

*Developing future  
leaders who will  
determine the  
bioenergy landscape of  
tomorrow*



## **BioenergizeME Infographic Challenge Toolkit**

### **Infographic Challenge 2015**

*“Bioenergy—Building on the  
Shoulders of Giants”*

#### **Deadlines:**

**Infographic Submission March 20, 2015**  
**National Bioenergy Social Media Campaign**  
**April 13-23, 2015**

**Bioenergy Technologies Office**  
**Spring 2015**

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## 1 INTRODUCTION

Welcome to the U.S. Department of Energy (DOE) BioenergizeME Infographic Challenge, where 9th through 12th-grade student teams use technology to learn about bioenergy.

In this challenge, student teams research, interpret, apply, and then design an infographic that responds to one of four bioenergy topics. Their infographics can be submitted to the DOE Bioenergy Technologies Office (BETO) for a chance to compete in a nationwide, student-driven, bioenergy social media campaign. Selected infographics are promoted nationally on the challenge website for the social media campaign, and one team of students will be selected to present their infographic at *Bioenergy 2015*, BETO's annual conference in Washington, D.C.<sup>a</sup>

The purpose of the infographic challenge is to provide students with an educational foundation about bioenergy that will help them be more informed when they hear information about energy issues in the news and other media. Students of today will be the future leaders of tomorrow. This understanding will be important for them in their future professions and communities as they make decisions about the changing energy landscape and how bioenergy can play a part.

To make student research easy and effective, the DOE and the Library of Congress have provided a resource guide with steps for doing research, along with valuable links and references to help students learn about their bioenergy topics. Rubrics and guides for creating infographics and designing social media campaigns are also provided.

Check out this interactive [BioenergizeME Infographic Challenge Map](#) to see submissions from schools across the country from the fall 2014 competition. Put your school on the BioenergizeME map by participating in the Spring 2015 BioenergizeME Infographic Challenge.

<sup>a</sup> DOE will sponsor up to four students and two chaperones (one female and one male).

## WHY BIOENERGY? WHY NOW?

Bioenergy has come a long way since dried plant material was first burned for light and heat by early human civilization. Bioenergy comes from biomass, or recently living plant material, that collects and stores energy from the sun as chemicals within its cells. There are many ways to harvest bioenergy from plant material, and technologies have been developed over time to use the energy in biomass more efficiently and cleanly.<sup>b</sup>

In the United States, biomass provides just a portion of the variety of resources used to meet America's energy needs. As our awareness increases about the diminishing availability of energy resources and the environmental effects of producing and using them, it is more important than ever to understand

- Basic energy principles
- Energy resource and technology options available
- Benefits and challenges of various energy resources
- How students and their peers can play an important role in shaping America's energy future.

Many young people haven't thought much about bioenergy as an option for power, transportation fuels, and other products. That's understandable, because the variety of information available about bioenergy, its promises, and its challenges can be confusing. The BioenergizeME<sup>c</sup> Infographic Challenge is designed to help young people and teachers/leaders get a handle on this important energy resource topic.

## BRINGING BIOENERGY INTO THE CLASSROOM

The BioenergizeME Infographic Challenge is suitable for both classroom and independent educational use, and follows the Global Literacy XPRIZE model<sup>d</sup> to “rethink learning by harnessing innovation and technology and by placing the capability and desire to become educated into the hands of the learner.”

In the challenge, teams present their BioenergizeME project in the form of an infographic, which is an interesting and quick way to communicate ideas and educate others. BioenergizeME infographics should convey a well-focused message that is predominantly image-led and that a general audience can understand in just a few minutes (great skills for students to practice).

<sup>b</sup> For a good introduction to exciting things related to bioenergy production, see the short video *Bioenergy: America's Energy Future* (full version: <http://youtu.be/GU0Cu45cLT4> or short version: <http://youtu.be/VskQZAvbjGE>).

