Technology Commercialization

Stan Miller, EERC senior research manager, with the advanced hybrid particulate collector (AHPC) being demonstrated at Otter Tail Power Company's Big Stone Plant in South Dakota.

EERC
Energy & Environmental Research Center

University of North Dakota

Technology Commercialization: The Critical Step

Commercialization of innovative technologies is the key to the creation of high-quality jobs, new wealth, and economic prosperity. It is also the key to the future at the Energy & Environmental Research Center (EERC) at the University of North Dakota. Many university-based research groups engage in research and development (R&D). The EERC is different. Not only does it operate as a business within a university, but since the late 1980s, the EERC has also been committed to aggressively moving technologies out of the laboratory and into the marketplace.

A technology that sits idle on the shelf or is merely described in a report will not produce energy more efficiently or result in a cleaner environment. Only through demonstration and commercialization can the world benefit from R&D efforts in promising energy and environmental technologies. At the EERC, each potential client, each new client, every new contract, and every project is considered a commercialization opportunity. The ultimate goal is to work in partnership with clients in industry and government to develop, refine, demonstrate, and commercialize marketable technologies that provide practical solutions to real-world problems.

To accomplish this goal, the EERC employs a multidisciplinary team of world-class scientists and engineers who provide a complete range of services using the Center's sophisticated analytical laboratories and state-of-the-art technology demonstration facilities. The EERC team is recognized internationally for its expertise in advanced energy systems, pollution prevention, waste utilization and management, and technologies for the cleanup of air, water, and soil. The EERC has provided products and services to 650 clients in 47 countries and 48 states. Approximately 70% of its contracts are with industrial clients, and more than 60% of its clients are repeat customers.

The successful commercialization of energy and environmental technologies requires talented and passionate people, capital, effective partnerships, practical experience, outstanding technical facilities, strong organizational support, and a tolerance for risk. The EERC has all the key components to make technology commercialization a reality.

EERC: Facilitating Commercialization

Technology commercialization is facilitated through the EERC Foundation, a nonprofit corporation formed in 1992. This provides the Center with a dedicated infrastructure to support its commercialization activities. The Foundation exists to house the rights for technologies developed by the EERC. The EERC Foundation has licensed rights to a number of EERC-developed technologies.

Facilitating confidentiality agreements is a cornerstone of the EERC's commercialization activities. Confidentiality for industrial clients seeking to maintain their competitive edge is provided through North Dakota law, which allows for practical confidentiality agreements between the EERC and its partners.

The EERC is committed to commercialization because it is the most important element in economic development. Spin-off businesses, high-tech jobs that pay well, and manufacturers are the fruits of successful commercialization efforts. An international trade association estimates that the global market for environmental technologies will reach $586 billion by 2008. Clearly, the potential benefits of effective commercialization are enormous.

The EERC helped SpinTek develop and demonstrate its innovative water cleanup technology, which is currently being used at the Los Alamos National Laboratory in New Mexico.

Successful field tests of the EERC's freeze-thaw/evaporation process have been conducted in New Mexico, Wyoming, and

EERC Commercialization Projects

Advanced Hybrid Particulate Collector (AHPC)

Partners: W.L. Gore & Associates, Inc. – Newark, Delaware
ELEX – Schwerzenbach, Switzerland
Wheelabrator Air Pollution Control, Inc. – Pittsburgh, Pennsylvania

Commercial Application: This pollution prevention technology removes microscopic particles (fine particulate) from exhaust gases of coal-fired power plants, incinerators, and cement production facilities. Fine particulate emissions contribute to visibility-reducing haze and have been linked to human health problems.

Technological Advantage: By combining the best characteristics of conventional technologies and using the GORE-TEX® membrane filter, the cost to operate the AHPC is significantly lower than conventional technologies. This fact, together with its ability to clean 99.99% or more of the fine particles from a coal-fired furnace, demonstrates the commercial viability of the AHPC. At a power plant employing an AHPC, air leaving the furnace would contain fewer particles than the air entering the furnace.

Status: The EERC Foundation has been granted a U.S. patent for the AHPC technology. Applications have been made for foreign protection. W.L. Gore & Associates has been granted an exclusive license for selected uses of the technology. Gore has granted a sublicense to the Swiss company, ELEX, for Europe, China, and India in selected markets and to Wheelabrator Air Pollution Control, Inc., of Pittsburgh, Pennsylvania, for coal-fired plants in the United States and Canada. This license positions W.L. Gore to secure a greatly enhanced market share of the $5 billion/year market for particulate control technology.

