

# Bioenergy in the Classroom: Design an Ethanol Plant

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OSTA 2014  
October 10-11

This project is supported by  
an AFRI Cap Grant no.  
2011-68005-30407 from the  
USDA National Institute of  
Food and Agriculture (NIFA).



# Procedure

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- ❑ Add ¼ cup water to your bag (60ml)
- ❑ Add 1 teaspoon (one level plastic spoon of yeast to the bag.
- ❑ Add your station's material to the bag (~ 1 level spoon's worth). [See me if you have the popped popcorn!]
- ❑ As you seal the bag, be sure to remove all air.
- ❑ Bring to the front of the room and return to your seat.



**Disciplinary Core Ideas**

**Cross Cutting Concepts**

**8 Science and  
Engineering Practices**

# This Lesson:

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## **Disciplinary Core Ideas**

- LS1.C: Organization for matter and energy flow in organisms

## **Cross Cutting Concepts**

- Energy and Matter: Flows, Cycles, Conservation

## **8 Science and Engineering Practices**

- Ask Questions/ Define Problems
- Planning and carrying out investigations
- Analyze and interpret data
- Construct explanations/ Design solutions

# NGSS & Engineering Design: The Basics

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NGSS states that students should be able to:

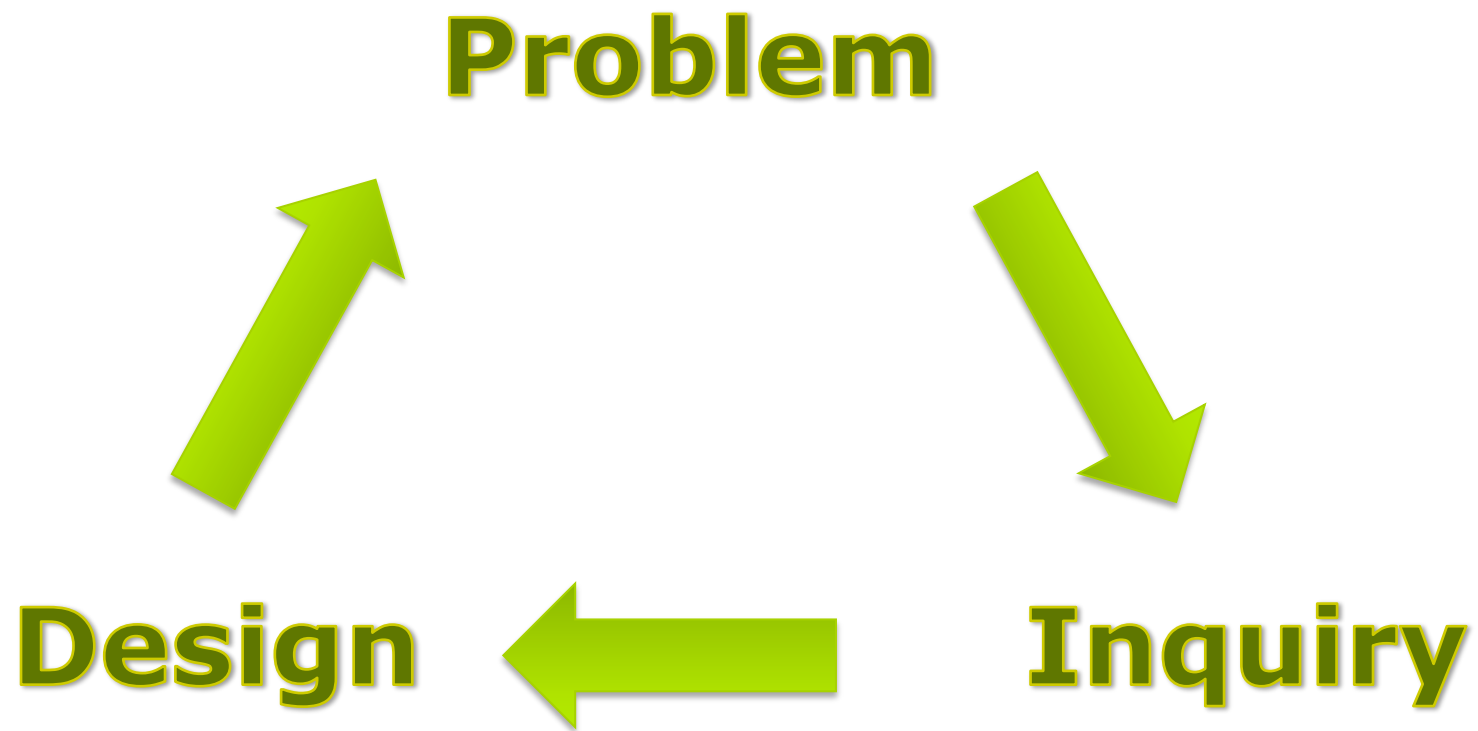
- Define and delimit engineering problems
- Design solutions to engineering problems
- Optimize the design solution

Problem-Based Learning (PBL) can be an excellent fit with NGSS! PBL Lessons should...

