

BRIDGES BIOENERGY 101 VIRTUAL WORKSHOP

Incorporating Bioenergy National Laboratory Research Into the Classroom



U.S. DEPARTMENT OF ENERGY OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY | BIOENERGY TECHNOLOGIES OFFICE

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- Audio connection options:
 - Computer audio
 - Dial-in through your phone (best connection)
- Automated closed captions are available

- Technical difficulties? Contact us through the chat feature
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https://www.energy.gov/eere/bioenergy/bioenergy-research-and-education-

bridge-program

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Bioenergy 101

- Bioenergy Technologies Office (BETO): BETO supports research, development, and demonstration to enable the sustainable use of domestic and waste resources for the production of biofuels and bioproducts.
- **Bioenergy:** Energy produced from biomass. When you see "bio-" in front of fuels, products, and power, it means these were made from biomass instead of petroleum.
- Bioeconomy: A global transition to the sustainable use of renewable biomass resources in energy and products aiming to increase economic, environmental, and social benefits and reduce environmental and social harm.
- Biomass: An energy resource derived from plant material. It includes agricultural residues (leftovers), forest residues, purpose-grown energy crops (such as algae and some kinds of grasses), urban wood waste, and food waste.



Access the BRIDGES Curriculum

Bioenergy Research and Education Bridge Program

Bioenergy Technologies Office

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U.S. Department of Energy Bioenergy Technologies Office

Bridging today's problem solvers to tomorrow's clean energy future

Access the BRIDGES Portal to download all BRIDGES materials needed for instructors to develop their curriculums.

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Regional Feedstock Case Study

BRIDGES MARKED AND Education

Bioenergy Research and Education Bridge (BRIDGES) Program

STUDENT GUIDE

to Achieving a Net-Zero Future?

ABSTRACT

Regional Feedstocks: Are They the Answer

uansportation industry as it meets the rising demands of all and manne taken with increasing fuel costs. Students will explore the challenges of transmontation bindinete their immant on meaning as any environment of the students.

travel with increasing fuel costs. Students will explore the cha transportation biofuels, their impact on greenhouse gas emiss transportation bioruels, their intpact on Breeninger well as exciting careers in the bioenergy industry.

Scenario

Regional Feedstocks: Are they the Answer to Achieving a Net-Zero Future?

Bioenergy.

SUBILITY If the transportation sector is to transition away from fossil fuels to using to lower-carbon If the transportation sector is to transition away from fossil fuels to using to lower-carbon mitting fuels and potentially reaching a net-zero future, the United States must dramatically increase statisticable transcorrection fuel conduction and use Sustainable fuels are made from emitting fuels and potentially reaching a net-zero future, the United States must dramatically increase sustainable transportation fuel production and use. Sustainable fuels are made from the restance of how the restance to Advise the restance of the states are advised to advised to advise the restance of the states are advised to advised increase sustainable transportation fuel production and use. Sustainable fuels are made from renewable biomass and waste resources and have the potential to deliver the performance of entroleum-based (or fuel with a fraction of ite carbon fractorint However the use of sustainable renewable biomass and waste resources and have the potential to deliver the performance of performance of sustainable performance of the section of its carbon footprint. However, the use of sustainable transvortation field have been limited by body of envolve and high production order. Addressing petroleum-based jet fuel with a fraction of its carbon footprint. However, the use of sustainable transportation fuels has been limited by lack of supply and high production costs. Addressing these challenges will require a collaborative affort from inductor and accomment to ender the transportation fuels has been limited by lack of supply and high production costs. Addressing these challenges will require a collaborative effort from industry and government to study the high production cost and evolve innovative colutions. outnass-usurenetity supply when any epity and sources. For sustainable transportation fuels to play a major role in achieving net-zero carbon emissions, the moduction of biofuels will need to be deamatically scaled on Orchid Risenerov is a ninneer

