

Benefits of Biofuel Production and Use Series—Spotlight on Illinois

The U.S. Department of Energy’s (DOE’s) Bioenergy Technologies Office (BETO) enables the development of novel technologies that can be used to establish Illinois as one of the leaders in the growing bioeconomy by helping the state leverage its extensive biomass resources and existing infrastructure to increase advanced biofuels production.

Setting the Stage for Biofuels

Illinois is among the top 10 petroleum-consuming states (6th). In 2015, Illinois consumed 26 times more petroleum than it produced (9.5 million barrels). Investing in advanced bioeconomy technologies will boost economic development, improve energy security, reduce carbon emissions, and create jobs.

- **Economy**

Illinois spent \$19.4 billion on petroleum-based fuels for transportation in 2015. Additional production of domestic biofuels could keep more of those dollars within the state to stimulate economic growth and add to jobs in the bioenergy and biobased products industries.

- **Energy**

Illinois consumed 248 million barrels of petroleum in 2015. The state is #3 in the nation for ethanol production capacity and #4 for biodiesel capacity. Expanding local biofuel production to utilize cellulosic and algal feedstocks can improve Illinois’ energy security and resilience.



Gayathri Gopalakrishnan (left) and Paul Benda (right), environmental scientists at Argonne National Laboratory, study potential biofuel crops. *Photo credit: ANL.*

- **Environment**

In 2014, fossil fuels’ use in the Illinois transportation sector released 65 million metric tons of carbon dioxide. On a life-cycle basis, advanced cellulosic biofuels can reduce harmful emissions by >50% compared to petroleum—helping to reduce environmental impacts.

- **Feedstocks**

Illinois’ first-generation biofuel facilities can be upgraded to convert cellulosic agricultural residues, such as corn stover, into advanced biofuels and high-value products. Energy crops and woody and urban wastes are among the 16.4 million dry tons of sustainable biomass resources currently available for use in Illinois annually.

Bringing Technology to Market

Strategic policies and investments help bridge the gap between promising research and large-scale production of advanced biofuels.

- The Illinois Renewable Portfolio Standard requires that all investor-owned electric utilities and alternative retail electricity suppliers obtain increasing proportions of their retail sales from renewable resources. The requirements started at 2% renewables in 2009 and will reach 25% by 2026.
- BETO has awarded \$114 million to national laboratory, university, and industrial partners in Illinois to research,

develop, and deploy sustainable biobased fuels and products since 2008. Argonne National Laboratory (ANL) received \$48 million or 42% of these funds. In December 2016, BETO also awarded a \$4 million project to LanzaTech, Inc. and its team to design, construct, and operate an integrated demonstration-scale biorefinery that will use industrial waste gases to produce 3 million gallons/year of low-carbon jet and diesel fuels.

- **Argonne National Laboratory** scientists and engineers are advancing research and development (R&D) on a broad portfolio of sustainable and clean energy technologies, including renewable transportation fuels. ANL’s publicly available Greenhouse Gases Regulated Emissions and Energy use in Transportation (GREET) model evaluates energy and emissions impacts of vehicles and transportation fuels.
- The **Gas Technology Institute (GTI)** is a leading research, development, and training organization addressing energy and environmental challenges to enable a secure, abundant, and affordable energy future.

Why Illinois?

- **Robust Agricultural Industry**

In addition to the current 16.4 million dry tons per year the state produces, Illinois can provide an additional 14.7 million dry tons of locally sourced cellulosic feedstocks annually.

- **Infrastructure**

Existing non-cellulosic ethanol facilities can be upgraded to utilize non-food-based feedstocks and contribute to advanced biofuels production.¹

- **Jobs and Economy**

In 2013, Illinois' biobased products industry contributed 39,940 direct jobs (90,930 total jobs) and \$3.5 billion in direct value (\$8.4 billion in total value). In 2015, Illinois' ethanol industry generated more than 700 direct jobs and 19,430 total jobs.²

- **Energy Security**

Developing in-state resources reduces dependence on imported petroleum.

