near buildings because shade is where the mosquitos lurk; don't . . . ."

Besides getting our shots in early March of 2009, we were busy looking for filming locations and researching energy use in India and the West African country of Cameroon. As soon as the snow melted, we planned to drive to Iowa to spend a week filming two "quintessential American families." In mid-March, I got a call from Bob Dambach, Director of Television for Prairie Public.

"You know those quintessential American families in Iowa with two kids, two cars, and the dog?" he said. "Well, we won't be filming them. They canceled."

We had tried to identify our families in Iowa through a relatively structured process, but now it was crunch time—so we made calls to friends. By late March, we had gotten rock-solid commitments from two "quintessential-enough" families in the Minneapolis area (college friends of Prairie Public Producer Matt Olien).

Meanwhile, Prairie Public was busy setting up the international travel. The schedule called for two overseas trips of 12 days each, featuring a crew of three from Prairie Public (Bob Dambach and two "shooters" or videographers), Alexander or Poonam as our country expert for Cameroon or India, and me, all of whom needed visas and plane tickets. Prairie Public also finalized the camera kits and made arrangements for vehicles, hotels, and guides—no easy feat from halfway around the world.

On my end, the shot list kept growing. Filming the everyday use of energy by families would be one thing, but these households were embedded in a larger energy picture, and everything from service stations to cell towers gave information regarding energy use and availability. We planned stops to shoot power plants, water treatment facilities, pipelines, and refineries, while sites like service stations would be filmed as we ran across them.

Early May saw the kickoff of the field phase of the project with a week in Minneapolis. After taking a day to film power plants and other B-roll footage (location shots to match with narration or interviews), we met our first American family, the Langes—Troy, Susie, and their sons, CJ and Chase—in their comfortable living room west of Minneapolis.

Ninety minutes later, Prairie Public was well into collecting digital high-def footage of the electric meter, propane tank, lights, thermostat, and dozens of other energy-related items. We recorded Susie and Troy cooking meals and doing chores and CJ and Chase doing homework and playing computer and Wii games. We filmed the boys at school and Troy at work and followed Susie down the highway making her way to the airport—all pretty familiar stuff for an American audience.

We started shooting at 6:30 a.m. and sometimes didn't wrap until 2 a.m. Through it all, the Langes smiled and ignored the camera. We would eventually repeat that same approach with the Presler family and be greeted with the same patience and hospitality. We received over a dozen hours of video that Charlene Crocker and I would sift through to identify video segments that might be useful in building the 30-minute show.

May 22 found our India crew at Ike's in the Minneapolis airport comparing notes on passports, packing, and camera shots. Soon after, we would take off for Amsterdam, where we would catch our connection to Delhi.

*Next time – "Go ahead. Eat just as you would if two cameras, a sound boom, and five strangers from 7200 miles away weren't standing around your dining room table."*

–Dan Daly



# New employee

Research Engineer **Dr. Dayanand Saini** develops geophysical models of the subsurface and runs dynamic simulations to determine the long-term fate of produced/injected fluids, including hydrocarbons, $CO_2$, and brine, using oil and gas industry simulation software. He holds a Ph.D. in Petroleum Engineering from Louisiana State University and a Bachelor of Engineering in Chemical Engineering and a B.S. in Mathematics from Chaudhary Charan Singh University in India.

Saini served as a graduate research assistant for the Department of Petroleum Engineering at Louisiana State University from 2006 to 2011. He worked as a reservoir engineer with Oil and Natural Gas Corporation Limited, the national oil company of India, from 2001 to 2006.

Saini currently works on the reservoir engineering aspects of two $CO_2$ and acid gas injection-based EOR projects at the EERC as part of the ongoing research efforts under the PCOR Partnership to develop full commercial-scale $CO_2$ sequestration projects.

Along with EOR and $CO_2$ sequestration, Saini's areas of interest and expertise include the development of mathematical models to reliably estimate gas–oil interfacial tension, pore-level prediction of wettability behavior in petroleum reservoirs, pressure transient analysis, and investigation of rock–fluid interactions at elevated pressures up to 15,000 psi and temperatures up to 400°F.

"I am excited to work closely with leading industry players to develop practical and environmentally sound $CO_2$ sequestration strategies to permanently store $CO_2$ in depleted oil and gas fields while recovering a significant portion of the stranded oil from them," said Saini. "I like the philosophical approach of the EERC, which emphasizes practical solutions to engineering problems."

