Green Jobs in the U.S. Bioeconomy

The emerging bioeconomy is improving U.S. energy security, addressing environmental challenges, and boosting U.S. technology leadership—while creating new industries and jobs.

Bioenergy is an integral part of the emerging U.S. bioeconomy. Breakthroughs in foundational science and multidisciplinary research continue to stimulate the discovery of new bio-based processes that enable the more affordable, efficient, and sustainable production of biofuels, bioenergy, and bioproducts.

The U.S. bioenergy industry creates employment opportunities for Americans in a broad range of fields, from scientific research to plant operations, farming, and equipment design. The United States has the potential to sustainably produce at least one billion dry tons of cellulosic biomass resources by 2030—enough to displace approximately 30% of the country's present petroleum consumption while meeting demand for food and feed. Achieving this potential will also significantly reduce greenhouse gas emissions.

New biorefineries are already producing advanced biofuels, bioproducts, and bioenergy from agricultural residues, organic wastes, and algae. The U.S. bioeconomy requires new systems and networks to efficiently grow, harvest, and transport large quantities of these home-grown resources. Technologies are also needed to more efficiently and economically convert biomass into a range of advanced biofuels and to upgrade intermediates into useful bioproducts. The U.S. Department of Energy's (DOE'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.

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

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. For example, DOE partnered with two pioneering biorefineries that opened in 2014. Together, the POET-DSM and Abengoa plants directly created 1,500 temporary jobs during design and construction and more than 120 permanent jobs.

Varied Employment Opportunities

The availability of skilled workers at all levels will be critical to successfully growing the U.S. bioeconomy. Construction and operation of new U.S. biofuel refineries have already created many new jobs that cannot be outsourced. Scientists and engineers are at work developing new biomass resources, conversion technologies, and advanced biofuels, while construction workers are building the infrastructure needed to transport, store, and deliver the biomass and biofuels.

The need for specialists in these fields is being met by new programs in school systems across the country. Information on specific skills needed for a range of positions is provided in the 2013 report *Careers in Biofuels*[1] by Emily Richards of the U.S. Bureau of Labor Statistics.

Stimulating Workforce Development

BETO is working with diverse partners to help develop the workforce needed to support the evolving bioeconomy. To raise public awareness of the varied career opportunities in bioenergy, BETO works with the Association of Science-Technology Centers to build engaging, interactive exhibits across the country.

To foster student interest in the advanced bioeconomy, BETO's OPERATION BioenergizeME engages future scientists and engineers now in primary through high school programs—challenging them to devise creative solutions for expanding bioenergy markets. OPERATION BioenergizeME provides information on the opportunities and challenges involved in developing a thriving bioeconomy.[2]

DOE also brings graduate and post-doctoral students to the Nation's capital to gain hands-on experience in helping to promote and deploy sustainable bioenergy technologies. The Department offers fellowship programs in partnership with the American Association for the Advancement of Science, Oak Ridge Institute for Science and Education (ORISE), and NOAA Sea Grant Program.

Economic Engine

The bioeconomy could become a powerful jobs stimulus. As production expands beyond ethanol to include a wide range of advanced biofuels and bioproducts, additional jobs will need to be filled.

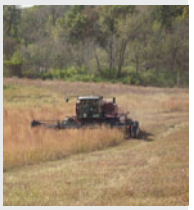
Available estimates of current and projected employment in the sector vary widely. Academic studies tend to focus on a single state or region, while commonly cited national employment numbers for the sector are based on analyses paid for by industry associations. A 2015 study sponsored by the Renewable Fuels Association, for example, estimates that ethanol production directly supported 83,949 jobs in 2014 (including construction, agriculture, manufacturing, and service jobs).[3] The National Biodiesel Board cites a recent study that estimates biodiesel supports 62,200 jobs nationally.[4] After applying the USDA jobs multiplier of 2.6 to the ethanol jobs,[5] these estimates suggest more than 280,000 people are working in positions directly or indirectly supported by ethanol or biodiesel production. While sector growth offers a range of important benefits to the nation, long-term job creation depends upon policy decisions and business investments. ■

Jobs in Bioenergy

Research

- Chemical engineers
- Chemical application specialists
- Chemical production workers
- Biochemists
- Genetic engineers and scientists

Biomass Supply and Logistics

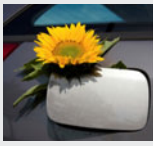


- Farmers and seasonal workers
- Tree farm workers
- Mechanical engineers
- Harvesting equipment mechanics
- Equipment production workers
- Agricultural engineers
- Storage facility operators

Conversion

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

End Use



- Station workers
- Codes & standards developers
- Regulation compliance workers
- Entrepreneurs

Construction and Transport

- Construction workers
- Truck drivers
- Barge operators
- Rail operators

Check out the video: *energy.gov/eere/bioenergy/biomass-2014-growing-future-bioeconomy*

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1 *www.bls.gov/green/biofuels/biofuels.pdf*

2 *http://energy.gov/eere/bioenergy/education-and-workforce-development*

3 Urbanchuk, John M., ABF Economics, "Contribution of the Ethanol Industry to the Economy of the United States in 2014," prepared for the Renewable Fuels Association, February 2015. Accessed March 26, 2015: *www.ethanolrfa.org/page/-/rfa-association-site/studies/Ethanol%20Economic%20Impact%20for%202014.pdf?nocdn=1*

4 National Biodiesel Board, Production Statistics webpage. Accessed March 26, 2015: *www.biodiesel.org/production/production-statistics*

5 Brown, Jason P., Jeremy G. Weber, and Timothy R. Wojan. Emerging Energy Industries and Rural Growth, ERR-159. U.S. Department of Agriculture, Economic Research Service, November 2013, p. 19. Accessed April 1, 2015: *www.ers.usda.gov/media/1229549/err159.pdf*

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