

Bioindustry Creates Green Jobs

Energy from abundant, renewable, domestic biomass can reduce U.S. dependence on oil, lower impacts on climate, and stimulate jobs and economic growth.

Rapid Growth Projected

The U.S. bioindustry is expanding rapidly in response to the need for a near-term alternative to liquid petroleum fuels. The Energy Independence and Security Act of 2007 (EISA) requires that renewable fuels collectively supply at least 36 billion gallons of U.S. motor fuels by 2022. Meeting this EISA-mandated Renewable Fuel Standard (RFS) will require unprecedented growth in the U.S. bioindustry over the next decade. In 2011, the United States exceeded the revised RFS annual production target for traditional biofuels (12.6 billion gallons),¹ but technical and economic hurdles delayed increased production of advanced (non-starch-based) biofuels.¹

Successfully growing the U.S. bioindustry will require new systems and networks to efficiently produce, harvest, and transport large quantities of diverse feedstocks. Biofuels will need to be produced from new biomass sources, such as switchgrass, fast-growing trees, crop residues, algae, and municipal wastes. Technologies will be needed to economically convert biomass into a range of advanced biofuels, and new or expanded infrastructure may be needed.

The Energy Department's Bioenergy Technologies Office (BETO) is actively working with public and private partners to meet these needs and facilitate growth of a robust, domestic bioindustry. Through cost-shared research, development, and demonstration (RD&D), BETO develops advanced technologies and real-world solutions. Workforce expansion is an important ancillary benefit of these efforts.



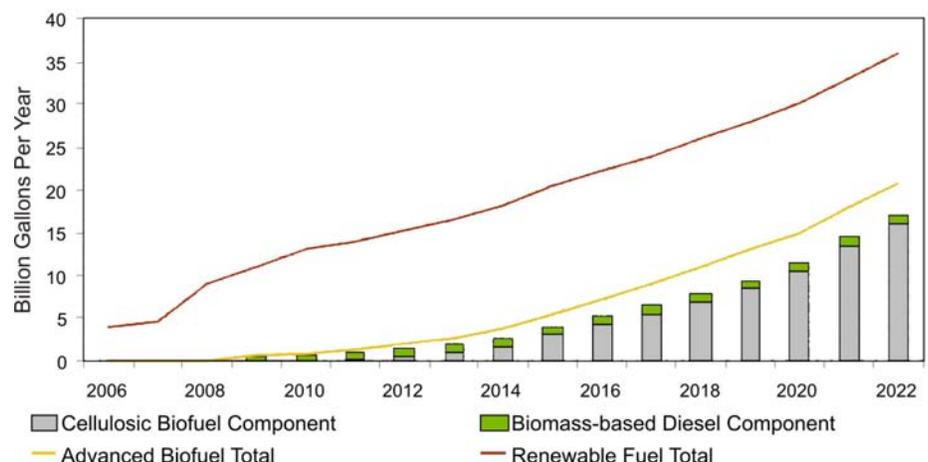
The growing U.S. bioindustry is creating opportunities for workers with a wide range of skills and supports the national strategy to develop diverse domestic energy resources.

Photo courtesy of Verenium

Stimulating Workforce Development and Jobs

The availability of skilled workers at all levels will be critical to successfully growing the U.S. bioindustry. Construction and operation of new U.S. biofuel refineries, which have nearly tripled in number since 2004,² have already created many new jobs. Scientists and engineers are at work developing new feedstocks, conversion technologies, and advanced biofuels, while construction workers are building the infrastructure needed to transport, store, and deliver the biomass and biofuels.

RFS Calls for Dramatic Increase in Renewable Fuels



¹ EIA, Biofuels Issues and Trends, Oct. 2012

² Statistics page, Renewable Fuels Association website. Accessed 31 Jan. 2013



Switchgrass being harvested for biofuels. Photo courtesy of Idaho National Laboratory

Continued growth will require an expanded workforce that is skilled in a range of disciplines, from chemical and biochemical engineering to agricultural science, microbiology, and genetics. Workers will be needed to design, build, and operate new biorefineries. In addition, more farmers, agricultural workers, and aquaculture specialists will be needed to expand the production of energy crops. Feedstock operations will also require workers to manufacture new harvesting and storage equipment and supply or recycle needed nutrients and chemicals. The need for specialists to conduct research in these fields is catalyzing the creation of new programs in school systems across the country.

The Energy Department is helping support the development of a workforce capable of meeting the needs of an expanded and advanced bioindustry. BETO RD&D supports graduate research at colleges and universities and promotes the development of curricula aimed at biofuels science and engineering. At the National Renewable Energy Laboratory, education programs help prepare future workers through undergraduate and graduate internships, teacher

training, and other programs. Through consortia and demonstration projects, the Energy Department also helps to provide biomass and biofuels professionals and production workers with real-world experience at the cutting edge of technology.

Economic Engine

A robust bioindustry will create high-paying jobs while helping reduce U.S. dependence on foreign oil. One industry report estimates that production, construction, and research in the ethanol industry supported more than 383,000 jobs (about 87,000 direct, 86,000 indirect, and the remainder induced) across the economy in 2012.³ Combined spending for operations, research, and agriculture in 2012 is estimated to have added \$43.4 billion to the nation's gross domestic product and put an additional \$30 billion into the pockets of American consumers.⁴

While projections of job creation vary, analysts agree that the sector could be a powerful jobs stimulus. As the industry expands beyond ethanol to include a wide range of advanced biofuels and biopower, additional jobs will be created. If production ramps up to meet current mandates, studies suggest that one to nearly two million new jobs could be added across the economy by 2030.⁵

³ John M. Urbanchuk, *Contribution of the Ethanol Industry to the Economy of the United States*, Renewable Fuel Association, 2 Feb. 2013.

⁴ Ibid.

⁵ John M. Urbanchuk, LECG, LLC, *Economic Impact of the Energy Independence and Security Act of 2007*, January 2008; U.S. Metro Economies, *Green Jobs in the U.S. Metro Areas*, October 2008; BioEconomic Research Associates, *U.S. Economic Impact of Advanced Biofuels Production: Perspectives to 2030*, Feb. 2009; Bloomberg New Energy Finance, *Moving towards a next-generation ethanol economy*, 2012.

Jobs in Biofuels

Feedstocks

- Farmers
- Seasonal workers
- Tree farm workers
- Mechanical engineers
- Harvesting equipment mechanics
- Equipment production workers
- Chemical engineers
- Chemical application specialists
- Chemical production workers
- Biochemists
- Agricultural engineers
- Genetic engineers and scientists
- Storage facility operators



Conversion

- Microbiologists
- Clean room technicians
- Industrial engineers
- Chemical & mechanical engineers
- Plant operators



End Use

- Station workers
- Construction workers
- Codes & standards developers
- Regulation compliance workers
- Consultants
- Chemists



Transport of Feedstocks & Biofuels

- Truck drivers
- Truck filling station workers
- Pipeline operators
- Barge operators
- Railcar operators
- Train station operators