Saini comes from a small agricultural village located 100 miles from New Delhi, India, where he learned to grow wheat and potatoes and raise livestock on the family farm. His hobbies include listening to music and talking with friends and family, and he wants to learn to play golf and tennis. Saini and his wife have an 8-year-old daughter. As a family, they like to watch movies, try different recipes from TV shows, play board games, and travel.

"We took the most wonderful trip recently to Disneyland in California in 2010," said Saini, "and in India, we visited Shillong, in northeastern India; Konark, famous for its 13th-century Sun Temple; and Puri, a coastal town along the Bay of Bengal known for its annual Festival of Chariots."

–Sandy Van Eck

# Construction begins on Fuels of the Future addition

*Ground was broken at the National Center for Hydrogen Technology® building in May for an addition that will add a 75-foot (six-level) high-bay demonstration area totaling 18,000 square feet. The addition will house the new Fuels of the Future programs.*

Photo of Caroll Shelby provided by Jim Duzan.

*Background: The legendary Carroll Shelby signs the dash of Duzan's 1967 Cobra with the LeMans 428 engine. Foreground: Jim Duzan displays one of his high-performance driving awards.*

# The fast lane

Jim Duzan, EERC Project Manager for Intellectual Property Management, has spent his life around cars and has a passion for high-performance cars and driving them fast. It's something that might just be in his genes.

"As a high school graduation present, I got to drive a 1964 Cobra for a day. That convinced me that I wanted to spend time in the fast lane," said Duzan. "It was absolutely stock, with a 271-hp, 289-cubic-inch, Ford V-8 4 speed in it. The top end was 153. My uncle brought the car out to the family farm and said 'Go anywhere you want to go—just be back at 6:00.' I took my grandmother for a ride, drove about 20 miles or so, wound it out a couple of times to 150. She was a person who was just immaculate—never a hair out of place. When I took her home, I said, 'Well, how did you like that?' 'Great!' she said. 'Let's do it again!'"

Because he was good at repairing farm equipment and liked fast cars, Duzan was encouraged to go to the Rose-Hulman Institute of Technology to become a mechanical engineer.

"It was a good school, but I didn't really want to BUILD the cars—I just wanted to drive them," said Duzan, who left his '48 Crosley and '51 Ford in the barn for good after buying a brand new, red 1969 Boss 429 Mustang.

"I had to drive by Jack Thrasher Ford every day and look at it on the lot. It was an absolute impulse buy," Duzan said. "Ford only made 300 for the street and 200 to race on drag strips. The Boss 429 had a Hemi head and no chrome on it. The Mustangs didn't qualify to run at Nascar, but just like at Nascar, the 429 Hemi engine reached maximum hp at 8500 rpm."

Before he was even out of engineering school, Duzan knew his niche was in intellectual property law, so after graduation, he worked as a design engineer for gas turbine engines at General Motors while attending law school at night. Duzan sold the Mustang to finish law school but insists he has no regrets.

"It wasn't all that fast. It was the street version without slicks, so it turned a quarter mile at 13.5 seconds and 105 mph. That's all it would do. The top end was 120, 130. That was fast for 1969 but not by today's standards," he says.

Duzan currently owns several high-performance cars, including a supercharged 2000 Dodge Viper and a 1967 Cobra with the LeMans 428 engine that produces about 490 hp. The dash of the car was signed by legendary performance racing engineer Carroll Shelby at the Las Vegas American Shelby facilities where it was made.

Duzan also owns 1992 and 2002 Lingenfelter Corvettes. The 1992 Lingenfelter Corvette has a 383-cubic-inch displacement engine that produces about 500 hp with the chassis modified to be stable at 200 mph. The engine was blueprinted, or designed, to specifications so exact every aspect of the engine is at maximum performance. The 2002 Lingenfelter Corvette has a twin turbocharged 427-cubic-inch engine that produces about 750 hp.

"I met with John Lingenfelter at his Decatur, Indiana, facility in 2002. He told me that this car was the first twin turbo 427 engine that he'd produced with a 6-speed transmission. All other twin turbo 427-engine Lingenfelter Corvettes were automatic transmission cars," Duzan said. "The car has street tires and is very drivable on the street, but it will generally have quarter-mile times and track speeds of about 9.4+ seconds and 145+ mph."