<sup>c</sup> OPERATION BioenergizeME is the U.S. Department of Energy Bioenergy Technologies Office's educational “base camp”, providing resources and activities to help engage younger stakeholders in bioenergy. OPERATION BioenergizeME supports the Energy Department's Energy Literacy Framework (see <http://energy.gov/eere/education/energy-literacy-essential-principles-and-fundamental-concepts-energy-education>)—an initiative to increase the public's understanding of the role of energy in the world and in their daily lives, and to help them apply this understanding to answer questions and solve problems.

<sup>d</sup> <http://www.xprize.org/prize-development/learning>

## 2 CHALLENGE DETAILS

Teachers/leaders and students can participate in the BioenergizeME Infographic Challenge in fall or spring school sessions, or both. Teachers/leaders are encouraged to integrate the challenge into their curriculums as they see fit, while keeping in mind the submission deadlines and the national BioenergizeME social media campaign schedule (see Challenge Structure, Task 5).

A pre-recorded kick-off webinar for teachers/leaders and students is available on the BioenergizeME Infographic Challenge website.

## STRUCTURE

The BioenergizeME Infographic Challenge is designed for teams of two to four high school students in 9th through 12th grade. Teachers can adjust team size as needed for their teaching situation, but only four students from the winning infographic team will be hosted at Bioenergy 2015 in Washington, D.C.

Each student team will respond to one of the research topics and prompts provided. Students should make sure their infographic communicates a well-focused thesis.

The challenge has two phases, and teams can participate in Phase 1 only or in both Phase 1 and Phase 2:

### Phase 1

#### Task 1

Students research a topic they choose from the list (See Section 6: Research Topic Areas and Prompts).

#### Task 2

Students create an infographic to communicate their research (See Section 8: Resources).

#### Task 3

Teacher or leader reviews infographics based on the provided rubric (Section 7), then submits to BETO those that meet challenge requirements as directed in Section 3: Challenge Rules.

#### Optional Task

Teachers may return infographics that do not meet the challenge requirements to student teams for revision and resubmission.

### Phase 2

#### Task 4

The U.S. Energy Department's Bioenergy Technologies Office review board evaluates entries for objectivity and well-referenced content and selects finalists for the national bioenergy social media campaign.

#### Task 5

Students whose infographics have been selected for the social media campaign develop and execute their own social media campaign strategies April 13–23, 2015 (See Social Media Planning Guide).

## ELIGIBILITY

The following eligibility requirements must be met in order for infographics to be included in the national bioenergy social media campaign:

- All entrants must be U.S. citizens or legal residents.
- Each submission must have approval by a sponsoring teacher or leader.
- Entrants must be no older than 19 years of age.

## 3 CHALLENGE RULES

- **Each submission must be emailed by the sponsoring teacher or leader to [BioenergizeME@ee.doe.gov](mailto:BioenergizeME@ee.doe.gov) by 5:00 p.m. Central Standard Time on March 20, 2015.**
- Each infographic must be image-led, using illustrations and/or graphics to communicate the team's research findings.
- Each infographic must respond to one research prompt found in Section 6.
- Each infographic must be reviewed by a sponsoring teacher or leader and receive at least three points for the research content section of the rubric (provided in Section 7).
- Infographics must be suitable for general audiences (i.e., contain no explicit language, crude/suggestive humor, drug innuendo, or mature/suggestive themes).
- Teams may submit more than one infographic, but each infographic must respond to a different research prompt.
- Each submission must be in JPEG or PNG format with a minimum width of 825 pixels.
- Any submissions that have previously advanced to the top 10 finalists may not be re-submitted.
- Infographics may not endorse a particular company or entity, nor display a trademarked product, without the explicit permission of the U.S. Department of Energy.
- Each submission must be the contestants' original work and must not infringe, misappropriate, or otherwise violate any intellectual property rights, privacy rights, or any other rights of any person or entity.
- Failing to meet submission requirements or other submission screenings will result in a submission being deemed ineligible to win a prize.
- Each contestant grants to DOE a royalty-free, non-exclusive, worldwide license to use, and copy for use, all parts of its submission, for purposes of evaluation of its entry or promotion of the competition.
- The winner of the competition will, in consideration of the prize to be awarded, grant to DOE a perpetual, non-exclusive royalty-free license to use any and all intellectual property in the winning entry for any purpose.