For sustainable transportation fuels to play a major role in achieving net-zero carbon emissions, the production of biofuels will need to be dramatically scaled up. Orchid Bioenergy is a pioneer is under how setton how cost transportation fuels and will enlist the help of a team of

the production of biofuels will need to be dramatically scaled up. Orchid Bioenergy is a pin in making low-carbon, low-cost, transportation fuels and will enlist the help of a team of preservices at Table National Laboratory (DT) to ender endered feederable and the kinetic in making low-carbon, low-cost, transportation fuels and will enlist the help of a team of researchers at Idaho National Laboratory (NL) to study regional feedstocks and the bioenergy enough while Owhid Ricenergy mede to reduce production every and early environments and early of the state researchers at Idaho National Laboratory (INL) to study regional feedstocks and the bioenergy supply chain. Orchid Bioenergy needs to reduce production costs and carbon emissions, while increasing the quality of the fuel commosite. They man to scale un operations by building a new supply chain. Orchid Bioenergy needs to reduce production costs and carbon emissions, while increasing the quality of the fuel composite. They plan to scale up operations by building a new biorefinery to meet the demand for transportation biofinale and maximize profite. Thereach a increasing the quality of the fuel composite. They plan to scale up operations by building a ne biorefinery to meet the demand for transportation biofuels and maximize profits. Through a callebration between inductor and POE estimat behaviorize. Cashid Biometerize biorefinery to meet the demand for transportation biofuels and maximize profits. Through a collaboration between industry and DOE national laboratories. Orchid Bioenergy and FML scientiste will be emdwine biomace barvest to conversion. You will be part of a team of intern collaboration between industry and DOE national laboratories. Orchid Bioenergy and INL scientists will be studying biomass harvest to conversion. You will be part of a team of interns, abellenced by your meetors to research which regional feedstock is best suited for producing the scientists will be studying biomass harvest to conversion. You will be part of a team of interns, challenged by your mentors to research which regional feedstock is best suited for producing the lowest maintaine and highest analyze module for the lowest east to addrive more team on the team of the lowest and the second sec challenged by your mentors to research which regional feedstock is best suited for producing the lowest moisture and highest quality product for the lowest cost. In addition, your team must also determine the best location for the next biorefinery to help offset production costs and earbon lowest moisture and highest quality product for the lowest cost. In addition, your team must als determine the best location for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next biorefinery to help offset production costs and carbon for the next bior Nouprime Your final project is to produce an infographic mapping a viable bioenergy value chain from biomass harvest to conversion to chare with the DOF and the board of directors for Orohid Your final project is to produce an infographic mapping a viable bioenergy value chain from biomass harvest to conversion to share with the DOE and the board of directors for Orchid Biometers

these challenges will require a collaborative effort from industry and biomass-to-bioenergy supply chain and apply innovative solutions.

RIDGES

Poll Everywhere

- What is the students' goal with this case study?
- What do you know already about this topic?
- What do you need to learn more about to complete the tasks presented in the Scenario?

Access live poll questions using Poll Everywhere

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Regional Feedstock Case Study

- Students assume the role of a bioenergy research intern investigating the biomass-tobioenergy value chain from harvest to conversion.
- Their goal is to research which regional feedstock is best suited for producing :
 - Lowest moisture and highest quality product for the lowest cost.
 - The best location for the next biorefinery to help offset production costs and carbon footprint.



Preparation

Students are introduced to INL's:

- **Bioenergy Feedstock Library** •
- **Bioenergy Feedstock Characterization Lab** ullet



Corn Stover

Data Sheet PDF (Single Pass) (Revised 11-28-2016) Data Sheet PDF (Multi Pass) (Revised 11-28-2016) Data Sheet PDF (Ensiled) (Revised 11-29-2016

Corn stover is the most common crop for bioenergy research. Corn stover, an agricultural by-product, consists of the leaves and stalks of corn plants left in a field after harvest. It can be harvested with a single piece of equipment for both cutting and baling (single pass), or use a double-pass method that first cuts and drops the stover in windrows in the field and then picks up and bales the windrowed stover, typically introducing more ash from soil.



