Delivering Advanced Domestic Bioproducts to the Marketplace

A Progress Report from the Department of Energy Bioenergy Research Centers

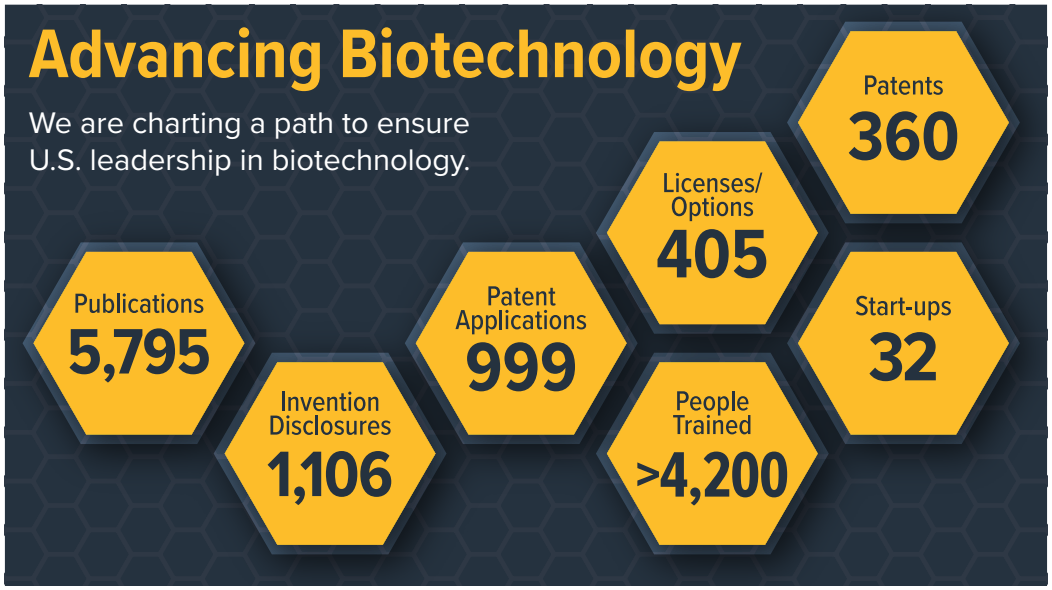
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U.S. DEPARTMENT *of* ENERGY

The Bioenergy Research Center Charge

The U.S. Department of Energy's Bioenergy Research Centers (BRCs) are driving major genome- and super intelligence (SI)-enabled advancements in the biodesign of microbes and complex plant-microbe communities to support a new biomanufacturing sector that converts non-food crops such as into chemicals, materials, and other products. Commercialization of this fundamental research can strengthen national and economic security, create domestic supply chains, generate jobs across the nation, and ensure U.S. leadership in biotechnology.



Each BRC is led by a DOE National Laboratory or a top research university, and consists of a multidisciplinary partnership involving experts from field and laboratory science, data science and engineering, as well as from private companies and non-profit organizations. Working with collaborators across the nation, each BRC takes a unique approach to improving the production of chemicals and materials from non-food crops.

First created by the Department of Energy in 2007, the BRCs expanded from three centers to four in 2017. Over nearly two decades, the centers have assembled vast, integrated datasets spanning plant and microbial genomes, crop performance in the field, and conversion into cost-effective products of industrial interest. SI and advanced computation are being used to unlock the full value of these large data sets, accelerating the path from fundamental discovery to industrial deployment.

Together the BRCs are addressing the challenges of generating U.S.-made chemicals, materials, and other bioproducts from abundant local resources on a scale far greater than any effort to date. The goal is an economic enterprise that bolsters the national economy, builds domestic supply chains and biomanufacturing capabilities, and strengthens national industrial resilience and security.

"The BRCs are powerhouses of technological innovation that have pushed the boundaries of what's possible. Their pioneering inventions have led to hundreds of licensing agreements and industry collaborations. We are proud to support and collaborate with them to drive forward transformative innovations for American industry."