## 4 REVIEW AND JUDGING

### PHASE 1: INFOGRAPHIC CONTENT AND DESIGN

#### TEACHER/LEADER'S REVIEW PRIOR TO SUBMISSION TO DOE

Each infographic should be reviewed and scored by the team's sponsoring teacher or leader using the rubric provided in Section 7. Infographics receiving at least three points in the research content category may be submitted to the Bioenergy Technologies Office by the sponsoring teacher or leader via email. The sponsoring teacher or leader may provide feedback to infographics receiving less than three points and give student teams the opportunity to rework and resubmit those infographics for a qualifying score.

#### DOE/BIOENERGY TECHNOLOGIES OFFICE REVIEW

All submitted infographics will be reviewed by a bioenergy expert panel selected by the Bioenergy Technologies Office. The panel will evaluate each entry for objectivity and well-referenced content and select finalists for the national bioenergy social media campaign.

The sponsoring teachers or leaders for infographic selected finalists will be contacted to inform student teams to proceed with planning their social media campaign strategy. The selected infographics will be posted on the BioenergizeME website, and a link to the infographics will be provided to the sponsoring teachers and leaders.

### PHASE 2: SOCIAL MEDIA CAMPAIGN

The teams whose infographics are selected as finalists share their infographic link via their personal social media outlets. When the media campaign time period is complete, DOE will perform web analytics to determine the top ten infographics as determined by greatest number of unique views.



## GRAND PRIZE WINNER SELECTION

The Bioenergy Technologies Office leadership team will review the top 10 infographics and select an overall winner based on content and design. A “viewer’s choice” winner may also be awarded based on the results of the web analytics (unique views).

## 5 AWARD DETAILS

### Awards:

- Recognition of all participants and winners with official DOE certificates.
- National promotion of infographic on DOE’s BioenergizeME website.
- Recognition of first-place team at *Bioenergy 2015*, the Bioenergy Technologies Office’s annual conference, held in Washington, D.C.

## 6 RESEARCH TOPIC AREAS AND PROMPTS

To ensure that teams have the flexibility to develop their ideas and conduct their own research, topic areas are provided. The topic areas help students explore the role of biomass in the context of an energy landscape that has changed many times throughout human history. Within each topic area are prompts that are foundational, broad, and open-ended to foster student-centered discovery.



To help students get on topic quickly and focus on bioenergy basics, keep the following considerations in mind when researching and developing infographics:

## WHAT BIOENERGY IS, AND ISN'T

Bioenergy is energy that is produced from renewable biomass resources, or recently living plant materials. Biomass resources include

- Agricultural grains such as corn and wheat
- Non-grain agricultural residues such as corn stover (stalks, leaves, and cobs) and grain straws
- Processing wastes such as sugar cane bagasse, distillers dried grains
- Energy crops such as soybean, switchgrass, miscanthus, or energy cane
- Animal manures
- Woody plantation crops
- Algae
- Municipal solid waste.

Bioenergy can be in the form of

- Electricity and processing heat
- Transportation fuels
- Bioproducts that help enable production of biopower and biofuels.

*(Note: Although not necessarily a form of bioenergy, bioproducts can be produced using the same biomass resources as used for bioenergy and include byproducts of the bioenergy process, such as soil amendments. Bioproducts also include plastics, chemicals, and other products that are typically produced using fossil energy sources.)*

Bioenergy **does not** include solar, wind, water, geothermal, or nuclear energy.

