

# ***BioenergizeME Office Hours***

## ***Integrating Bioenergy into the 9<sup>th</sup>—12<sup>th</sup> Grade Classroom***

December 10, 2015

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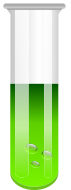
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Contractor, The Hannon Group  
Bioenergy Technologies Office  
U.S. Department of Energy

# Agenda

1. Overview Of Energy Literacy



2. Overview of Next Generation Science Standards



3. Bioenergy Basics



4. 2016 BioenergizeME Infographic Challenge



5. Incorporation of Bioenergy into the Classroom



# Questions and Comments

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Please record any questions and comments you may have during the webinar and send them to [BioenergizeME@ee.doe.gov](mailto:BioenergizeME@ee.doe.gov)

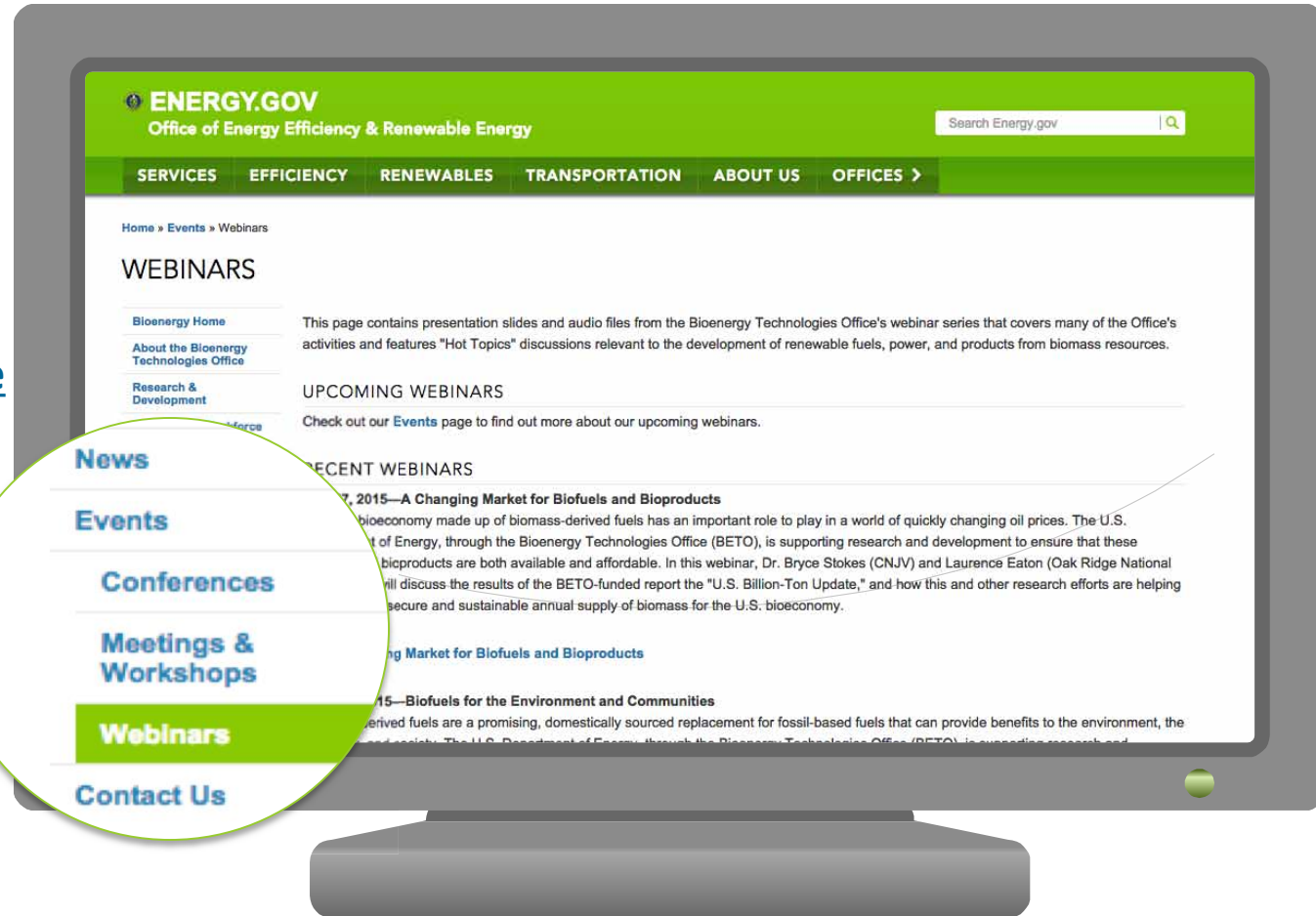
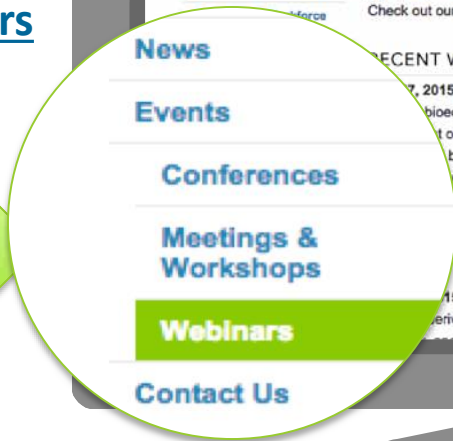
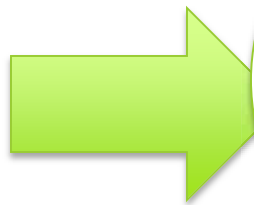
As a follow-up to the webinar, the presenter(s) will provide responses to selected questions.

For general questions regarding the BioenergizeME Infographic Challenge, please email [BioenergizeME@ee.doe.gov](mailto:BioenergizeME@ee.doe.gov)

# Webinar Recording

Find today's webinar recording and slides on the Bioenergy Technologies Office website:

<http://www.energy.gov/ere/bioenergy/webinars>

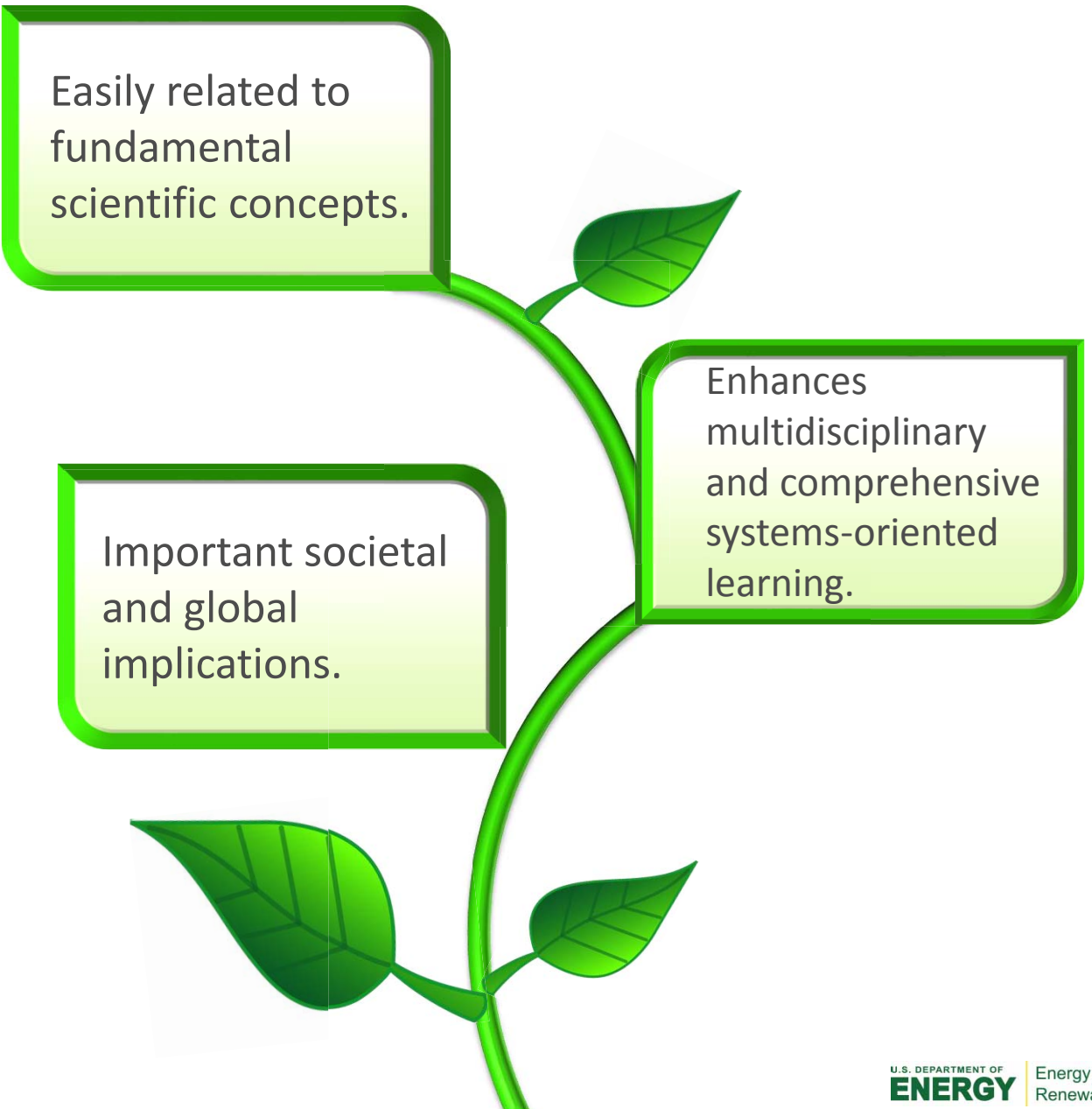


# Why Bioenergy? Why Now?

- **Bioenergy** use has changed over time
- **Bioenergy** is part of a variety of resources used to meet America's energy needs
- **Important to understand:**
  - Basic energy principles
  - Energy resource & technology options available
  - Benefits & challenges of various energy resources
  - How students & their peers can play an important role in shaping America's energy future



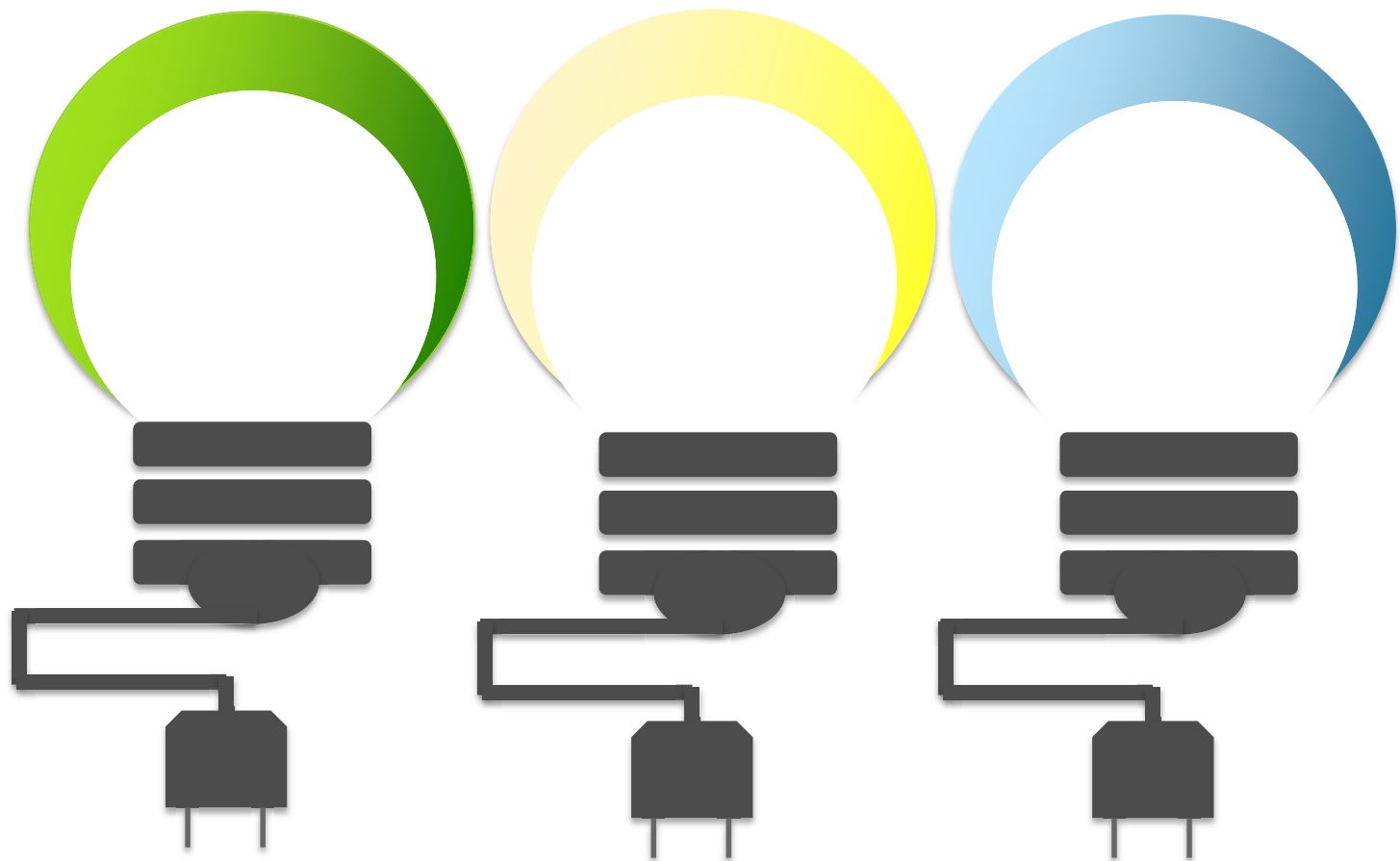
# Bioenergy in the Classroom



Easily related to fundamental scientific concepts.

Important societal and global implications.

Enhances multidisciplinary and comprehensive systems-oriented learning.



# Overview Of Energy Literacy

# What is Energy Literacy & Why does it matter?

Energy literacy is an understanding of the nature and role of energy in the universe and in our lives. It is the ability to apply this understanding to answer questions and solve problems.

- **An energy-literate person:**
  - can trace energy flows and think in terms of energy systems
  - knows how much energy he or she uses, for what, and where that energy comes from
  - can assess the credibility of information about energy
  - can communicate about energy and energy use in meaningful ways
  - is able to make informed energy and energy use decisions based on an understanding of impacts and consequences
  - continues to learn about energy throughout his or her life