Data Sheet PDF (Revised 11-28-2016)

Sorghum is a cereal grain that grows tall like corn and can be produced as a quick-growing annual. High-biomass sorghum uses water and nutrient inputs efficiently, is drought resistant, has robust establishment characteristics, and can be produced



Switchgrass

Switchgrass is a native warm-season perennial grass that can thrive in a variety of climatic conditions and soil types. It can be grown on land that is not suitable for row grop production in either conventional tillage or no-till production systems.



Data Sheet PDF (Revised 11-28-2016)



perennial grass that resembles bamboo. It is easy to grow requires few nutrient inputs, and produces a crop with a high biomass yield and low mineral content. Miscanthus can be grown on lands not suitable for row-crop production.



Data Sheet PDF (Revised 11-28-2016) Wheat straw, an agricultural by-product, consists of the dry stalks that remain after the grain and chaff have been removed. It's use as a large-scale biomass power source is increasing in many parts of the world.



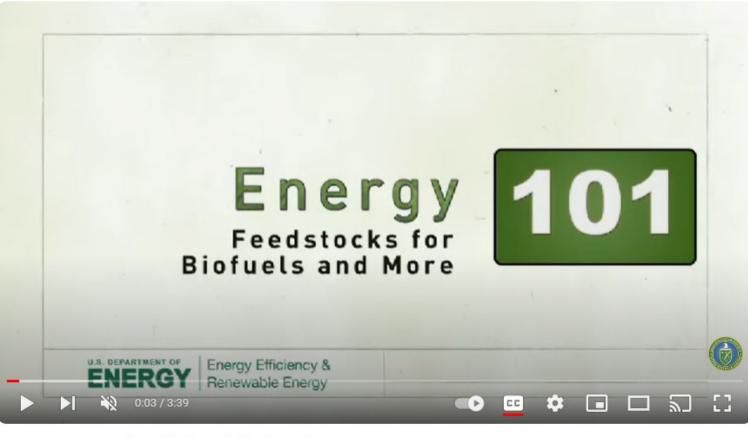
Data Sheet PDF (Revised 1-8-2018)

Poplars grow fairly well in the northern, central, and southern United States. Extensive genomic resources and ease of clonal propagation and transformation, will allow the generation of advanced transgenic clones with enhanced traits.

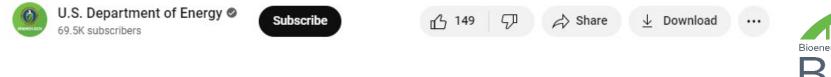


Bioenergy Feedstock Characterization Laboratory

Advanced biomass characterization to evaluate feedstock quality for processing and conversion performance



Energy 101: Feedstocks for Biofuels and More

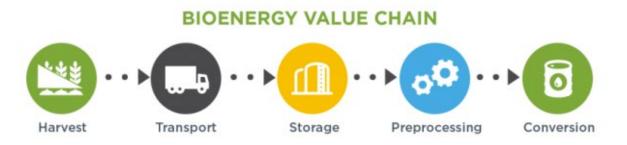




Task 1: Biomass-to-Bioenergy Examples

 Explore "Biomass Supply and the Sustainable Development Goals: International Case Studies"

	Forest Biomass	Agricultural Residue	Energy Crops	Waste Biomass
Year & Location				
Harvest				
Transport				



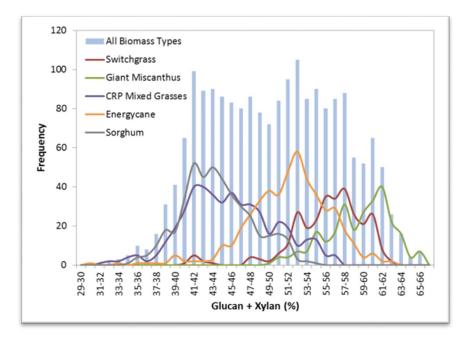


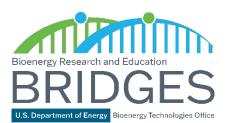
Breakout Session



Task 2: Review Biomass Characterization and Regional Supply Data

• Students learn the ideal characteristics for conversion to biofuels.