Bioenergy **does not** include non-renewable fossil energy sources, like coal, oil, or natural gas.

## STICKING TO BIOENERGY BASICS

This challenge is designed to help students gain a science-based, foundational understanding of the benefits and challenges of bioenergy.

Student teams should work under the following assumptions:

- Bioenergy is one of several renewable energy resource options for the United States.
- Bioenergy itself is neither good nor bad—it needs to be produced in ways that provide benefits and overcome challenges.

Avoid controversial messages that often lack context or endorse a particular company or entity.

Focus messages on understanding the conditions that need to be considered for bioenergy production to enhance food and feed production, the environment, and economic development.

## CHOOSE A PROMPT FROM ONE OF THE RESEARCH TOPIC AREAS BELOW AND CREATE AN EDUCATIONAL INFOGRAPHIC.

As you consider your research topic area and the prompts, remember that the strongest entries will show that you have a clear and focused understanding of a relevant issue within the topic area and creativity in how you respond.

### TOPIC AREA 1 - BIOENERGY HISTORY

Throughout human civilization, many different energy sources have been used to provide cooking, heating, lighting, transportation, safety, communication, and a host of other things we take for granted in daily life. Biomass has been used many ways at different times to provide this energy.

1. How has the use of biomass for energy changed or stayed the same? How have technological breakthroughs improved bioenergy efficiency over time?

*Possible subject headings/key words:*

History of biomass; history of bioenergy

### TOPIC AREA 2 - WORKFORCE AND EDUCATION

The major resources used for energy production have changed over time depending on ecosystem diversity, abundance, transportability, safety, and opportunity for profit. Energy transitions have occurred many times, impacting the livelihoods of candle makers, loggers, whalers, miners, oil producers, and others.

1. Research one of these events, give an overview, and describe new research and employment opportunities that were created. (**Note:** *Keep responses broad; do not focus on individual companies.*)

*Possible subject headings/key words:*

Transitions in energy sources

2. What new research and employment opportunities could bioenergy development create? Describe one promising bioenergy-related career and the steps one would take to prepare to work in this position. Make sure to focus your research on an existing bioenergy-related job.

*Possible subject headings/key words:*

Bioenergy/biofuels careers

## TOPIC AREA 3 - SCIENCE AND TECHNOLOGY

1. How do plants capture and store energy from the sun? Describe a process for harvesting energy from plants for sustainable transportation fuels. Include mention of the research challenges being addressed to make your selected method of bioenergy conversion feasible for widespread public adoption.

*Possible subject headings/key words:*

Energy from biomass  
Grain ethanol, biodiesel (commercially established)  
Cellulosic ethanol (emerging or under development for near term)  
Pyrolysis oil, gasification (under development for mid term)  
Algae (under development for more distant future)

2. What are common types of biomass that are being explored in the United States to produce biofuels? What characteristics do biofuels developers look for in selecting types of biomass to use as feedstocks for biofuels? Select one resource and describe its availability, its bioenergy-related benefits, and challenges that are being addressed or that need to be addressed to encourage broad use as a bioenergy feedstock.

*Possible subject headings/key words:*

Bioenergy feedstock: grain and oil seed crops; agricultural residues such as corn stover; energy crops such as switchgrass and miscanthus; forest product residues; plantation woody crops such as southern pine, poplar, or willow; algae; municipal solid waste.

## TOPIC AREA 4 - ENVIRONMENTAL IMPACTS

1. How can biofuel production help benefit the environment? How can bioenergy production augment forestry or agriculture to provide bioenergy feedstock while benefiting the environment?

*Possible subject headings/key words:*

Environmental benefits bioenergy; environmental bioenergy benefits forestry; environmental benefits bioenergy agriculture; landscape design  
bioenergy gulf hypoxia

2. Research and explain why the U.S. Energy Independence and Security Act of 2007 and the Renewable Fuel Standard<sup>e</sup> were created, why they include biofuels, and how they intend to ensure that biofuels have positive effects on greenhouse gas reduction.

