

Bio Diesel Project

Center for Entrepreneurship Builds on Students' Success



Entrepreneurship students on location in Richvale, CA.

“THIS PROJECT TAKES STUDENTS OUT OF THE CLASSROOM AND INTO THE MIDDLE OF ONE OF THE MOST IMPORTANT INDUSTRIES IN THE UNIVERSITY’S SERVICE REGION. OUR STUDENTS HAVE THE POTENTIAL TO MAKE A REAL IMPACT.”

— Ryne Johnson

In September 2007, Chico State's Center for Entrepreneurship (CFE) director, Ryne Johnson, walked purposefully through campus, barely noticing the beautiful autumn colors. A few weeks earlier, College of Business Dean Willie Hopkins had tasked Johnson with responsibility for operational management of the University's Accelerator Fund. Supported by generous donations from alumni, the fund was established in 2006 to help talented Chico State professors, students, and local entrepreneurs get their ideas into the marketplace.

Fund assets are used to make direct investments in entrepreneurial ventures and to mobilize students to help entrepreneurs prepare their proposals for presentation to established investor groups. Johnson had just met with a group of Chico State deans and faculty to identify research projects that offered the potential for business or product development and could benefit from assistance from the CFE and its Accelerator Fund.

Johnson was directed to an interesting project that was in progress within the College of Engineering, Computer Science, and Construction Management. In March 2007, Chico State Manufacturing Technology Program students won the Grand Prize in the prestigious WESTEC (Western Tool Exposition and Conference) Manufacturing Challenge for building a bio diesel reactor unit that they redesigned from an existing manually operated home bio diesel kit.

The reactor unit produced by the Chico State students was outfitted with a fabricated stainless steel tank, fitted stainless steel valves, control sensors, and a pump. The team chose to automate their unit with an Allen Bradley micrologix 1100 programmable logic controller in a protective housing with a touch screen on the front for programming the unit.

The automated system took just a push of a button to make bio diesel fuel. In as little as eight hours the reactor is capable of making up to 100 gallons of high-quality bio diesel fuel. Joe Greene, professor of Manufacturing Technology and Mechanical Engineering, spoke with Johnson about the project.

The bio diesel reactor unit was originally designed to reduce, reuse, and recycle the used vegetable oil and animal fat from Chico State's residence hall kitchen. The project team also considered use of animal renderings from the university farm as a potential feedstock for bio diesel fuel. The resulting fuel could be used to run tractors at the university farm, providing students with good information about which engines work best with the bio diesel fuel that is produced by their reactor unit. Their evaluation would also facilitate comparisons of the student's bio diesel processor unit with other existing processors.

While the Chico State bio diesel reactor unit was built more for research than for commercial production, Johnson's conversations with Professor Greene—and research that Johnson conducted following those conversations—led to a CFE-initiated assessment of the feasibility of alternative feed stock products from which bio diesel could be produced. In particular, Johnson wanted to explore the possibility of identifying a feedstock that would be plentiful within the University's 12-county service region—preferably byproducts that were currently discarded or under-utilized—thereby creating new revenue sources for the local agricultural business community and facilitating new opportunities in the area of sustainable farming.

Johnson hired a team of students to work on the study, including one student from the College of Natural Sciences. Their work led to the discovery that rice processing provides an effective feedstock for the production of bio diesel. Specifically, the team found that in India and China, advanced research and development has led to the successful production of bio diesel fuel from rice bran.

Rice bran is the thin shell that immediately surrounds the rice kernel, comprising approximately 10 percent of gross weight of a harvested rice head. Rice bran is removed from rice kernels during the milling process. Rice bran oil, from which bio diesel may be produced, can be extracted from rice bran at approximately 15–22 percent by volume, depending on the extraction method used. Studies show that (continued next page)

the conversion efficiency of rice bran oil to bio diesel can reach as high as 98 percent given existing technologies, but this is an area open for further research and development. The CFE's initial research demonstrated that rice-producing areas in Butte and Glenn counties may be capable of producing sufficient bio diesel from rice bran to substantially impact the amount of petroleum-based

“THIS EFFORT SUPPORTS OUR COMMITMENT IN THE AREA OF SUSTAINABILITY AND PROVIDES STUDENTS WITH EXPERIENTIAL LEARNING OPPORTUNITIES. IT HELPS US MOBILIZE CAMPUS RESOURCES THAT CAN CONTRIBUTE TO THE VIBRANCY OF THE LOCAL ECONOMY.”
— Dean Willie Hopkins

diesel fuel needed for the industry's production processes. Rice bran oil may offer significant benefits over some of the more traditional feed stock products that can be used to produce bio diesel. Rice bran is commonly used in several Asian countries, including Japan and China, as cooking oil. In the United States, however, its most common use is as a fiber component for animal feed. Converting rice bran to an industrial fuel in America may have a lesser impact on domestic food supplies than other potential bio diesel feed stocks, such as corn, rapeseed, or soy beans. The conversion process produces significant quantities of

the byproduct glycerol, a mixture of glycerin, impurities, and any remaining alcohol and catalyst. The alcohol evaporates off naturally or can be accelerated by a slow heat process over time, and the catalyst can be washed out. The glycerin, amounting to approximately 20 percent of a finished batch of bio diesel, can be as high as 95 percent pure and can be used as a good degreaser and hand soap, and it is used extensively in the cosmetic industry.

Additionally, research is being done to determine ways to efficiently convert glycerin into crop fertilizers or even herbicides with significant organic qualities. If glycerin can be gleaned from the bio diesel production process and sold, the value of rice and the farmers' profits will increase, and yet the bio diesel production process is not expected to reduce the amount of rice available for human consumption.

Johnson is currently partnering with senior executives in the local rice industry to continue work in this area. Students from the College of Business are currently developing a business plan that will outline model options and necessary relationships for a commercial entity to operate a bio diesel reactor/business in the Richvale area, while Professor Greene continues his work evaluating the projects associated with the bio diesel unit built by the students within the College of Engineering, Computer Science, and Construction Management.

While the story is still unfolding, it is clear that when students, faculty, and staff from colleges across the Chico State campus work together to support the vitality and sustainability of the North State everyone wins.

Students learn about rice production and processing operations on location in Nelson, CA.