- **Location**

A favorable geographic location facilitates distribution of products to new markets.

DOE (often in partnership with the U.S. Department of Agriculture) has supported applied R&D at Illinois universities. This applied research improves the productivity of bioenergy feedstocks and maximizes the benefits of biofuels and bioproducts. DOE seeks to promote promising biofuel and biotechnologies research with the greatest chance of impact on biofuel and bioproducts production. ■

Integrated Biorefinery Projects in Illinois

Organization	GTI and Haldor Topsoe, Inc.	Elevance Renewable Sciences	LanzaTech	Archer Daniels Midland Company	GTI's IH ² Process
Project	Demonstrate green gasoline production from wood using carbona gasification and Topsoe Improved Gasoline Synthesis processes	Produce fuels and chemicals from renewable natural oils by using novel catalysts	Develop a hybrid conversion technology for catalytic upgrading of biomass-derived syngas to jet fuel	Convert agricultural residue into cellulosic ethanol and renewable chemicals	Demonstrate a new technology for direct conversion of biomass into fungible fuels
Location	Des Plaines	Bolingbrook	Skokie	Decatur	Chicago
Stage	Engineering scale	Engineering scale	R&D	Engineering scale	Engineering scale
Primary product	Renewable gasoline	Biodiesel, alpha olefins, and methyl esters	Low-carbon fuels and chemicals	Cellulosic ethanol ³	Renewable gasoline and diesel
Feedstock	Wood waste	Natural oils such as algal oil, other seed oils, and animal fats	Waste gases, bio-gases, and waste wood	Corn stover	Wood waste

Projects with Universities

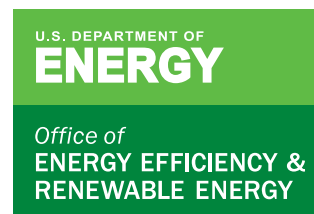
University	Southern Illinois University	University of Illinois	University of Illinois at Urbana-Champaign	Illinois State University	
Research area	Expand ethanol production and impacts	Improve genetics of sorghum for compositional and agronomic traits	Quantify phenotypic and genetic diversity of miscanthus	Study genetics of Andropogoneae feedstocks	Address barriers to the sustainable production of perennial energy crops
Stage	R&D	R&D	R&D	R&D	R&D
Primary product	Ethanol	N/A	N/A	N/A	N/A
Feedstock	N/A	Bioenergy sorghum	Miscanthus	Andropogoneae feedstock grasses	Switchgrass

For more information on Illinois' energy portfolio and the economic and environmental benefits of biofuels, visit:

- [Illinois state profile and energy estimates](#)
- [U.S. petroleum consumption by sector – 2015](#)
- [U.S. petroleum expenditures by sector – 2015](#)
- [State carbon dioxide emissions – 2014 USDA analysis on economic impact of U.S. biobased products industry](#)
- [2016 Billion-Ton Report state biomass resources download tool](#)
- [U.S. ethanol capacity and production by states \(2016\)](#)
- [Biodiesel production capacity](#)

For more information on Illinois clean energy initiatives and DOE partnerships, visit:

- [ANL renewable energy](#)
- [ANL GREET model](#)
- [Illinois laws and incentives](#)
- [Renewable energy in Illinois](#)
- [Elevance Renewable Sciences project](#)
- [Green Gasoline-TIGAS project](#)
- [DOE-BETO](#)
- [BETO funding opportunities](#)



For more information, visit energy.gov/eere/bioenergy

¹ In 2016, Illinois ranked third (38 million barrels) among 26 fuel ethanol-producing states in the United States. The state's current biodiesel capacity is 166 million gallons/year.

² Ethanol industry job numbers are based on the National Renewable Energy Laboratory's Jobs and Economic Development Impact (JEDI) model job estimates, which are full-time equivalent employees per year.

³ Current focus is renewable, high-performance chemicals and polymers.