Duzan has been a student at the Bob Bondurant School of High Performance Driving three times. The first time, he attended the 4-day Grand Prix Road Racing course as a gift from a managing partner at his previous law firm. He was hooked. Later he went on his own and yet again as a gift from his wife, both times to the 5-day Advanced Grand Prix Road Racing course, where one gets an individual instructor and can turn off all stability and traction system controls. The course requires passing the Sports Car Club of America written licensure test in order to graduate, in addition to mastering the 1.6-mile course with 15 turns and two straightaways (see the track layout at www.bondurant.com/pdf/track_layout.pdf).

Did he pass the course? Decidedly. The school rated Duzan's driving to be better than that of an average professional race car driver, and he took the course with quite a few of them.

–Sandy Van Eck



*At left and below: A remarkable aspect of the 1992 Lingenfelter Corvette engine, which generates nearly 500 hp, is that it can also obtain high mpg. When cruising at highway speed in 6th gear, the engine is only turning at 1800 rpm and can get as high as 29 mpg. The "blueprinted" build of the engine is a major reason for this efficient mileage.*

# 530 years of experience. . .

The EERC celebrated with its UND Annual Years of Service recipients on May 19, with congratulatory gifts for the recipients and cake for all.

The honorees are shown above, left to right, with their UND years of service after their names: Kelly Fox, 20; Randy Knutson, 5; Judy Kamrowski, 20; Barry Botnen, 10; Heidi Vettleson, 5; Michelle Olderbak, 15; Trish Kvasager-Belker, 10; Ye Zhuang, 10; Austin Theisen, 5; Brent Lahr, 5; Debby Johnson, 20; Ben Oster, 5; Lisa Borgen, 5; Kelly Hodgson, 5; Josh Stanislowski, 5; Trish McGuire, 5; Jenny Sun, 20; Jarda Solc, 20; Kathy McIntyre, 5; Anne Fiala, 30; June Novacek, 15; Jason Laumb, 10; Gerry Groenewold, 30; Paul Arnason, 10; Ed Steadman, 25; Tim Kujawa, 20; and Bruce Folkedahl, 10.

Honorees not pictured are Junhua Jiang, 5; Chris Martin, 5; Brandon Pavlish, 5; Dingyi Ye, 5; Erick Zacher, 5; Lisa Botnen, 10; Tera Buckley, 10; Phillip Hutton, 10; Kirk Williams, 10; Kevin Galbreath, 20; Carol Grabanski, 20; Ted Aulich, 25; Mark Musich, 25; and Jerry Petersburg, 30.

–Sandy Van Eck

*Coaches Stacy Halverson and Jamie Overgaard (middle) discuss lineup and strategy with the Little League Cardinals.*

# It's baseball season for mother and son

*Halverson's son rounds the bases.*

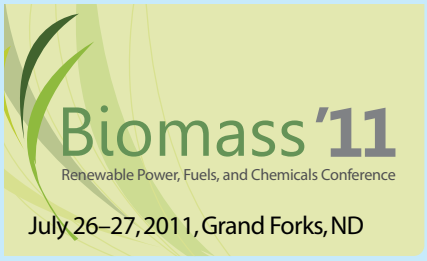
Stacy Halverson is having a busy summer. She's spending her days as a Research Information Associate at the EERC and four nights a week coaching Little League baseball at the ballpark in East Grand Forks.

When there was trouble finding a coach for the Cardinals, her son's team of fourteen 11- and 12-year-olds this year, Halverson said she didn't have to think too long and hard about volunteering.

"I love baseball. I jumped at the opportunity to teach kids the ins and outs of this great game," Halverson said. "I did have to give up playing softball myself, and I don't know how things like the laundry are going to get done, but I'll be spending the summer outdoors on the ball field—right where I want to be, so I couldn't be happier!"

–Sandy Van Eck

## Upcoming events




## EERC EDGE

The EERC Edge is published for employees and friends of the Energy & Environmental Research Center at the University of North Dakota. Send comments and story suggestions to Sandy Van Eck, Editor, (701) 777-5023 or svaneck@undeerc.org.

Energy & Environmental Research Center
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018
(701) 777-5000
www.undeerc.org