- Have multiple solutions
- Usually extend over multiple lessons (major/minor questions)
- Have students acting like scientists/engineers with authentic science materials
- Have a meaningful problem with a real-world context

# Inquiry-Design Cycle

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# This Lesson

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- **Big Picture:** Better places to get fuel
- **Engage** – How can we get fuel from plants?
- **Explore** – Experiment with different food for yeast
- **Explain** – Why do they grow with some?
- **Engineer** – Design a basic ethanol plant.
- **Evaluate** – Why does the design work?



# Which Materials Do Yeast Digest?

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- ❑ Corn leaves
- ❑ Cornmeal
- ❑ Corn starch
- ❑ Corn kernels
- ❑ Popped corn
- ❑ Glucose

What factors affect ethanol production?

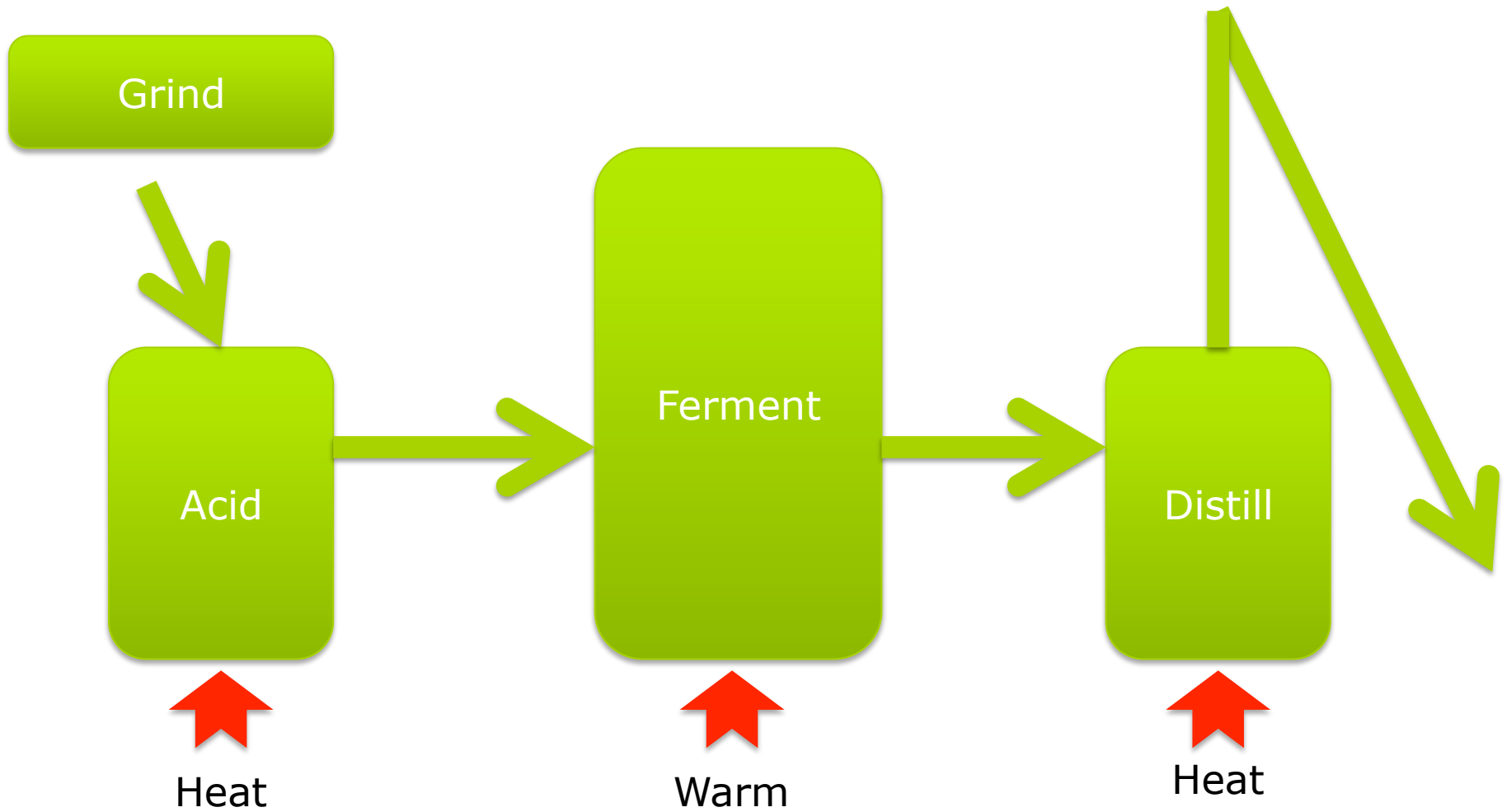
# Design an Ethanol Plant

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# Design an Ethanol Plant

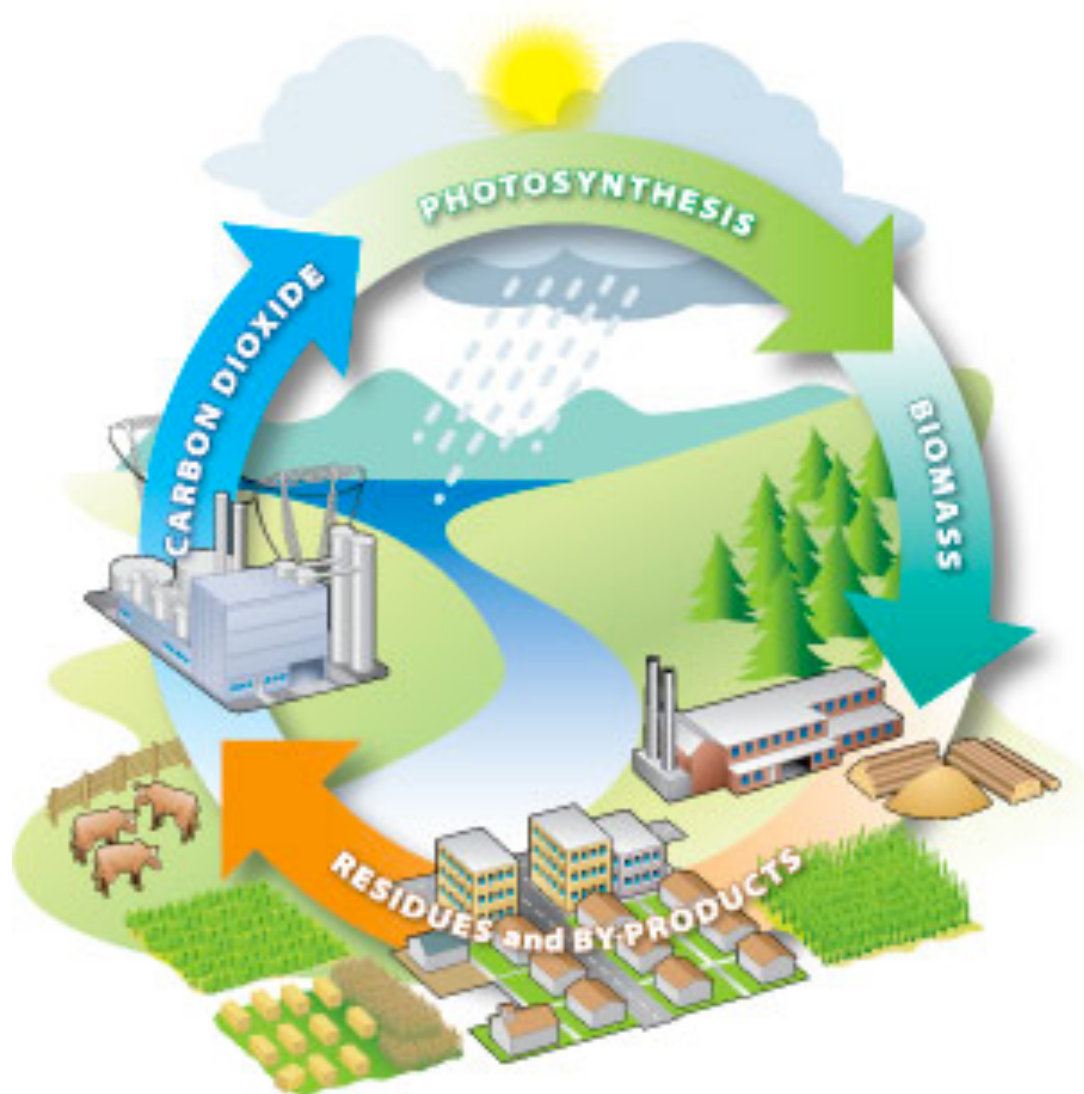
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# Bioenergy

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# NGSS Design

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- Defining
- Developing
- Optimizing



# NGSS

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## □ **Disciplinary Core Idea:**

LS1.C: Organization for Matter and Energy Flow in Organisms

## □ **Performance Expectations:**

- MS-LS1-7: Develop a model to describe how food is rearranged through chemical reaction forming new molecules that support growth and/or release energy as this matter moves through an organism.
- HS-LS1-7: Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a new transfer of energy.