Electron Microscopy Techniques

Partner: Microbeam Technologies Inc. (MTI) – Grand Forks, North Dakota

Commercial Application: The buildup of coal ash in coal-fired power plants increases maintenance costs and reduces the efficiency of energy generation. MTI uses sophisticated electron microscopy techniques to conduct routine analysis of coal and ash for the coal-fired utility industry, as well as for boiler manufacturers, environmental consultants, and public and private research institutions.

Technological Advantage: The buildup of coal ash in power plant boilers is an ongoing problem for the utility industry worldwide. Electron microscopy techniques pioneered at the EERC provide information on the chemical and physical characteristics of coal and ash, helping to develop solutions or identify problems before they occur.

Status: Formed in 1992 by EERC researchers, MTI has been given a nonexclusive license from the EERC Foundation for copyrighted computer software packages developed at the EERC. The Grand Forks, North Dakota, company serves as a commercial laboratory, offering a full range of analytical services to clients all over the world.

Recovery of Mercury from Contaminated Liquid Wastes

Partner: ADA Technologies, Inc. – Englewood, Colorado

Commercial Application: Mercury-contaminated wastewater must be cleaned before it can be safely discharged into the environment. This contamination can occur on a scale ranging from wastewater produced in dentistry to large-scale industrial operations, such as U.S. Department of Energy (DOE) nuclear weapons facilities. This technology is now being used for the removal of trace amounts of mercury in the cleanup of dental wastewater and was first field-tested at DOE's nuclear weapons plant in Oak Ridge, Tennessee.

Technological Advantage: The process developed by ADA Technologies is based on the efficient and selective removal and recovery of dissolved mercury from wastewater. It provides business and industry with a safe, effective, and economical mercury cleanup technology.

Status: The EERC teamed with ADA to provide technical assistance in process development. The EERC conducted testing to evaluate the overall effectiveness of the process and assisted ADA in the design and demonstration of a prototype system for the recovery of mercury from liquid waste streams found at DOE facilities and elsewhere. The technology is owned by ADA.

Municipal Waste Combustion Process

Partner: EnerTech Environmental, Inc. – Atlanta, Georgia

Commercial Application: The technology was developed in partnership with Atlanta-based EnerTech Environmental and DOE. It creates a clean-burning liquid fuel made from municipal solid waste, thus assisting communities in solving landfill and waste disposal problems. The fuel can also be burned with low-rank coal in power plants to improve energy efficiency and reduce pollution.

Technological Advantage: The process separates recyclable materials such as glass, aluminum, and iron from municipal waste and then converts the remaining material to a clean-burning liquid fuel. Known as slurry carbonization, the technology is similar to a process that turns wood into charcoal. The fuel is virtually free of chlorinated organics and sulfur found in other waste-to-energy technologies. Rather than extracting water to create a solid fuel, this process exploits the advantage of fluid processing.

Status: EnerTech is working with Mitsubishi to complete a demonstration of the technology in Japan. EnerTech has title to the technology developed under the joint EnerTech–EERC activity. The EERC Foundation will receive royalty payments from EnerTech based on income derived from any commercial use of the technology.

Flue Gas Pretreatment for Mercury Continuous Emission Monitors

Partner: MSP Corporation – Minneapolis, Minnesota

Commercial Application: Accurate mercury measurement is critical to the implementation of effective strategies to reduce mercury emissions from coal-fired power plants and other industries. However, continuous measurement of mercury in power plant emissions is complicated by interference from certain gases and fine-particle matter. The technology developed by MSP and the EERC solves this problem.

Technological Advantage: This pretreatment system will work with any mercury analysis system. The EERC developed a pretreatment technique to eliminate the interference caused by gases and particles. MSP developed a system to remove fine particles without using a filtration system because such systems can adversely affect accurate mercury measurement.

Status: The EERC has successfully demonstrated the integration of the two techniques in the laboratory, and plans are under way for a larger-scale demonstration. MSP has the right to market the device that combines the EERC and MSP technologies. The EERC Foundation retains the rights to use and license its technology to eliminate interference because of the gaseous constituents noted, independent of the combined MSP–EERC application.