- Erik Iverson, CEO of the Wisconsin Alumni Research Foundation

The Research Centers at a Glance

Center for Advanced Bioenergy and Bioproducts Innovation | cabbi.bio

The Center for Advanced Bioenergy and Bioproducts Innovation (CABBI), led by University of Illinois Urbana-Champaign, integrates recent advances in SI, automation, genomics, synthetic biology, and computational biology in a transformative research model designed to accelerate research and development while incorporating newly developed technologies. CABBI is developing efficient ways to grow non-food crops, transform biomass into valuable chemicals, and market the resulting fuels and products. The center is developing the predictive capability to determine which crop combinations, regions and land types, market conditions, and chemicals/products have the potential to support the bioeconomy.
Technology Contact: Vijay Singh - vsingh@illinois.edu

Center for Bioenergy Innovation (CBI) | cbi.ornl.gov

The Center for Bioenergy Innovation (CBI), led by Oak Ridge National Laboratory, seeks to accelerate domestication of non-model plants and microbes to enable high-impact innovations for the production of performance advantaged fuels, chemicals, and materials from abundant domestic resources. In this endeavor, CBI is pursuing a host of new technologies to alleviate critical cost barriers to industrialization. The center is implementing automation, advanced genetic engineering, and SI-driven predictive tools to create robust, high-yield, non-food plant feedstocks and microbial production platforms; developing catalytic and microbial conversion methods for high-yield production of biologically-derived chemicals that can be blended with existing transportation fuels; and identifying complementary technologies to convert biomass-processing residuals into valuable, performance-advantaged chemicals and materials.
Technology Contact: John Wagner - wagnerjp@ornl.gov

Great Lakes Bioenergy Research Center (GLBRC) | glbrc.org

The Great Lakes Bioenergy Research Center (GLBRC) is a cross-disciplinary research center led by the University of Wisconsin–Madison. With Michigan State University and other partners, GLBRC is designing non-food crops and microbes in order to turn domestic biomass into bio-based chemicals and materials for American industry. GLBRC has three integrated areas of research – resilient cropping systems, biomass conversion, and data-driven field-to-product optimization – that together will help build a resilient bioeconomy. GLBRC's groundbreaking research in biosystems design is paving the way for new innovations in producing bio-based products that are industry relevant and economically viable.
Technology Contact: Jennifer Gottwald - jennifer@warf.org

Joint BioEnergy Institute (JBEI) | jbei.org

The Joint BioEnergy Institute (JBEI), led by Lawrence Berkeley National Laboratory, is working to convert bioenergy crops into economically viable, carbon-neutral biofuels and renewable chemicals currently derived from petroleum, and other bioproducts that cannot be efficiently produced. JBEI's mission is to establish the scientific knowledge and new technologies to convert bioenergy crops and carbon-rich waste streams, such as agricultural waste and forest debris, into economically viable, carbon-neutral biofuels and renewable chemicals and bioproducts.
Technology Contact: Robin Johnston - rjohnston@lbl.gov

Enabling Commercialization, Creating Opportunity

The BRCs are generating the knowledge to enable the operation of a new generation of biorefineries and developing a portfolio of new biobased products, methods, and tools for American industry. Using a broad range of genome-driven research methods coupled with SI and automation, BRC technologies represent a variety of approaches to industry-informed bottlenecks in the path from field to product. Some technologies focus on improved ways of breaking down biomass for conversion, some on engineering crops with the characteristics most advantageous for industrial use, and still others on designing microbes that turn biomass into high-value chemicals and materials. In total, the BRCs have successfully launched 32 start-up companies, disclosed over 1,100 new inventions, optioned or licensed out hundreds of technologies, and trained more than 2,100 postdoctoral researchers, graduate students, and staff for the U.S. biotechnology workforce.

> **"These inventions will be the new startups, the new chemicals and materials in our lives, and the manufacturing jobs in America."**
> - Jay Keasling, Joint BioEnergy Institute (JBEI) Chief Executive Officer