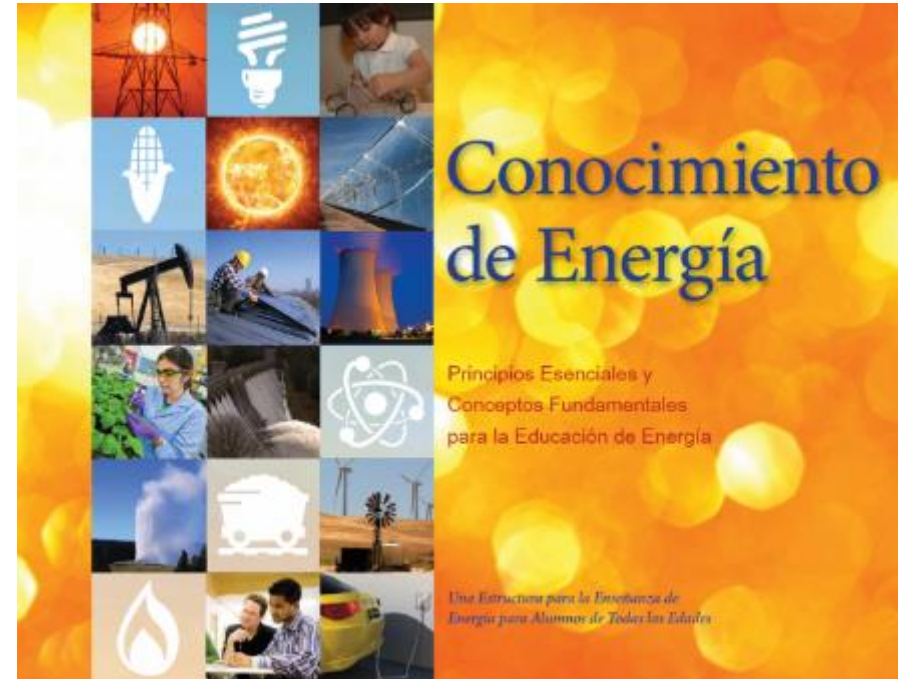
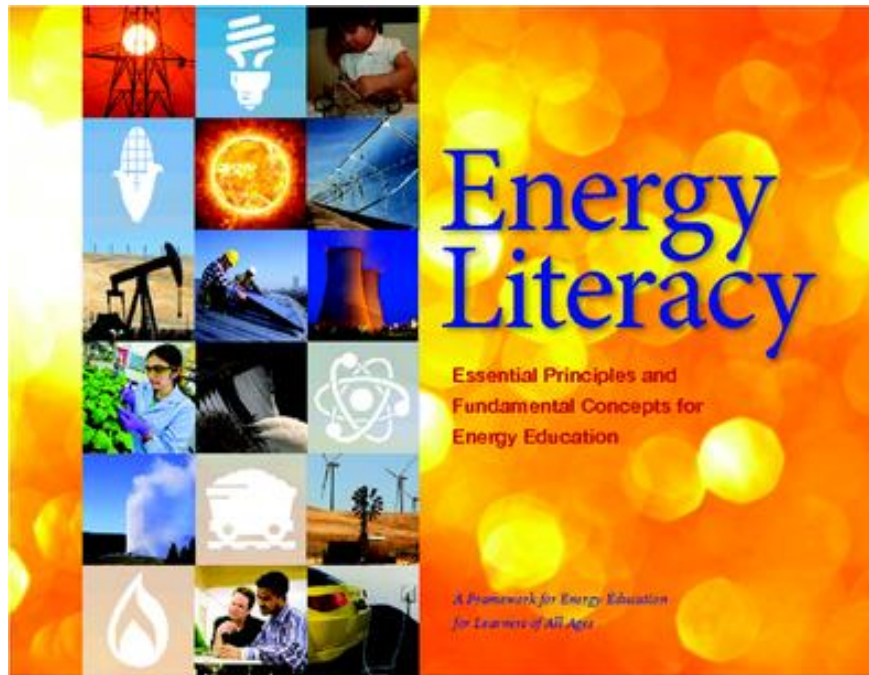
A better understanding of energy can:

- lead to more informed decisions
- improve the security of the nation
- promote economic development
- lead to sustainable energy use
- reduce environmental risks and negative impacts
- help individuals and organizations save money





# Energy Literacy



**To download or request a copy of the framework, visit:**

**[www.energy.gov/energyliteracy](http://www.energy.gov/energyliteracy)**

# The Energy Literacy Scaffold

The Energy Literacy Framework is not prescriptive, it is a scaffold intended for energy curriculum developers and instructors.



- The **principles** are meant to be broad categories representing big ideas.
- Each **fundamental concept** under the **principles** is intended to be unpacked and applied as appropriate for the learning audience and setting.
- The **concepts** are not intended to be addressed in isolation. A given lesson on energy will most often connect to many of the concepts.

# Energy Literacy Principles

01



Energy is a physical quantity that follows precise natural laws.

02



Physical processes on Earth are the result of energy flow through the Earth System.

03



Biological processes depend on energy flow through the Earth system.

04



Various sources of energy can be used to power human activities & must be transferred from source to destination.

05



Energy decisions are influenced by economic, political, environmental, and social factors.

06



The amount of energy used by human society depends on many factors.

07



The quality of life of individuals and societies is affected by energy choices.

# Aligned to NGSS

## Alignment between the **Energy Literacy Framework** and the **Next Generation Science Standards (NGSS)**

**CLICK BELOW TO SEE ALIGNMENT FOR YOUR GRADE LEVEL:**

[ELEMENTARY SCHOOL \(K-2\)](#)

[ELEMENTARY SCHOOL \(3-5\)](#)

[MIDDLE SCHOOL \(6-8\)](#)

[HIGH SCHOOL \(9-12\)](#)



STRAID	NGSS.K-PS.	PHYSICAL SCIENCE
TITLE	K-PS3.	Energy - Students who demonstrate understanding can:
PERFORMANCE EXPECTATION / FOUNDATION	K-PS3-1.	<p>Make observations to determine the effect of sunlight on Earth's surface.</p> <p>ELF 2.3 Earth's weather and climate is mostly driven by energy from the Sun.</p> <p>ELF 2.4 Water plays a major role in the storage and transfer of energy in the Earth system.</p> <p>ELF 2.6 Greenhouse gases affect energy flow through the Earth system.</p>
PERFORMANCE EXPECTATION / FOUNDATION	K-PS3-2.	<p>Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.</p> <p>ELF 1.2 The energy of a system or object that results in its temperature is called thermal energy.</p>

# Resources for Teaching Energy

## Energy Literacy Framework

### A Quick Start Guide for Educators

Energy – it's everywhere! When you turn on the lights, listen to the radio, heat your home, fuel your car, or use a computer, you are using energy. Energy is crucial to everything we do and experience. Understanding energy can help us make better informed decisions about our homes, communities, and our nation.

If you are new to energy education, then the following answers to questions about Energy Literacy will help you get started. Start thinking and teaching about energy from the natural to the social sciences. In this guide, you will find references to resources for implementing Energy Literacy concepts in your classroom using the links below.

#### 1) What is Energy Literacy?

To help guide educators and the public on the big ideas of Energy Literacy, the U.S. Department of Energy published the Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education. This framework provides the essential energy concepts that, if understood and applied,

will help students to make informed energy decisions. To download a copy or order for your school, go to: <http://energy.gov/eere/education/downloads/get-free-copy-energy-literacy-framework>

#### 2) Do I have to teach everything in the Energy Literacy framework?

No! No single person is expected to understand every detail about energy. The Energy Literacy framework helps to clarify key Principles to consider including in lessons. Your instruction is most likely to be effective when it focuses on

a small set of ideas at a time and takes into account what the student may have already learned.

To see the Energy Literacy Principles and Fundamental Concepts, download: [http://energy.gov/sites/prod/files/2014/09/18/Energy\\_Literacy\\_Low\\_Res\\_3.0.pdf](http://energy.gov/sites/prod/files/2014/09/18/Energy_Literacy_Low_Res_3.0.pdf)

#### 3) Do I have to be a science teacher to teach Energy Literacy concepts?

No! Energy Literacy looks at energy through the lens of natural science as well as social science. Energy issues require an understanding of civics, history, economics, sociology, psychology, and politics in addition to science, technology, engineering and mathematics. Energy issues are inherently interdisciplinary and provide an excellent opportunity for you to create a curriculum that integrates multiple disciplines, is project-based, and connected to

the community – local, state, national and global; critical attributes of a twenty-first century curriculum.

For ideas about lessons that relate Energy Literacy to Social Studies, go to: <http://go.usa.gov/3aXPT>

Mathematics and English/Language Arts, download the "Teachers Guide" link at the bottom of: <http://energy.gov/eere/education/downloads/energy-literacy-videos>

#### 4) I must implement my state's standards. How do I relate the Energy Literacy framework to this requirement?

For most states, standards express the concepts and skills to be performed but leave curricular and instructional decisions to districts, schools, and teachers. The Energy Literacy

standards you are required to implement and the concepts presented in the framework. For example:

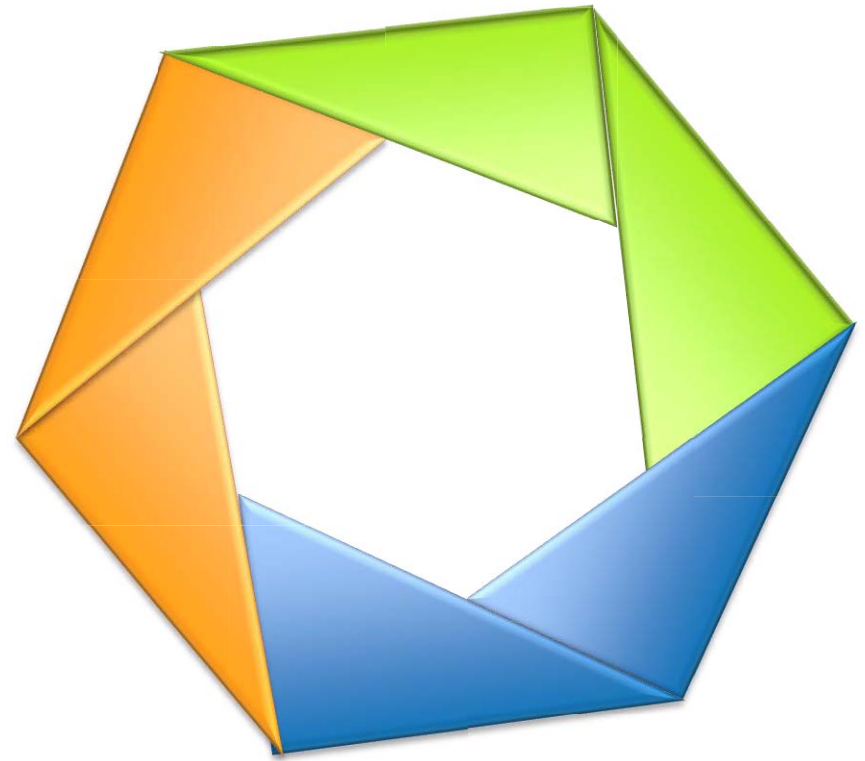
For an alignment of the Energy Literacy Principles with

## New:

- Quick Start Guide
  - Basic info
  - Tips to get started
  - Sample activities
  - Sample Resources

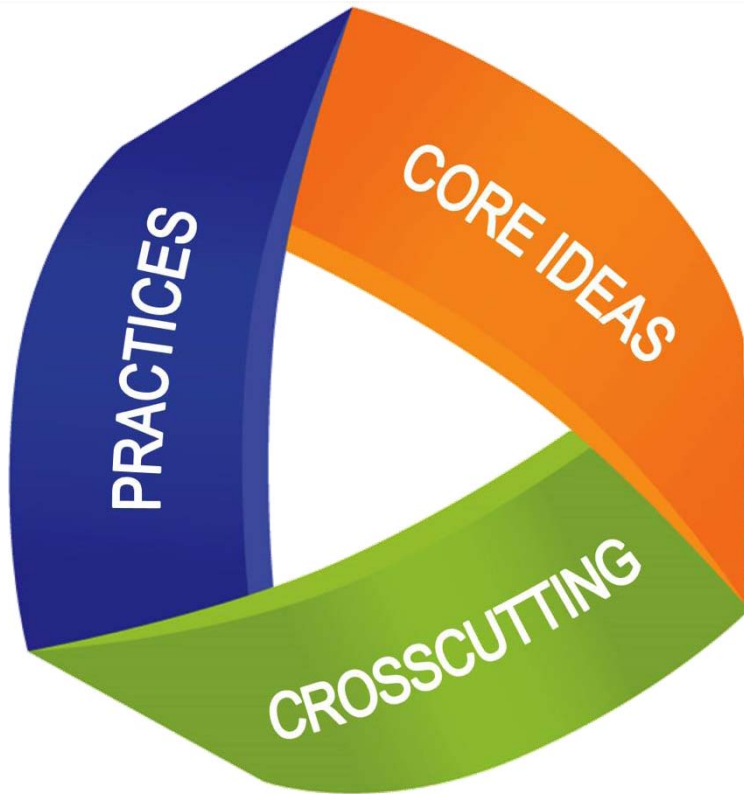
## Download it!

[EnergyLiteracy\\_QuickStartGuide.pdf](#)



# OVERVIEW OF NEXT GENERATION SCIENCE STANDARDS

# Next Generation Science Standards



- Disciplinary Core Ideas
- Crosscutting Concepts
- Science and Engineering Practices

# Disciplinary Core Ideas

## LIFE SCIENCE

LS1: From Molecules to Organisms: Structures and Processes  
LS2: Ecosystems: Interactions, Energy, and Dynamics  
LS3: Heredity: Inheritance and Variation of Traits  
LS4: Biological Evolution: Unity and Diversity



## PHYSICAL SCIENCE

PS1: Matter and Its Interactions  
PS2: Motion and Stability: Forces and Interactions  
PS3: Energy  
PS4: Waves and Their Applications in Technologies for Information Transfer



## EARTH & SPACE SCIENCE

ESS1: Earth's Place in the Universe  
ESS2: Earth Systems  
ESS3: Earth and Human Activity

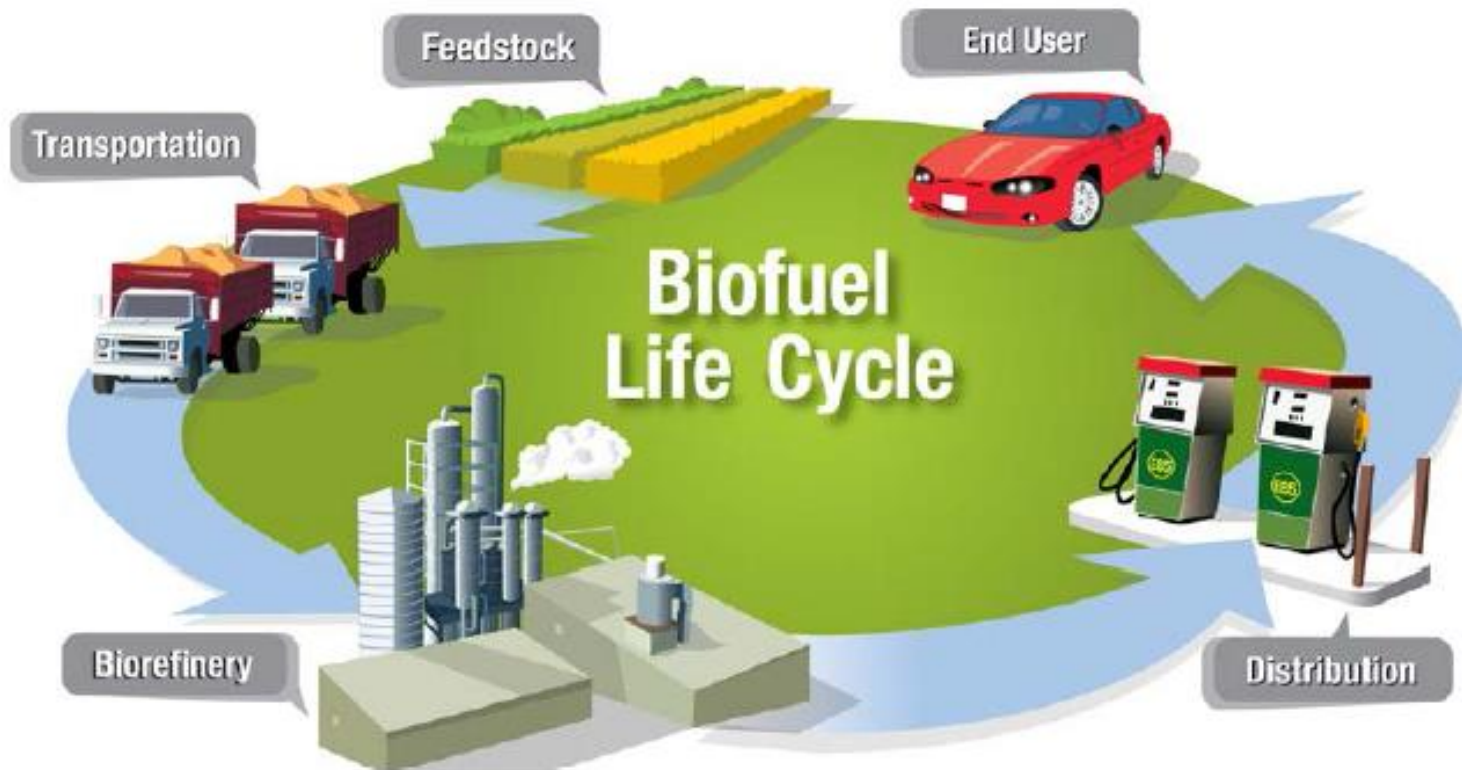


## ENGINEERING TECHNOLOGY

ETS1: Engineering Design  
ETS2: Links Among Engineering, Technology, Science, and Society







