Lesson Number: MS.NR.6.5

Alternative Energy Jeopardy

Middle School Food and Agricultural Literacy Curriculum

Precepts

E. Awareness

E3. Participate in activities that promote appreciation of diversity.

National Standards

PST.03.04.01.a. Apply the meaning and measurement of electricity, including amperage, voltage, and wattage.

CS.01.05.03.c. Plan an activity that promotes appreciation of diversity.

NL-ENG.K-12.4 – Communication Skills

NM-NUM.6-8.1 – Understand Numbers, Ways of Representing Numbers, Relationships among Numbers, and Number Systems

NS.5-8.2 – Physical Science

Student Learning Objectives

As a result of this **unit** the students will…

Describe alternative energy sources utilized in the United States.

As a result of this **lesson** the students will …

Apply math concepts as they apply to alternative energy sources.

Time

Instruction time for this lesson: 45 minutes.

Resources

Merriam-Webster Dictionary Thesaurus. (2009). Merriam-Webster Dictionary. Retrieved August 25, 2009, from http://www.merriam-webster.com/ — National FFA Organization. (2003). LifeKnowledge Precepts and Signs of Success — NEED Project. (2008). Energy Math Challenge. Retrieved September 12, 2009, from http://www.need.org/needpdf/Energy%20Math%20Challenge.pdf

Tools, Equipment and Supplies

MS.NR.6.5.AS.A (Jeopardy type game paper format)
MS.NR.6.5.AS.B (Jeopardy type game electronic format)
Computer (if using electronic format)
Projector (if using electronic format)
Game board (if using paper format)
Calculators – one per student
Scratch paper – one per student
Pencil – one per student
MS.NR.6.5.AS.C – one per teacher (answers to Jeopardy questions)
MS.NR.6.5.ASSESS.A – one per student

Key Terms

The following terms are presented in this lesson and appear in ***bold italics:***

Kilowatt-hour (kWh)

Ampere (amps)

Volts

Ohms

Content Outline

Objective 1. Apply math concepts as it applies to alternative energy sources.

I. Types of alternative energy

A. Solar energy

1. ***Kilowatt-hour (kWh):*** the amount of electricity used in one hour at a rate of 1,000 watts. Utility companies charge their customers for the ***kilowatt hours*** they use during a month.
2. A***mpere (amps):*** the practical meter-kilogram-second unit of electric current that is equivalent to a flow of one coulomb per second or to the steady current produced by one ***volt*** applied across a resistance of one ***ohm***
3. Volts: the practical meter-kilogram-second unit of electrical potential difference and electromotive force equal to the difference of potential between two points in a conducting wire carrying a constant current of one ampere when the power dissipated between these two points is equal to one watt and equivalent to the potential difference across a resistance of one ohm when one ampere is flowing through it
4. ***Ohms:*** the practical meter-kilogram-second unit of electric resistance equal to the resistance of a circuit in which a potential difference of one ***volt*** produces a current of one ***ampere***.

B. Wind energy

C. Biomass energy

Alternative Energy Jeopardy

Interest Approach

This interest approach requires you to bring in a rarely used or specialized tool, instrument, or utensil. Examples include a torque wrench, spanner wrench, T-bevel, digital multimeter, etc. If you cannot get a specialized tool, an alternative would be to use a photo of a specialized tool or tools. Display the tool or picture of the tool in front of the room at the beginning of class.

Thank you for showing up for class today. Let's be curious learners as we take a look at this item. What is it?

Allow student responses.

Great ideas! Way to be curious! This is a tool. Not just any ole common tool – this is a tool that is rarely used because it is so specialized. But when it is needed, it is the only tool that can meet the specialized need it fills. In other words, no other tool can do what this tool can accomplish!

Explain what tool you have and what its purpose is.

Just as specialized tools each have a specialized ability and a purpose, so each member of a team also has their own special talents and abilities that allow them to serve a very special purpose in our classroom and FFA teams. Appreciating the diversity present in the teams we are a part of throughout life will allow every member to contribute their own special talents and allow the team to capitalize on the unique skills of everyone. Just as we weren't exactly sure of what our tool was or what its purpose was, let's have some fun using some mathematical tools in the arena of alternative energy. We may not see their purpose, but when we use them, they get the job done!