*Possible subject headings/key words:*

Purpose of the U.S. Energy Independence and Security Act of 2007;  
Renewable Fuel Standard, greenhouse gas reduction

3. Why is it important to develop sustainable forms of transportation, and what are important characteristics that you think sustainable transportation should have?

*Possible subject headings/key words:*

Biofuels sustainable transportation; sustainable transportation quality  
of life

<sup>e</sup><http://www.gpo.gov/fdsys/pkg/PLAW-110publ140/pdf/PLAW-110publ140.pdf>; see Section 201–202 for the Renewable Fuel Standard.

## 7 RUBRIC

Infographic Rubric				
Research Content	<ul style="list-style-type: none"> <li>Evidence based</li> <li>Clear analysis and explanation</li> <li>Logical flow</li> </ul>	3	2	1
		<ul style="list-style-type: none"> <li>The data and facts presented are evidence based from reliable sources. All sources are referenced. All content is accurate.</li> <li>There is clear analysis and explanation of the research topic selected.</li> <li>The information and messages present a logical flow.</li> </ul>	<ul style="list-style-type: none"> <li>The content contains one inaccuracy, and content is partially cited with credible sources.</li> <li>The analysis and explanation are incomplete.</li> <li>One of the elements of the infographic does not logically flow with the subject matter.</li> </ul>	<ul style="list-style-type: none"> <li>The content contains more than one inaccuracy, content is occasionally cited, and/or credible sources are visibly lacking.</li> <li>Lacking analysis and explanation.</li> <li>More than one of the elements of the infographic does not logically flow with the subject matter.</li> </ul>
Design	<ul style="list-style-type: none"> <li>Aesthetics (font, color, shape)</li> <li>Correct use of data visualization</li> <li>Relevance of graphics</li> </ul>	3	2	1
		<ul style="list-style-type: none"> <li>The infographic is highly attractive in terms of layout, design, and neatness. The color choices enhance the visibility of the infographic, and the fonts used are readable and complement the content.</li> <li>The chosen data visualization formats make the data presented clear and simple for the viewer to understand.</li> <li>The images and illustrations match the tone and subject matter of the infographic.</li> </ul>	<ul style="list-style-type: none"> <li>The infographic is adequately attractive in terms of layout, design, and neatness. Color and font choices do not add or detract from the infographic.</li> <li>The chosen data visualization formats illustrate the data correctly, but some may be difficult for the viewer to understand.</li> <li>The images and illustrations are relevant but may distract attention away from the content of the infographic</li> </ul>	<ul style="list-style-type: none"> <li>The infographic lacks attractiveness in terms of layout, design, and neatness. Fonts used are difficult to read, and color choices are distracting.</li> <li>Data visualizations are seen, but other formats could have been chosen to better illustrate the data for the viewer.</li> <li>The images and illustrations used do not match the subject matter of the infographic and take away from the content of the infographic.</li> </ul>
Mechanics	<ul style="list-style-type: none"> <li>Grammar</li> <li>Guideline/format</li> </ul>	2	1	
		<ul style="list-style-type: none"> <li>The writing is free of errors.</li> </ul>	<ul style="list-style-type: none"> <li>The writing contains one or more errors.</li> </ul>	

## 8 RESOURCES

The Bioenergy Technologies Office collaborated with the Library of Congress to develop a collection of quality resources for the BioenergizeME Infographic Challenge. These resources were compiled to provide a solid foundation of credible information covering various aspects of bioenergy.

