DOE Bioenergy Research Centers

FACT SHEET
June 26, 2007

NAME OF CENTER: DOE Bioenergy Science Center (BESC)

LEAD INSTITUTION: Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee

PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR: Martin Keller

PARTNERING INSTITUTIONS: Georgia Tech (Atlanta, Georgia); National Renewable Energy Laboratory (Golden, Colorado); University of Georgia (Athens, Georgia); University of Tennessee (Knoxville, Tennessee); Dartmouth College (Hanover, New Hampshire); ArborGen (Summerville, South Carolina); Diversa Corporation (San Diego, California); Mascoma Corporation (Lebanon, New Hampshire and Cambridge, Massachusetts); Samuel Roberts Noble Foundation (Ardmore, Oklahoma); Brookhaven National Laboratory (Upton, New York)

INDIVIDUAL RESEARCHERS REPRESENTING: Cornell University (Ithaca, New York), North Carolina State University (Raleigh, North Carolina); University of California at Riverside (Riverside, California); University of Minnesota (Twin Cities, Minnesota); Virginia Tech (Blacksburg, Virginia); Washington State University (Pullman, Washington)

LOCATION OF CENTER: ORNL Campus, Oak Ridge, Tennessee

FUNDS/SUPPORT FROM OTHER SOURCES:

- $24.6 million from the state of Tennessee, including $11.6 million for building to house Center, $3 million for dedicated research equipment, $10 million for research, and $3-5 million for three faculty positions supporting bioenergy research
- An additional $40 million from the state of Tennessee for a 5 million gal/year demonstration-scale facility to be completed in 2009
- $5 million from Mascoma Corporation to support collaborative research
- $6 million of equipment funds from the Georgia Research Alliance: $3M for equipment, $3M for faculty
- $500,000 in cost share support from Virginia Tech

PROJECT DESCRIPTION:
The challenge of converting cellulosic biomass to sugars is the dominant obstacle to cost-effective production of biofuels in sustained quantities capable of impacting U.S. consumption of fossil transportation fuels. The BioEnergy Science Center (BESC) research program will address this challenge with an interdisciplinary effort focused on overcoming the recalcitrance of biomass. By combining engineered plant cell walls to reduce recalcitrance with new biocatalysts to improve deconstruction, BESC will revolutionize the processing of biomass. These breakthroughs will be achieved with a systems biology approach and new high-throughput analytical and computational technologies. BESC will focus on switchgrass and poplar, identified by the Department of Energy as model feedstock crops for bioenergy production.

PROJECT OBJECTIVES:
BESC will pursue the following aims in three research focus areas:

- Biomass formation and modification: Develop a thorough understanding of the genetics and biochemistry of plant cell wall biosynthesis so the process can be modified to reduce biomass recalcitrance.
- Biomass deconstruction and conversion: Develop an understanding of enzymatic and microbial biomass deconstruction, characterize and mine biodiversity, and use this knowledge to develop superior biocatalysts for consolidated bioprocessing.
- Characterization and modeling: Develop a high-throughput (HTP) pretreatment and characterization pipeline that enables study of the structure, composition, and deconstruction of biomass to elucidate the underlying causes of recalcitrance. Apply cross cutting science to integrate the knowledge gained using chemical, spectroscopic, and imaging methods and computational modeling and simulation.

FACT SHEET
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NAME OF CENTER: DOE Great Lakes Bioenergy Research Center (GLBRC)

LEAD INSTITUTION: University of Wisconsin-Madison

PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR: Timothy J. Donohue

PARTNERING INSTITUTIONS: Major Partner: Michigan State University (East Lansing, Michigan); Other Partners: Pacific Northwest National Laboratory (Richland, Washington); Lucigen Corporation (Middleton, Wisconsin); University of Florida (Gainesville, Florida); Oak Ridge National Laboratory (Oak Ridge, Tennessee); Illinois State University (Bloomington-Normal, Illinois); Iowa State (Ames, Iowa)

LOCATION OF CENTER: University of Wisconsin-Madison (Michigan State University is a major partner)

FUNDS/SUPPORT FROM OTHER SOURCES:

- $104 million from the state of Wisconsin, including $100 million for a Bioenergy building at the Madison campus and $4 million for new faculty hires

PROJECT DESCRIPTION:
To increase the contribution of biofuels to the US energy portfolio, the Great Lakes Bioenergy Research Center (GLBRC) will conduct fundamental, genomics-based research to remove bottlenecks in the biofuel pipeline. The GLBRC will develop a set of vertically integrated research programs aimed at removing existing bottlenecks in the bioenergy pipeline, developing economically- and environmentally-sustainable bioenergy practices, and educating society, scientists and biomass producers or consumers about bioenergy issues.

PROJECT OBJECTIVES:
The long-term goals of the GLBRC are to improve:

- the characteristics of biomass plants;
- the procedures for processing plant biomass;
- the biological or chemical processes to convert biomass into energy products; and
- the economic and environmental sustainability of the biomass–to–biofuel pipeline.

To achieve these goals, the GLBRC will combine biological, physical, and computational approaches to resolve currently limiting factors in biofuel production. Imaging, high-throughput genomic, proteomic or metabolomic technologies, synthetic biology, and computational modeling will be vertically integrated into GLBRC research activities. The Wisconsin/Great Lakes Center will concentrate on corn stover, switchgrass, and poplar. The GLBRC will develop programs to inform farmers or educate scientists, students, and society about advances in biofuels technology.

FACT SHEET
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NAME OF CENTER: DOE Joint Bioenergy Institute (JBEI)

LEAD INSTITUTION: Lawrence Berkeley National Laboratory, Berkeley, California

PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR: Jay Keasling

PARTNERING INSTITUTIONS: Sandia National Laboratories, (Livermore, California and Albuquerque, New Mexico); Lawrence Livermore National Laboratory, (Livermore, California); University of California, Berkeley; University of California, Davis; Stanford University (Palo Alto, California)

LOCATION OF CENTER: San Francisco Bay (East) , California

FUNDS/SUPPORT FROM OTHER SOURCES: Extensively leveraged

PROJECT DESCRIPTION:
Currently, biofuels are produced largely from starch, but there is a large, untapped resource (more than a billion tons per year) of plant biomass that could be utilized as a renewable, domestic source of carbon-neutral, liquid fuels. The development of cost-effective and energy-efficient processes to convert lignocellulose in biomass into fuels is hampered by significant roadblocks, including the lack of specifically developed energy crops, the difficulty in separating biomass components, low activity of enzymes used to deconstruct biomass, and the inhibitory effect of fuels and processing byproducts on organisms responsible for producing fuels from biomass sugars. The Joint BioEnergy Institute (JBEI) is designed to address these roadblocks in biofuels production.

PROJECT OBJECTIVES:
Short-term research (5 year time frame) is directed toward the generation of existing biofuels, with efficient ethanol production from cellulose, improved enzymes, improved microbial tolerance to ethanol, and improved understanding of lignocellulose synthesis.
Intermediate-term research (5-10 year time frame) is directed toward understanding the enzymes involved in plant wall synthesis, finding and characterizing enzymes from lignocellulose-rich environments, and developing microorganisms that can synthesize and tolerate novel biofuels.
Long-term research (10-15 year time frame) will involve the development of plants specifically for energy production, novel enzymes to deconstruct biomass, and microorganisms that can deconstruct biomass and produce fuels in a single bioreactor.