This lesson utilizes a form of the *Jeopardy e-Moment®* within the context of alternative energy sources allowing students to practice their skills with addition, subtraction, multiplication, division, fractions, decimals, percentages, basic algebra, and basic geometry. This activity will enhance their math skills as they continue to learn about alternative energy sources. Before the lesson, you will need to have two pre-assigned groups and a designated spokesperson for each group. You will need to decide if you will utilize the electronic or paper format for the activity and prepare the computer/projector and **MS.NR.6.5.AS.B** if using the electronic format or create the game board using **MS.NR.6.5.AS.A**. Some upper level mathematics will be used. It is appropriate for you to pause the game and teach the concepts if needed.

You should be flexible with the game and feel free to mix teams, play as an entire class, teach and play, extend the time, add bonus points, whatever will make it work best for you and your students. It would be helpful for the students if you have photos/images of solar panels, solar panel arrays, wind turbines, wind farms, and biomass images including ethanol, methane, and biodiesel production to refer to and review as you progress through the questions that refer to each energy source.

Summary of Content and Teaching Strategies

Objective 1. Apply math concepts as it applies to alternative energy sources.

I. Types of alternative energy

A. Solar energy

1. ***kWh***: A ***kilowatt-hour*** is the amount of electricity used in one hour at a rate of 1,000 watts. Utility companies charge their customers for the ***kilowatt hours*** they use during a month.
2. ***ampere (amps):*** the practical meter-kilogram-second unit of electric current that is equivalent to a flow of one coulomb per second or to the steady current produced by one ***volt*** applied across a resistance of one ***ohm***
3. ***volts:*** the practical meter-kilogram-second unit of electrical potential difference and electromotive force equal to the difference of potential between two points

in a conducting wire carrying a constant current of one ***ampere*** when the power dissipated between these two points is equal to one watt and equivalent to the potential difference across a resistance of one ***ohm*** when one ***ampere*** is flowing through it

4. ***ohms***: the practical meter-kilogram-second unit of electric resistance equal to the resistance of a circuit in which a potential difference of one ***volt*** produces a current of one ***ampere***

B. Wind energy

C. Biomass energy

Yesterday we learned about agriculture's role in the production of alternative energy. We will be using our knowledge of those alternative energy sources and our math skills to be able to solve some very real life math problems involving our use of energy. This will be important to us as we make decisions about our own use of energy now and in the future. Today we will be playing "Alternative Energy Jeopardy"!

We play this game in a very similar manner to the Jeopardy Game played on television. Because this game involves solving math problems related to alternative energy, everyone on the team is required to work on the problem, then come to a group consensus and the spokesperson will explain the answer for the group. Both teams must work on the answer since the team who did not pick the question must be prepared to answer if the team who chose the question does not answer it correctly.

The categories are: Solar, Wind, and Biomass Energy with three point levels. Use your team's math skills to compute the answer. If your team answers incorrectly, the question will move to the other team. If neither team answers the question correctly, we will work through it together to come to the correct solution. What questions do you have?

Before we get started we need each team to come up with a name relating to alternative energy sources. Take the next 60 seconds to decide on a name.

Time is up.

Write each team's name on the board to keep score below.

Answer any questions and allow the students to gather together in their two groups. Students will need to have paper and pencil plus calculators with them as they move to their groups. They should have a writing surface of some type to work out their calculations.

You will act as the host or moderator and guide the game. You should pick a team to go first (use coin toss, etc.) and begin by allowing the team spokesperson to choose a category and value. You will read the corresponding problem and instruct both groups to calculate the answer. The category choosing team spokesperson will explain how they determined their answer.

If the answer is correct, they get the point value of that problem. If the answer is incorrect, the other team gets the opportunity to answer. If they are correct, then they get the point value for that problem. The category choices rotate back and forth between teams until all of the problems have been answered. The questions can be projected using Power Point format or presented on a game board. Keep score on the board or someplace where all of the students can see the points.

To add excitement to the game you can use a buzzer (kitchen timers work well) to indicate the end of the allotted time for each question. Suggested time for each question is a maximum of two minutes but this can be adjusted depending on the level of the class and their math skills. Teams should answer when ready and not wait the full two minutes unless they are using the time for formulating their answer. If neither team can answer the question, the teacher will provide the answer and demonstrate how the answer is formulated. Simple prizes can be a wonderful motivator but everyone in the class should be rewarded for working together and building their math skills.

Review/Summary

That was an amazing game of jeopardy. We not only used some outstanding math skills to answer the problems, but we also completed calculations about forms of alternative energy that will certainly become more and more important to us in the future as their use becomes more common. Thanks for your team spirit and hard work on the problems today. Come to class tomorrow ready to continue our adventure in learning.