Centrifugal Membrane Filtration

Partner: SpinTek Filtration – Huntington Beach, California

Commercial Application: Contaminated liquid wastes pose serious environmental problems for both government and industry. For example, DOE's Environmental Management (EM) Program estimates that the cleanup of contaminated sites will last 30 years and cost $1 trillion. According to DOE, there are 90.6 million gallons of tank waste requiring treatment. SpinTek filtration could be applied to these wastes, as well as to the remediation of contaminated groundwater plumes, treatment of secondary liquid waste streams, and filtration of liquid waste generated during deactivation and decommissioning activities.

Technological Advantage: The SpinTek novel cleanup technology uses ultrafiltration and centrifugal force to reduce the volume and concentrate the contaminants in liquid wastes. It can be applied to a wide variety of liquid waste streams.

Status: The EERC worked with SpinTek to enhance filtration performance, compare the effectiveness to other traditional filters, and achieve integration with a 3M-developed technetium removal cartridge. SpinTek is currently demonstrating its technology on low-level radioactive waste at Los Alamos National Laboratory in New Mexico. The technology is owned by SpinTek.

Chemical Processing with Subcritical Water

Partners: Discussions under way

Commercial Application: Uses demonstrated by the EERC include selective extraction of oxygen-rich rosemary oil (a prized fraction); cleanup of soils contaminated with polychlorinated biphenyls (PCBs), mercury, pesticides, and explosives; destruction of waste explosives and pesticides; and removal of contaminants from commercial polymers and plastics.

Technological Advantage: When water is heated above the boiling point and pressure is applied, it remains liquid and its chemical properties change dramatically. Under these conditions, water's ability to dissolve organic chemicals increases up to one million times. The EERC has spearheaded the development and understanding of the practical uses of this unique behavior of water.

Status: The EERC Foundation has been granted a U.S. patent covering the use of subcritical water for a variety of applications. A continuation-in-part patent application has been filed to enhance that position. The Foundation is seeking industrial partners to commercialize this technology.

Freeze–Thaw/Evaporation (FTE®)

Partners: Amoco; Crystal Solutions; McMurry Oil; North Dakota Division of Community Services; North Dakota Department of Health; City of Devils Lake, North Dakota; North Dakota Central Planning Council; and the U.S. Bureau of Reclamation

Commercial Application: Oil and gas production activities each year produce millions of barrels of saline water high in total dissolved solids. FTE® is a desalinization process that economically cleans large volumes of contaminated water, substantially reducing the amount of disposable water and creating water that can be used for beneficial industrial, agricultural, and municipal purposes.

Technological Advantage: Conventional disposal technologies rely on expensive deep-injection wells or evaporation ponds that do not work during cold weather. FTE® combines freeze crystallization water purification technology with evaporation, enabling the process to operate in both warm and cold weather. The result is an economical, low-energy, environmentally friendly process that uses naturally occurring freezing and thawing cycles to do much of the work.

Status: Work on FTE® is moving toward full-scale commercial deployment. Field demonstration facilities have been constructed and operated in Farmington, New Mexico; Jonah, Wyoming; Red Desert, Wyoming; and Devils Lake, North Dakota. The EERC is also exploring opportunities to use FTE® technology to separate valuable by-products from industrial wastewater streams.

PCQUEST (Predictive Coal Quality Effects Screening Tool)

Partners: Ameren-UE; Isobord Enterprises, Inc.; Microbeam Technologies, Inc.; EPRI; Alliant Energy; Xcel Energy; Arkansas Power and Light; Duke Power; Foster Wheeler Development Corporation; Sauder Woodworking; Saskatchewan Power; Kansas City Power and Light; Dairyland Power Cooperative; and Minnesota Power, Inc.

Commercial Application: Advanced computer modeling of coal combustion characteristics assists the utility industry in predicting the behavior of ash in coal-fired power plants, helping to reduce ash deposition and slagging while improving plant efficiency and lowering maintenance costs.

Technological Advantage: PCQUEST is a valuable tool in predicting the effects of coal quality. It assists the utility industry in improving power plant operation and efficiency by matching fuel characteristics to power systems. The PCQUEST model can also be used for new fuels, fuel blends, biomass, and waste fuels.

Status: A validation and model improvement program is now under way for PCQUEST that includes different fuels and systems. Additional coal types and biomass fuels are being modeled for ash deposit properties and temperature effects. PCQUEST is continually marketed to the energy industry.

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