# Bioenergy Basics

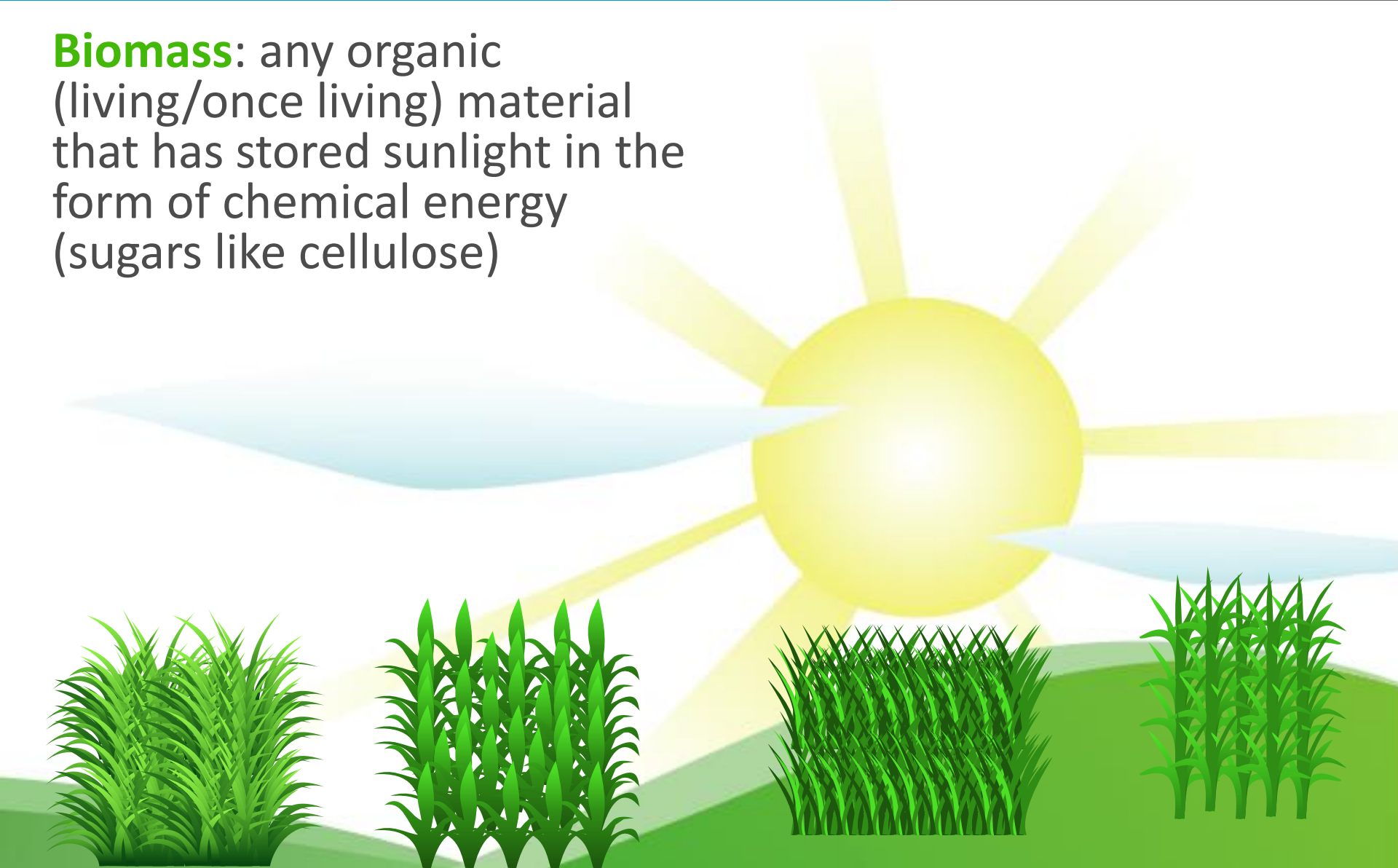
# What is Bioenergy?



**Bioenergy** is a form of renewable energy derived from biomass to generate heat and electricity (biopower), biofuels (transportation fuels), biochemicals, and other energy-related bioproducts that are produced from biomass.

# What is Biomass?

**Biomass:** any organic (living/once living) material that has stored sunlight in the form of chemical energy (sugars like cellulose)



# Sustainable Feedstocks



## Agricultural Residues

Plant parts left in the field after harvest are commonly called agricultural residues. This plant matter and secondary residues like manure and food processing wastes can be useful feedstocks.



## Energy Crops

Fast growing trees and perennial grasses are specifically grown for energy uses. Trees and perennial grasses can be grown on marginal land and also have high biomass production potential



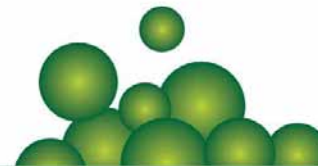
## Forest Resources

Leftover wood or plant material from logging operations, forest management, and land-clearing are available feedstock resources. Secondary residues like mill wastes supplement this category.



## Waste

Waste has potential as a gasifier feedstock. Its near-term availability and pre-existing collection and transport infrastructure make it an attractive resource.



## Algae

Many species of algae carry out photosynthesis to drive rapid biomass growth. Algae biomass can contain high levels of oil, making it a promising feedstock.

# What Bioenergy Is Not



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.

# General Perspectives of Bioenergy



- **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.

# 2016 BioenergizeME Infographic Challenge



# BioenergizeME Infographic Challenge

## Purpose

- Provide an engaging virtual venue for 9-12<sup>th</sup>-grade participants to gain foundational knowledge about bioenergy and to educate others about what they have learned.
- Their enhanced energy literacy will enable them to be better consumers of energy information and to dispel energy myths they encounter in the media and from other sources.

## Challenge Activities

- Student teams research bioenergy topics and report their findings in an infographic.
- Selected teams promote their infographic in an 11-day social media challenge.
- Winners are selected in two categories: quality of infographic and effectiveness of social media campaign.






# Classroom-Ready Support Materials!

## BioenergizeME resources provided

- Challenge rules, research topics and prompts, evaluation rubrics
- Guidance on doing research, creating infographics, and developing a social media campaign
- Research references, search phrases, and links to government-funded publications
- Easy for educators and fun for students!

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




**BioenergizeME Infographic Challenge Toolkit**

IN PARTNERSHIP WITH Energy Efficiency & Renewable Energy BIOENERGY TECHNOLOGIES OFFICE

### 5 STEPS FOR BUILDING AN INFOGRAPHIC

- RESEARCH**  
Research your topic fully. Pull together a list of impressive facts that you think are important. Make sure to use credible sources.
- SKETCH**  
Ultimately, you are going to share facts and data that tell a story. Write first things you find down a sketch for each key point.
- DESIGN**  
Now it's time to bring everything together in one cohesive design. Choose the layout, and choose a color palette. Bring your sketches to life with hand-drawn or digital illustrations and icons. You can create lines from scratch or find ready-made resources online. Be sure to use a consistent style throughout the infographic.
- TEST**  
Getting input from others will let you know if your infographic is doing what you want it to. Share your infographic with others and ask them for feedback.
- FINALIZE**  
Review the feedback that you receive, and incorporate constructive changes to produce a final version of your infographic.



Infographic Rubric			
	4	3	2
Research Content	<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>The 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 data and facts presented are evidence based from reliable sources. All sources are referenced. All content is accurate.</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, and 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>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 used 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>Spelling/ format</li> </ul> <ul style="list-style-type: none"> <li>The writing is free of errors.</li> </ul>	<ul style="list-style-type: none"> <li>Grammar</li> <li>Spelling/ format</li> </ul> <ul style="list-style-type: none"> <li>The writing contains one or more errors.</li> </ul>	<ul style="list-style-type: none"> <li>Grammar</li> <li>Spelling/ format</li> </ul> <ul style="list-style-type: none"> <li>The writing contains more than one error.</li> </ul>

### SOCIAL MEDIA GUIDE



**GOAL:** Share what you've learned about bioenergy through a 10-day social media campaign!

**HOW TO DO IT:**

- Assign team roles
- Plan a strategy & timeline
- Start your campaign & monitor progress

**Team Director:** Lead and organize your team, keep your team on schedule, and monitor progress (over, like, and share) during your social media campaign.

