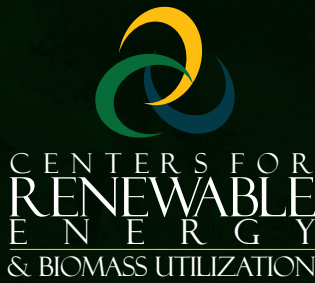




# CENTERS FOR RENEWABLE ENERGY & BIOMASS UTILIZATION



## Renewable Energy for a Sustainable Future

The Energy & Environmental Research Center (EERC) at the University of North Dakota (UND) in Grand Forks, North Dakota, believes renewable energy from hydroelectric, solar, biomass, wind, wave, and geothermal sources is a necessary component to attain longer-term energy independence in the United States. Tremendous effort is being put forth to develop technologies through applied research, development, and demonstration that will make significant strides in developing renewable fuels for heat, power, and transportation. With this commitment to renewable energy comes an equal appreciation for existing fossil resources such as oil, gas, coal, oil shale, and tar sands and the integration of all energy sources.

### Renewable Innovations

The EERC's Centers for Renewable Energy & Biomass Utilization represent more than 12 years of dedicated effort in development of technologies and tools to advance electricity, heat, and fuels production from renewable resources. The EERC has been aggressively pursuing renewable technologies in partnership with the U.S. Department of Energy (DOE), the U.S. Department of Agriculture, and many national and international corporations. The EERC is focused on moving new, innovative technologies out of the laboratory and into the commercial marketplace.

### Partnerships

The EERC has been aggressively pursuing effective partnerships in renewable technologies with a broad range of stakeholders, including national and international corporations. The EERC has mastered the art of leveraging government research dollars by developing true working partnerships with government, the research community, and private sector clients to research, develop, refine, demonstrate, patent, and commercialize innovative technologies that provide practical solutions to strategic global energy and environmental issues. The EERC welcomes partners in developing renewable energy technologies. A partnership may be formed to conduct a series of tests on a client's technology or to work collectively on joint technology.



*The EERC's portable biomass gasifier turns forest and agricultural residues into a valuable resource for heat and power in remote locations.*

## EERC Capabilities

### Full-Scale Field Testing Experience

- Over 60 years of experience with a variety of fuel types, including all fossil and renewable sources.
- Experience in virtually every area of utilization for biomass and wind energy and growing experience in solar and geothermal energy.

### Pilot-Scale Equipment

- More than a dozen pilot-scale combustion and gasification systems, all designed for testing biomass.
- Experience with client-driven demonstration projects throughout North America, such as the EERC's biomass microgasifier.

### Biomass Processing Equipment

- Mobile systems for biomass hauling and temporary storage.
- Complete fuel-handling, crushing, shredding, and chipping preparation facilities for developing and testing process methods for fuel preparation.

### State-of-the-Art Bench-Scale Laboratory Equipment

- Autoclaves and pressurized thermogravimetric equipment.
- Numerous analytical facilities for measuring organic and inorganic materials.
- Small-scale test systems for fuels production.

## Commercial Deployment of Renewable and Biomass Technologies

- Production of fuels and energy (microgasification power system) from biomass.
- Production of hydrogen and chemicals from wind and biomass.
- Working with industry to rapidly advance new technologies into the marketplace.

## Areas of Expertise

With nearly \$20 million in ongoing private sector renewable energy projects at any given time, the EERC is engaged in applied research, development, and demonstration to overcome barriers in producing renewable energy, fuels, and value-added products.

