



Montana ICTL Demonstration Program

Background

The Department of Energy (DOE) funds basic and applied research toward the development of technologies that will allow the U.S. to depend to a greater extent on renewable fuels, especially those derived from domestic sources of energy. Coal is one of the nation's most abundant domestic energy resources; however, conventional technologies using coal release large amounts of carbon dioxide (CO₂) into the atmosphere. Liquefaction is being studied as a cleaner method for using coal as an energy source. Combining coal with biomass can further reduce the net carbon output. The National Energy Technology Laboratory (NETL) is partnering with Crow Nation to provide an effective demonstration of the Montana Integrated Carbon to Liquids (ICTL) program using domestic coal and biomass as the carbon source.

Project Description

The scope of this project is threefold. First, the ICTL demonstration unit will be designed and built to produce sample quantities of distillate fuels for testing and certification by the U.S. Air Force, which is mandated to develop renewable fuels for its aircraft. The project will construct a microcatalytic direct liquefaction production unit at the University of North Dakota's Energy and Environmental Research Center (UNDEERC). This unit will be designed to use Montana bituminous coal and indigenous biomass, with a goal of nominal production of two gallons per day.

Second, the research team will conduct a preliminary bioengineering assessment to find a biomass source capable of recycling carbon dioxide (CO₂) from the ICTL, helping to make the fuel production process a low-carbon emitter. This assessment will work toward the integration of CO₂ reuse and biomass use, with the eventual goal of developing pilot- and commercial-scale implementations. The project will identify candidate algae strains that can be sustainably grown at a large scale to meet project needs for (1) CO₂ reuse and (2) biomass feedstock for fuel production. Bench-scale studies will be conducted at Montana State University (MSU).

Third, this project was designed with the intention to provide selected students from the Crow Nation with opportunities for academic and industrial advancement in the field of ICTL. The project team will establish a coordination and steering committee; design and execute an education, training, and development program; and institute scholarship and internship programs for two to three students at MSU, UNDEERC, and/or Little Big Horn College (Crow Agency, MT).

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PARTNERS

University of North Dakota Energy and
Environmental Research Center
Montana State University
Little Big Horn College
Accelergy Corporation (Houston, Texas)

PROJECT DURATION

Start Date

10/01/2010

End Date

09/30/2012

COST

Total Project Value

\$1,551,500

DOE/Non-DOE Share

\$1,201,500 / \$350,000

NATIONAL ENERGY TECHNOLOGY LABORATORY

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U.S. DEPARTMENT OF
ENERGY

Goals and Objectives

The main objectives for this project are to demonstrate Accelergy's ICTL technology utilizing Montana bituminous coal and indigenous biomass feeds, develop engineering and econometric models for conversion of coal and biomass/algae to liquids using a Montana planning basis, and implement a comprehensive education and training program to prepare the local community for future jobs in the ICTL arena.

Accomplishments

The project team completed the preliminary design phase for a pilot-scale microcatalytic coal/biomass to liquids (MCL) facility to be installed at UNDEERC. Revised detailed engineering drawings (P&IDs) of the planned facility are currently in review. The facility is slated to be a multi-plug, once through, reactor design capable of producing 0.3 L/hr of distillate liquid that is capable of being upgraded to JP-8.

The algal biomass screening process has narrowed its focus to one particular strain of *Anabaena cylindrica* and is concentrating efforts on designs for raceway and bag reactor systems for testing.



Characterization and cultivation of oil-producing algae. Interns Amanda Not Afraid and Elaine Stone setting up air systems for photo-bioreactors. (Little Big Horn College, 2011)

The scholarship program portion of the project graduated its final class of participants in 2011. Overall, the program awarded 49 scholarships and internships, of which 38 students completed their programs.

Benefits

This project will help meet DOE's goal of developing technologies for the production of fuels with lower environmental impact and decreased dependence on foreign sources of energy. The project also provides educational and development opportunities for academic and industrial advancement in the field of ICTL.



Characterization and cultivation of oil-producing algae. Intern Zac Cummins cutting test tubes to be used for photobioreactors. (Little Big Horn College, 2011)