**Content Manager:** Determine key messages you want to convey to your audience about your infographic, and write catchy text to draw viewers to better illustrate the data for the viewer.

**Engagement Manager:** Identify the various social media networks (Twitter, Instagram, Facebook, etc.) for your campaign. Engage and respond to questions and comments from followers.

**Deadlines:** You will have one week to prepare your social media strategy and ten days to carry it out.

**Posting Social Media:** Be creative to bring attention to your infographic and encourage audiences to share your infographic across their social network.

**Responding to Comments:** Reply quickly and courteously to comments about your infographic. Be sure your viewers know what what they are learning about bioenergy from your infographic.

**Monitor Progress:** Monitor your success by talking, like, share, and comment, and consider adjusting your outreach strategy based on your progress.

**Tip:** Stay positive and be thoughtful towards your audience; they may not know very much about your topic, or they may be more knowledgeable than you. "Thanks for checking out my infographic" is a good lucky response. If you get negative or hostile comments, you may agree or decline them. If this does not stop a hostility, tell a teacher. Be active on social media. Like, share, and comment on others' posts, and they may do the same for you.

# 2016 Challenge Topic Areas



## Topic Area 1

*Bioenergy History*



## Topic Area 2

*Workforce & Education*



## Topic Area 3

*Science & Technology*



## Topic Area 4

*Environmental Impacts*

# 2016 Challenge Topic Areas

## Topic Area 1 – Bioenergy History



*Possible areas of focus: history of biomass; history of bioenergy; low-carbon future*

## Topic Area 2 –Workforce & Education



*Possible areas of focus: bioenergy/biofuels careers; STEM education and bioenergy; non- traditional bioenergy careers*

## Topic Area 3 – Science & Technology



*Possible areas of focus: advanced biofuel conversion; second- generation conversion; bioenergy feedstock*

## Topic Area 4 - Environmental Impacts



*Possible areas of focus: life-cycle analysis, bioenergy systems cradle-to-grave; environmental benefits of bioenergy*

# Spring 2015 Finalists

1

## CELLULOSIC ETHANOL

**THE PROCESS**

1. **Step 1: Pretreatment:** Biomass is collected, handled, and converted into the pretreatment step.
2. **Step 2: Enzymatic Conversion:** Enzymes and acids are used to partially breakdown cellulose into simple sugars.
3. **Step 3: Fermentation:** Yeast use simple sugars to create energy. In the lack of oxygen, ethanol is released as a byproduct.
4. **Step 4: Ethanol Recovery:** Ethanol is purified and made ready to distribute.

**THE BENEFITS**

- In 2013, ethanol production added more than 87,000 jobs across the country.
- Biofuel produced from cellulosic ethanol can reduce greenhouse gas emissions by 86% compared to gasoline derived from fossil fuels.
- Ethanol is a renewable, domestically produced transportation fuel. It is found in more than 95% of US gasoline.

Fuels made from biomass can reduce greenhouse gas emissions. Corn and sugarcane are easily converted into ethanol, however, they are food-based feed stocks. Cellulosic ethanol is obtained from crop residues and other non-food sources.

Fuel Product Type	Reduction in Greenhouse Gas Emissions
GASOLINE (Fossil fuels)	0%
CORN ETHANOL (Biomass)	52% reduction
SUGARCANE ETHANOL (Biomass)	78% reduction
CELLULOSIC ETHANOL (Biomass)	86% reduction

**CONSIDERATIONS**

**Energy Independence and Security Act of 2007:**

- Ethanol based fuel has 27% less energy per gallon than gasoline.
- Farming for energy crops requires careful consideration of land use change.
- Converting cellulose to ethanol is a difficult and costly process.
- US plans to make 36 billion gallons of renewable fuel by 2022. 15 billion gallons will come from corn ethanol; the remaining 21 billion gallons will come from advanced biofuels, including cellulosic ethanol.
- IMPROVE FUEL ECONOMY
- DECREASE DEPENDENCE ON FOREIGN PETROLEUM

## Algae

**BIOFUEL**

**Algae**

Hanna, Michael, et al. Biofuels from algae: challenges and potential. *Biofuels* 1 (2010): 763-764.

Pittman, Jon K., et al. The potential of sustainable algal biofuel production using wastewater resources. *Bioresour. Technology* 102(2010): 17-25.

<https://www.algae.wiki.zoho.com/Chapter-1--Introduction-to-Algae-Biofuels.html>

Lara, Ido. "Where are we with algae biofuels?" *Biofuels Digest* (13 October 2014). <http://www.biofuelsdigest.com/bfdigest/2014/10/13/where-are-we-with-algae-biofuels/>

# Put Your School On the Map

## CELLULOSIC ETHANOL

Process    Benefits    Considerations

1.    2.    3.

### THE PROCESS

**Step 1: Pretreatment:** Biomass is collected, hauled, and given the pretreatment required.

**Step 2: Enzymatic Conversion:** Enzymes and acids are used to partially breakdown cellulose into viable sugars.

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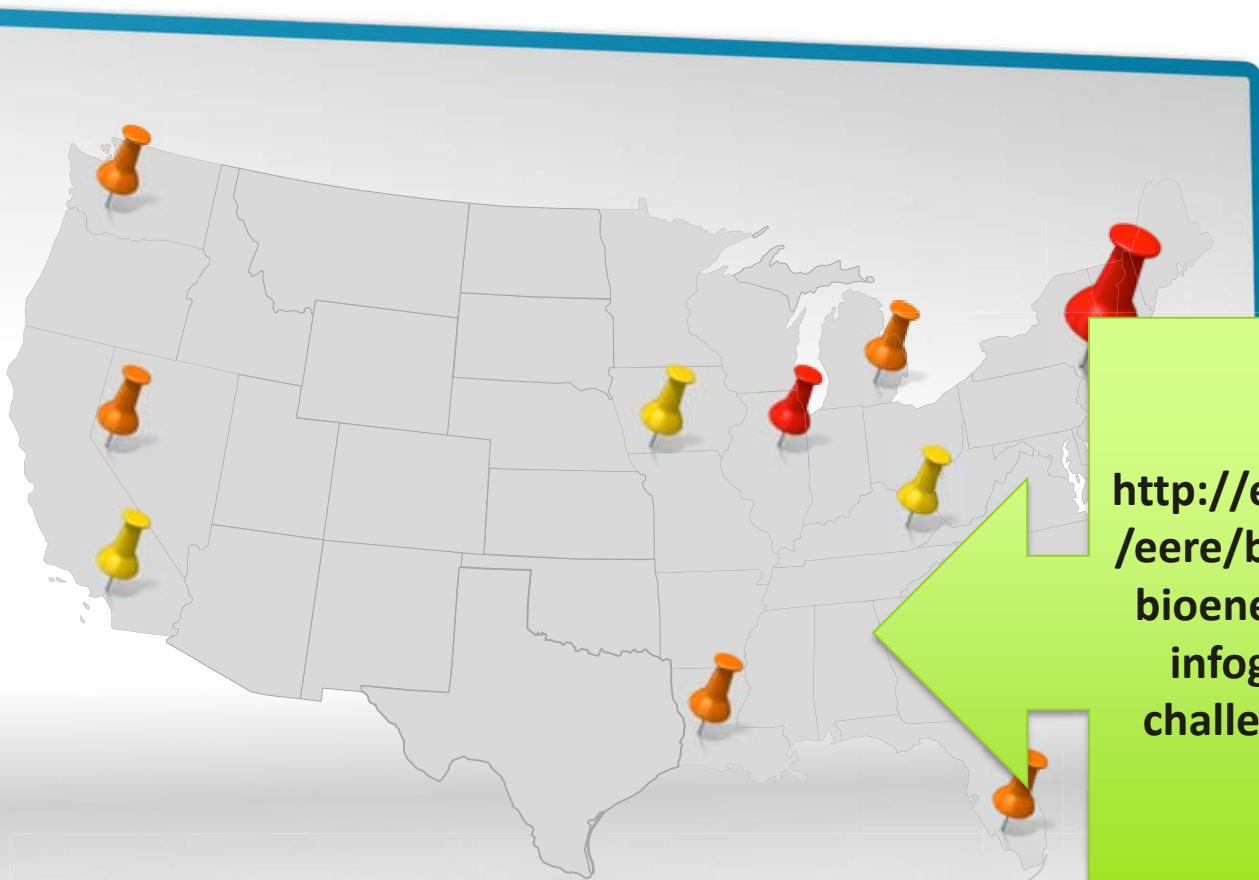
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<http://energy.gov/eere/bioenergy/bioenergizeme-infographic-challenge-map>