### Biomass Feedstocks

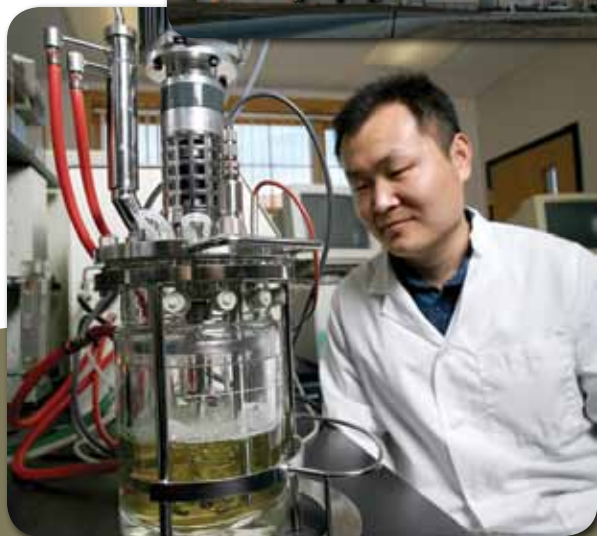
- Characterization and analysis of any type of biomass, including wood residue, rice straw, switchgrass, wheat straw, forest and wood residues, agricultural residues, energy crops, and municipal solid waste.
- Assessment of biomass resources and determination of annual biomass tonnage available.

### Biopower

- Conducting pilot- and full-scale cofiring tests of biomass with coal.
- Providing economic and technical assessments for biomass electricity and emissions.
- Determining energy potential for lignin, a by-product of biomass ethanol production.
- Development of fixed or mobile industrial biomass gasifier systems producing 10 kWe – 1 MWe of power.



*Ethanol Plant*



*EERC researchers assess the performance and emission impacts of vegetable oil-derived fuels.*



*The EERC is integrating biomass gasification with state-of-the-art solid oxide fuel cell technology.*

### Biofuels for Transportation

- Development of new renewable tactical fuels from domestic sources to replace JP-8 jet fuel.
- Biodiesel production and value-added ultrahigh-cetane diesel additives.
- Ethanol production from corn and cellulosic materials.
- Conversion of biomass feedstocks into ethanol, butanol, methanol, dimethyl ether, and Fischer-Tropsch distillates.

### Bioproducts

- Creation of alcohols, organic acids, and other bio-based products from plant materials and other renewable sources using biorefinery processes.
- Conversion of by-products from biodiesel processing into commodity chemicals such as propylene glycol.
- Refining biomass-derived oils into ethanol and high-value organic acids.
- Fertilizer production from renewable feedstocks.



*Early-stage switchgrass for production of bioenergy.*

## Wind Energy

- Performing wind resource assessments and other wind energy evaluations.
- Providing wind resource data through an online database.
- Evaluating transmission-related issues through wind forecast modeling, dynamic scheduling, and production of alternative products such as fertilizer and hydrogen.
- Evaluating carbon risk and the role of renewables related to carbon management.

## Renewable Hydrogen

- Producing clean hydrogen from renewable resources.
- Economic hydrogen production at ethanol plants.
- Fuel cell development.
- Integration of hydrogen production and fuel cells.
- Demonstrating the production of hydrogen from wind power.
- Hydrogen production from renewable fuels.

## Building Efficiency

- Energy audits to help housing authorities and building owners reduce cost and improve building efficiency.
- Design support for building energy systems.
- Building energy modeling.

## About the EERC

The EERC is a high-tech, nonprofit organization which operates like a business and pursues an entrepreneurial, market-driven approach to research and development in order to successfully demonstrate and commercialize innovative technologies. The EERC currently employs over 330 people and is aggressively expanding its staff. The Center was founded in 1951 as the Robertson Lignite Research Laboratory, a federal facility under the U.S. Bureau of Mines. It became a Federal Energy Technology Center under DOE in 1977 and was defederalized in 1983. Today, the EERC leverages and enhances government research dollars by developing working partnerships with industry, government, and the research community. Since 1987, the EERC has nearly 1100 clients in all 50 states and 51 countries. In FY2009, 94% of its contracts were funded by nonfederal entities.



*A hydrogen fuel cell-powered forklift deployed at the North Dakota Army National Guard Base.*

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