### LIBRARY OF CONGRESS

The Library of Congress is the world's largest library by number of items catalogued and serves as the research library for the U.S. Congress. For the BioenergizeME Infographic Challenge, the Library of Congress put together the Research Strategy Guide and Resource Library for students to use as a starting point for their research. The Research Strategy Guide provides students with guidance on developing a successful research strategy. The Resource Library provides students with references and links to various sources such as books, fact sheets, and publications. Both documents are currently available on the Library of Congress website and via the links below:

- [BioenergizeME Research Strategy Guide](#)
- [BioenergizeME Resource Library 2015](#)

The Library of Congress is a valuable resource for researchers at any level, and the “Ask a Librarian” function is a great way to get research assistance from Library of Congress librarians.

### GOVERNMENT

Government agencies such as the U.S. Department of Agriculture (USDA), Environmental Protection Agency (EPA), and Department of Energy (DOE) are on the leading edge of science and technology research and produce valuable publications, fact sheets, and reports that are available to the public for free. The U.S. Department of Energy's Bioenergy Technologies Office (BETO) compiled the following list of bioenergy-related resources from various government agencies to provide a foundation for students to begin their research:

- [Bioenergy Technologies Office website](#)
  - [Biomass Basics](#)
    - [Biofuels Basics](#)
    - [Bio-Benefits](#)
    - [Bioproducts](#)
    - [Biopower](#)
  - [Field-to-Fuel Gateway to BETO](#)
  - [EERE Education Toolbox](#)—Allows the user to view and search educational resources from DOE's Office of Energy Efficiency and Renewable Energy.

- [Bioenergy Knowledge Discovery Framework](#)—A resource providing access to a variety of data sets, publications, and collaboration and mapping tools that support bioenergy research, analysis, and decision making.
- [Alternative Fuels Data Center](#)—Provides information, data, and tools to help fleets and other transportation decision makers find ways to reduce petroleum consumption through the use of alternative and renewable fuels, advanced vehicles, and other fuel-saving measures.
- [USDA “Ask the Expert”](#)—Visitors can click “Submit a Question” to submit a question to USDA subject matter experts.

## NATIONAL LABORATORIES

The U.S. Department of Energy provides funding to national laboratories across the United States that provide valuable bioenergy-related research:

- [National Renewable Energy Laboratory](#)
  - [Biomass Energy Basics](#)
  - [Biomass Research Homepage](#)
  - [Library](#)
- [Oak Ridge National Lab](#)
  - [Biomass Energy Data Book](#)
  - [Research Library](#)
- [Pacific Northwest National Laboratory](#)
  - [Publications Page](#)

## BIOENERGY RESEARCH CENTERS

The U.S. Department of Energy established three bioenergy research centers in 2007 to help to address the challenges of biofuel production:

- [Great Lakes Bioenergy Research Center](#)
- [BioEnergy Science Center](#)
- [Joint BioEnergy Institute](#)



## INFOGRAPHICS

The Bioenergy Technologies Office compiled the resources in the following sections to assist students with developing their infographics. The Infographic Guide at the link below was developed specifically for the BioenergizeME Infographic Challenge to provide tips and guidance for creating an infographic.

- [Infographic Guide](#)

## EXAMPLES

The infographics found below provide great examples of high-quality infographics that were produced for the U.S. Department of Energy and may provide useful examples for students in designing their own.

- [POET-DSM: Project LIBERTY](#)
- [Abengoa Biorefinery](#)
- [Alpena Biorefinery](#)
- [Warding Off Energy Vampires and Phantom Loads](#)
- [Wind Energy in America](#)
- [Home Heating](#)

## IMAGE RESOURCES

The following resources provide free image galleries that can be used to find bioenergy-related photos and graphics:

- Pacific Northwest National Laboratory—[PictureThis](#)
- National Renewable Energy Laboratory—[Image Gallery](#)
- United States Department of Agriculture
  - Agricultural Research Service [Image Gallery](#)
  - [Photography Services](#)

U.S. DEPARTMENT OF  
**ENERGY**

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Energy Efficiency &  
Renewable Energy

[eere.energy.gov](http://eere.energy.gov)  
[bioenergy.energy.gov](http://bioenergy.energy.gov)

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