## BioenergizeME Infographic Challenge Map

Bioenergy

Biomass

Biofuels



# Incorporation Of Bioenergy Into The Classroom

# LS1: From Molecules to Organisms: Structures and Processes

3

4

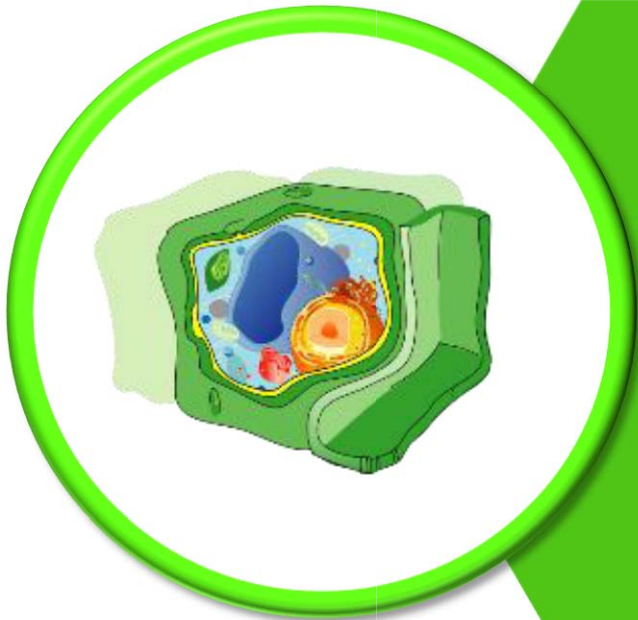
Topic 3

## *How do organisms live and grow?*

- Structure and Function
- Growth and Development
- Organization for Matter and Energy Flow in Organisms

## *Potential Bioenergy Applications*

- **Macromolecules and Plant Cell Structure**  
*Bioenergy as a model to illustrate: the process of photosynthesis; the global importance of macromolecules such as cellulose (polysaccharide found in the cell walls of plants) and cellulases (family of enzymes that facilitate the breakdown of cellulose); and plant cell wall structure.*





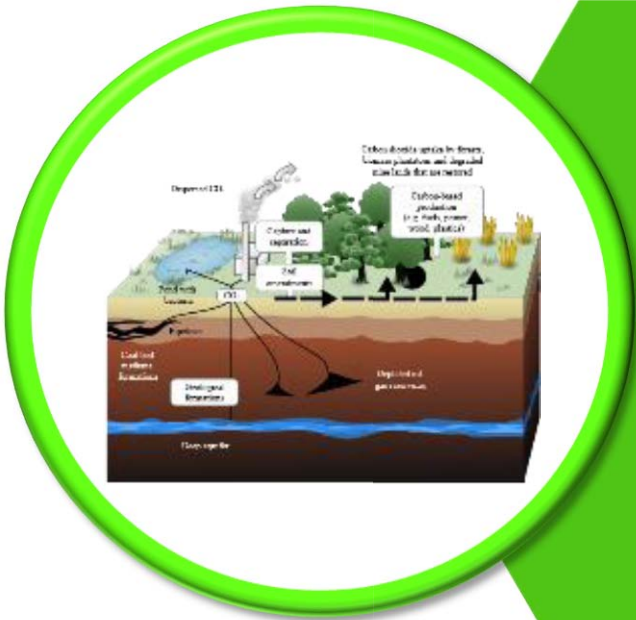
## How do organisms interact with their environment?

- Interdependent Relationships in Ecosystems
- Cycles of Matter & Energy Transfer in Ecosystems
- Ecosystem Dynamics, Functioning, and Resilience
- Biodiversity and Humans

## Potential Bioenergy Applications

### ● The Carbon Cycle & Biodiversity

*Bioenergy as a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among earth's systems as well as a potential solution for reducing the impacts of human activities on the environment and biodiversity.*





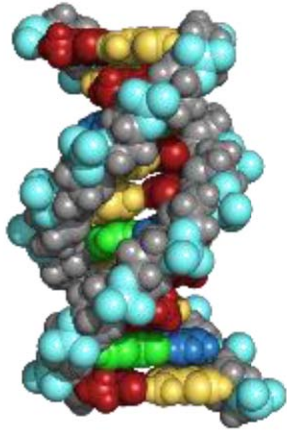
## *How are traits passed to the next generation?*

- Structure and Function
- Inheritance of Traits
- Variation of Traits

## *Potential Bioenergy Applications*

- **DNA, Mutation, Protein Synthesis & Bioengineering**

*Bioenergy as a practical application to demonstrate how changes in the DNA sequence can result in a functional change for an organism and have a favorable outcome on the traits that would be ideal for biofuel production.*



3

4



## ***What evidence shows that species are related?***

- Evidence of Common Ancestry and Diversity
- Natural Selection
- Adaptation
- Biodiversity and Humans

## ***Potential Bioenergy Applications***

- **Sustainability & Biodiversity**  
*Biofuel feedstock development to explore the best management practices used to sustainably grow crops to produce energy resources, earn income, and improve biodiversity and ecosystem services.*

1

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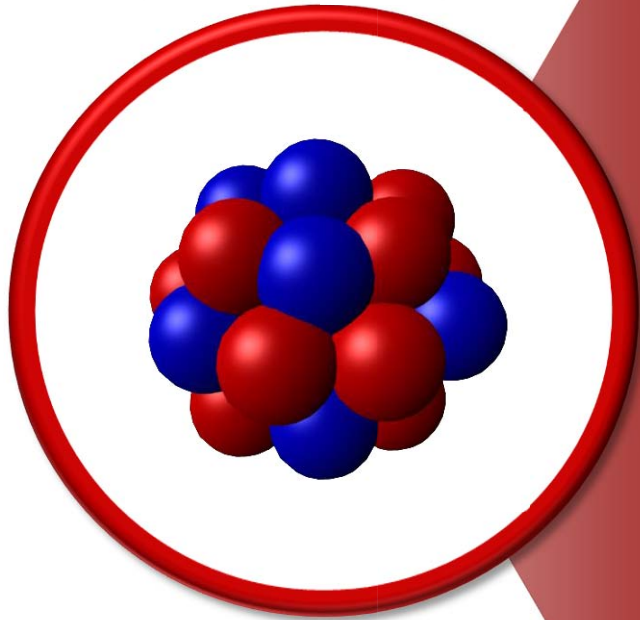
## *The structure, properties, and interactions of matter.*

- Structure and Properties of Matter
- Chemical Reactions
- Nuclear Processes

## *Potential Bioenergy Applications*

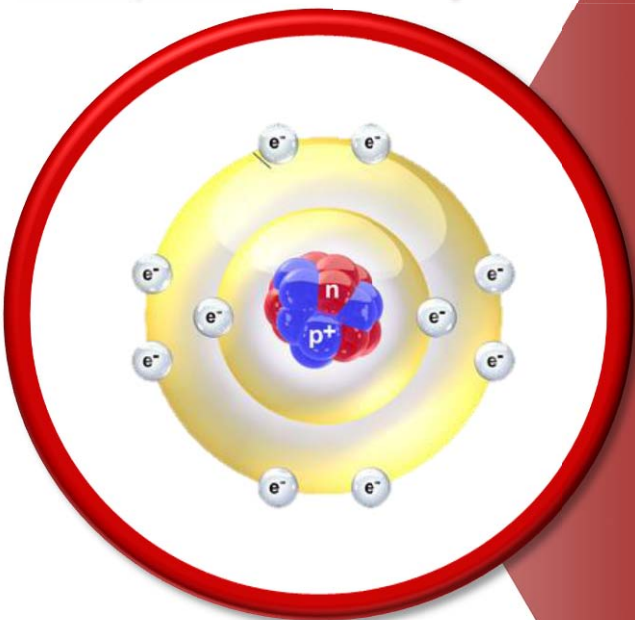
- Chemical Reactions & Reaction Rates

*The chemical conversion of cellulosic biomass to biofuel and the associated energy transfers as a tool to explain: the structure, properties, and interactions of matter; how substances combine or change to make new substances; and how to characterize and explain these reactions to make predictions about them?*



