Awardees for
U.S. Department of Energy
Energy Efficiency and Renewable Energy
Integrated Biomass R&D Solicitation

1. Advanced Biorefining of Distiller's Grain and Corn Stover Blends: Pre-Commercialization of a Biomass-Derived Process Technology

High Plains Corporation (HPC), in collaboration with Novozymes North America, Inc. (NZNA), VTT-Findland (VTT) and the National Renewable Energy Laboratory (NREL), will develop a novel biomass-derived process technology that utilizes advanced biorefined Distiller's Grain (DG) and Corn Stover (CS) blends to achieve significantly higher ethanol yields while maintaining the protein feed value. This technology will enable a more economical, sustainable industry; reduce petroleum use per ethanol gallon produced; and increase the availability of ethanol. The project will demonstrate at bench and pilot scale, a viable pretreatment process for DG and CS to convert residual starch, cellulose and hemicellulose to ethanol and high-protein feed. Bench-scale and small pilot-scale process analysis will undergo Stage Gate economic criteria for advancement into large pilot-scale integration. The bench and small pilot scale phases of the project will be performed at the NREL and NZNA facilities. Final integration of the large-scale pilot facilities will occur at the High Plains York, Nebraska (HPY) plant, a 50 million gallon per year corn dry-mill plant.

2. A Second Generation Dry Mill Biorefinery

Broin and Associates, Inc. will work in cooperation with DOE in a joint project to to research and develop a dry mill "Biorefinery" process for enhancing the economics of existing ethanol dry mills by creating additional co-products and increasing ethanol yields. In this "2nd Generation" dry mill, Broin will fractionate the bran, germ, and endosperm in the incoming corn feed using proprietary processes and equipment. This revolutionary mechanical separation will enable flexibility in feedstock utilization, substrate conversion, and fermentation process, while expanding options for value added co-product production. With the assistance of the National Renewable Energy Laboratory (NREL), Broin will investigate at bench and pilot-scale the technical and economic feasibility of converting the hemi-cellulosic and cellulosic fractions of the extracted corn bran to ethanol as well as upgrading the bran and endosperm fermentation residues to high protein animal feeds.

3. A New Biorefinery Platform Intermediate

Cargill, through collaboration with their partners Codexis, Inc. and Pacific Northwest National Laboratory (PNNL), will develop, a new bio-based platform technology to produce a portfolio of products based on 3-hydroxypropionic acid (3-HP) produced by

the fermentation of carbohydrates. For the first step, Codexis, a subsidiary of Maxygen, Inc., and a leader in DNA evolution technology, will optimize the genes and pathway for production of 3-HP. Cargill will then optimize the organism and fermentation process. For the second step, Cargill will partner with the Chemical Process Development Group at PNNL to screen catalysts and develop process flowsheets, simulations, and economic estimates for a number of 3-HP derivatives. This project will deliver an organism and process for 3-HP production, and catalysts and complete process concepts suitable for piloting and scale-up for industrial production.

4. Making Industrial Bio-refining Happen

Cargill Dow in partnership with Iogen, Shell Global Solutions, and CNH Global NV (CNH) will develop and pilot-scale a demonstration biorefinery project in collaboration with wheat, corn, and rice grower organizations, national labs, and universities, as well as environmental and social non-government organizations. The project focuses on process and fermentation technologies as these will constitute the "heart" of the economically and environmentally sound biorefinery of the future. The Cargill Dow team is taking a unique and long-overdue approach by allocating over 25% of the proposed research budget to agricultural process systems and integration of biomass technologies into the agriculture community. This project will for the first time bring all of the players required for successful commercialization of the lignocellulosic biorefinery concept into an integrated focused effort. The major goals of the project are to develop and validate process technology and sustainable agricultural systems that will cost effectively produce sugars and chemicals such as lactic acid and ethanol from lignocellulosic biomass; and Ensure that growers and grower organizations have a first opportunity to participate in the commercial development of the resulting biorefinery technology.

5. Integrated Corn-Based Bio Refinery (ICBR) Project

DuPont will work in cooperation with DOE in a joint project to build a bio-based production facility. The plant will utilize new technology to convert corn and stover into fermentable sugars for parallel production of added value chemicals. DuPont will collaborate with Diversa and the National Renewable Energy Laboratory (NREL) on the project.

6. Separation of Corn Fiber and Conversion to Fuels and Chemicals Phase II: Pilot-scale Operation

Under a current DOE/EE/OTT sponsored project entitled Corn Fiber Separations and Conversion to Fuels and Chemicals, bench-scale testing has lead to the development of a technically and economically feasible integrated process for recovery of the hemicellulose, protein and oil components from corn fiber and subsequent conversion of these components to value-added products. Under this new project, the National Corn Growers Association (NCGA) will lead a team to conduct pilot-scale testing to validate the process prior to full-scale commercial implementation. The project team is

multidisciplinary, with business managers, engineers, chemists, and biochemists from Archer Daniels Midland (ADM), and Pacific Northwest National Laboratory (PNNL) joining NCGA for the effort.