Biomass Value Chain	Description	Pros	Cons
Biomass Selected			
Feedstock Characterization Notes			
Harvest			
Transport			

Task 3: Focusing Your Research

Teams come to a consensus on the biomassto-bioenergy value chain they will recommend to Orchid Bioenergy

They will also make a recommendation for the best location for the next Orchid biorefinery.



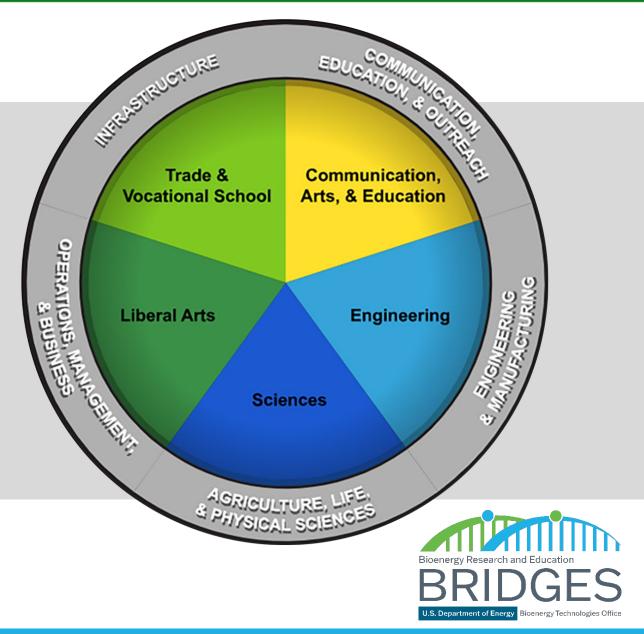
Task 4: Create an Infographic

Students demonstrate their chosen biomass to bioenergy value chain by creating an infographic to be shared with FCIC and presented to Orchid's board of directors to help them decide which feedstock is the best investment and best location to build their next biorefinery.



CAREER HIGHLIGHT: Bioenergy Research Intern

- Average salary
- Common majors for this position
- Responsibilities of a sustainability specialist
- Students then explore the career wheel to identify a career of interest to them



BRIDGES STUDENT AND INSTRUCTOR GUIDES NOW AVAILABLE



STUDENT GUIDE

Upcycling: Could My Plastic Bag Someday Become the Sustainable Alternative?



ABSTRACT

Students will be introduced to the challenges and benefits of bioenergy, as well as to exciting careers in the industry, by taking on the role of a materials chemist to learn how scientists and industry professionals are reimagining the life cycle of plastics in the U.S. economy.



STUDENT GUIDE

Solid Waste to Energy: Traditional Ecology and Environmental Justice

Bioenergy Research and Education Bridge (BRIDGES) Program



ABSTRACT

Students will be introduced to the challenges of managing municipal solid waste, opportunities for turning these products into usable energy sources, issues of environmental justice, and exciting careers in the bioenergy industry. A REMARKING OF ENERGY Office of RENEWABLE ENERGY RENEWABLE ENERGY

STUDENT GUIDE

Farm to Flight: Are Sustainable Aviation Fuels Good for the Environment?



ABSTRACT

Students will be introduced to the challenges and benefits of bioenergy, as well as to exciting careers within the industry. Students will take on the role of a sustainability specialist in the cutting-edge biotuel industry to compare the use of sustainable and petroleum jet fuels, including their greenhouse gas emissions.



STUDENT GUIDE

Regional Feedstocks: Are They the Answer to Achieving a Net-Zero Future?

Bioenergy Research and Education Bridge (BRIDGES) Program



ABSTRACT

Students will be introduced to the sustainability challenges facing the transportation industry as it meets the rising demands of air and marine travel with increasing fuel costs. Students will explore the challenges of transportation biofuels, their impact on greenhouse gas emissions, as well as exciting careers in the bioenergy industry.

VISIT THE BETO BRIDGES WEBSITE:

https://www.energy.gov/eere/bioenergy/bioen ergy-research-and-education-bridge-program

OFFICE HOURS (registration only)

Oct 24th, 2024 Nov 7th, 2024

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Thank you!

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