1

4



**How is energy transferred and conserved?**

- Definitions of Energy
- Conservation of Energy and Energy Transfer
- Relationship Between Energy and Forces
- Energy in Chemical Processes

**Potential Bioenergy Applications**

- Energy in Reactions & Energy Transfer
- Biofuel as part of a discussion centered on how energy manifests itself in multiple ways (e.g. chemical energy or the energy that can be released or stored in chemical processes). The conversion of cellulosic biomass to biofuel to demonstrate that chemical reactions may release or consume energy and how energy and mass are converted from one form to another.*

2

### *How and why is Earth constantly changing?*

- Earth Materials and Systems
- Plate Tectonics and Large-Scale System Interactions
- Roles of Water in Earth's Surface Processes
- Weather and Climate

### *Potential Bioenergy Applications*

- **Systems, Biogeochemical Cycles & Climate**  
*Renewable and nonrenewable energy sources in a discussion of how changes to the Earth's surface can create feedbacks that cause changes to other Earth systems (e.g. carbon cycle) and to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.*





Topics  
1,2,3, &  
4

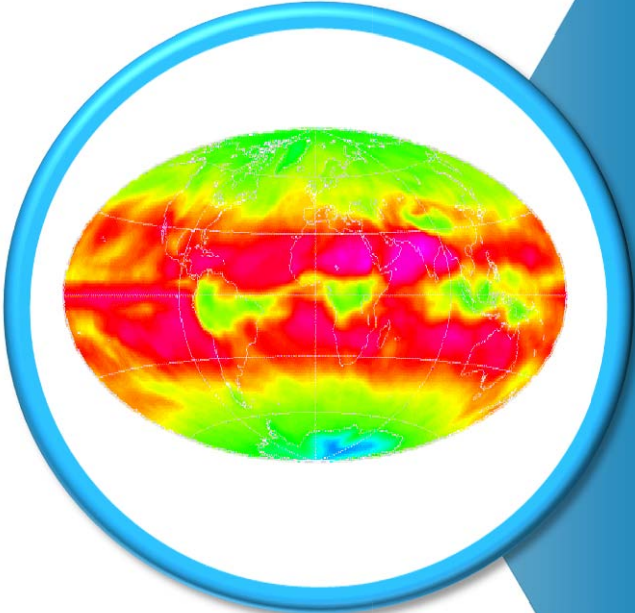


## How do human activities affect the earth?

- Natural Resources
- Natural Hazards
- Human Impacts on Earth Systems
- Global Climate Change

## Potential Bioenergy Applications

- **Natural Resources & Climate Change**  
*The difference between renewable and nonrenewable resources. How are humans affecting the carbon cycle and how can bioenergy minimize human impacts on environments and local landscapes by: (1) reducing pollution, and (2) reducing the release of greenhouse gases.*



4

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## *How can engineering solve real world problems?*

- **Defining and Delimiting Engineering Problems**
- **Developing Possible Solutions**
- **Optimizing Design Solution**

## *Potential Bioenergy Applications*

- **Solving Engineering Problems**

*How challenges in developing commercial scale bioenergy production can be addressed through engineering.*

6

7



This lesson plan may contain links to other resources, including suggestions as to where to purchase materials. These links, product descriptions, and prices may change over time.

## The Bio-Fuel Project

### AUTHORS:

Matthew A. Brown and Raymond I. Quintana

### GRADE LEVEL/SUBJECT:

10<sup>th</sup>, 11<sup>th</sup>, 12<sup>th</sup> Chemistry & Technology Education



### Relevant Curriculum Standards:

#### From The National Science Education Content Standards

##### Science as Inquiry Standard A:

- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, explanations, predictions, and models using evidence
- Think critically and logically to make the relationships between evidence and explanations.

##### Physical Science Standard B:

- Structure and Properties of Matter - The physical properties of compounds reflect the nature of the interactions among its molecules. Carbon atoms can bond to one another...to form a variety of structures, including synthetic polymers, oils, and the large molecules essential to life.



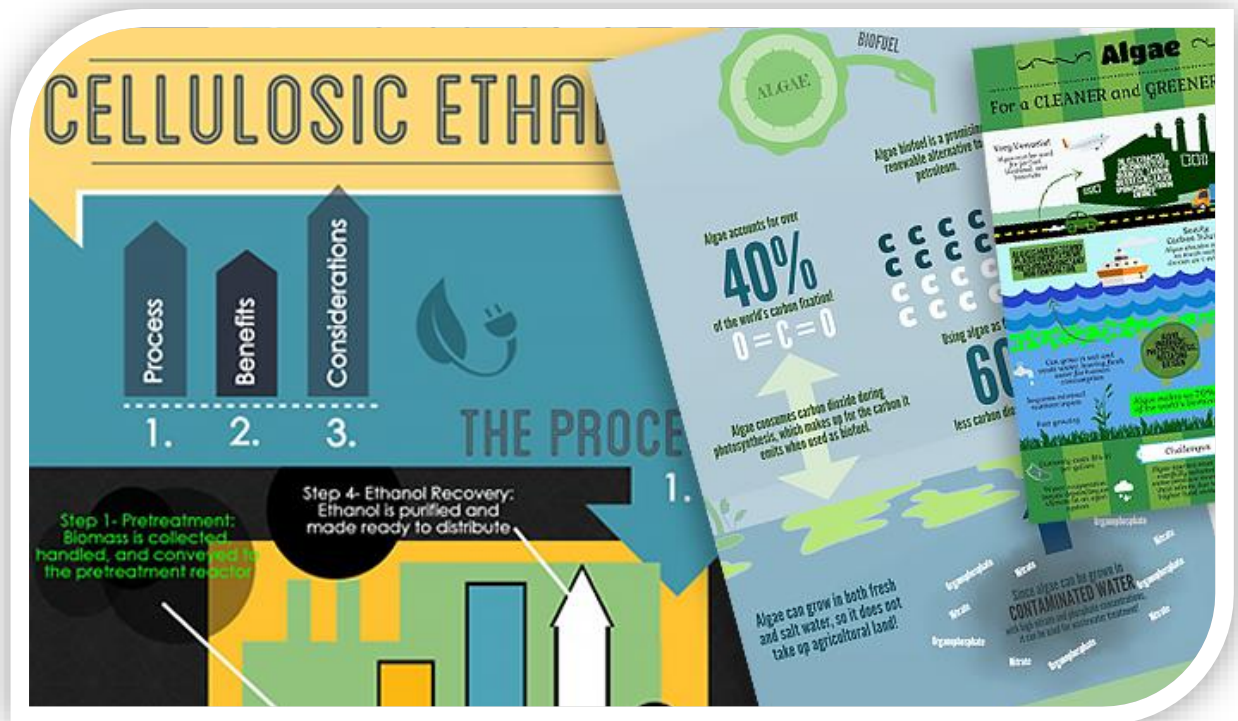
# BioenergizeME Infographic Challenge

Registration Closes Feb. 4, 2016, at 5 p.m. Central Time

Submissions Due By March 4, 2016, at 5 p.m. Central Time.

Register your student teams by Dec. 31 and get access to an exclusive webinar!

<https://www4.eere.energy.gov/bioenergy/bioenergizeme-infographic-challenge-registration>



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# Thank you for your attention!

Questions? Email us:

[BioenergizeME@ee.doe.gov](mailto:BioenergizeME@ee.doe.gov)

**BioenergizeME Challenge Website**

<http://energy.gov/eere/bioenergy/infographic-challenge>

**EERE Education Toolbox**

<http://energy.gov/education-toolbox/search>

**More Information:**

<http://www.energy.gov/eere/bioenergy/>