Application

Extended classroom activity:

1. Using their family's electricity bill, students calculate the cost of a day's worth of energy. 2. Hold an "energy fair" for the school and invite students from other classes or grades to visit the booths showcasing alternative energy projects created by the agricultural classes.

FFA activity:

Create an energy awareness campaign in the school and have FFA members educate the school population by creating public service announcements they will share during the morning announcements. Also create a poster campaign that can be displayed around the school to teach about energy conservation and alternative energy sources.

SAE activity:

Encourage FFA members to complete an energy usage survey for their SAE and determine if there are ways they can improve or implement energy conservation strategies for their SAE.

Evaluation

MS.NR.6.5.ASSESS.A

Answers to Evaluation

1. B
2. A
3. B
4. B

Questions for game board

Solar

10 points (Addition, Subtraction, Multiplication, Division)

If a solar panel array of 110 panels produces 352 kw/hr, how many kw does each panel part produce per hour?

20 points (Fractions, Percentages)

A solar panel fully charges a battery in five hours in full sunlight. What percentage of an eight-hour period of full sun is five hours?

30 points (Advanced-Basic Algebra/Geometry)

If an electric motor powered by a solar panel draws two amps of electricity at a volume of 9 volts, how many ohms of resistance is generated by the motor?

(Formula) Ohms = Volts/Amps

Wind

10 points (Addition, Subtraction, Multiplication, Division)

If a wind farm of 200 three-blade turbines has five turbines with one damaged blade each and two turbines with two damaged blades each, how many blades must be replaced? How many operational blades are on the farm?

20 points (Fractions, Percentages)

If ¾ of the turbines on a 150-turbine wind farm are inactive, what percentage of them are active?

30 points (Advanced-Basic Algebra/Geometry)

A wind turbine has a rotor radius (r) of 150 feet. How much surface area do the blades consume when the blades spin?

$\pi = 3.14$ (Formula) πr^2

Biomass

10 points (Addition, Subtraction, Multiplication, Division)

An acre of corn produces 235 gallons of ethanol per acre. How many acres must be grown to power a vehicle for a 1,000-mile trip if the vehicle maintains an average of 9 miles per gallon?

20 points (Fractions, Percentages)

If 2,000 cows produce 1,200 cuft of methane per day, how many cows would be needed to increase production by 15%?

30 points (Advanced-Basic Algebra/Geometry)

If a biodiesel producer stores the fuel in standard 55-gallon drums measuring 35 inches tall and 23 inches in diameter, how many cubic inches of space is each drum when empty?

(Formula. $\pi r^2 \cdot h$

$\pi = 3.14$

$d = 2r$

r = radius

pork checkoff™

Questions for game board

Solar

10 points (Addition, Subtraction, Multiplication, Division)

If a solar panel array of 110 panels produces 352 kw/hr, how many kw does each panel part produce per hour?
3.2 kw/hr.

20 points (Fractions, Percentages)

A solar panel fully charges a battery in five hours in full sunlight. What percentage of an eight-hour period of full sun is five hours?
62.5%

30 points (Advanced-Basic Algebra/Geometry)

If an electric motor powered by a solar panel draws 2 amps of electricity at a volume of 9 volts, how many ohms of resistance is generated by the motor?
(Formula) Ohms = Volts/Amps 4.5 ohms

Wind

10 points (Addition, Subtraction, Multiplication, Division)

If a wind farm of 200 three-blade turbines has five turbines with one damaged blade each and two turbines with two damaged blades each, how many blades must be replaced? How many operational blades are on the farm?
9 blades; 591 blades.

20 points (Fractions, Percentages)

If ¾ of the turbines on a 150-turbine wind farm are inactive, what percentage of them are active?
25%

30 points (Advanced-Basic Algebra/Geometry)

A wind turbine has a rotor radius (r) of 150 feet. How much surface area do the blades consume when the blades spin?

π= 3.14 (Formula) πr^2 70,650 sq. ft.

Biomass

10 points (Addition, Subtraction, Multiplication, Division)

An acre of corn produces 235 gallons of ethanol per acre. How many acres must be grown to power a vehicle for a 1,000-mile trip if the vehicle maintains an average of 9 miles per gallon?
0.439 acres

20 points (Fractions, Percentages)

If 2,000 cows produce 1,200 cu. ft. of methane per day, how many cows would be needed to increase production by 15%?
2300 cows

30 points (Advanced-Basic Algebra/Geometry)

If a biodiesel producer stores the fuel in standard 55 gallon drums measuring 35 inches tall and 23 inches in diameter, how many cubic inches of space is each drum when empty?

(Formula. $\pi r^2 h$

π = 3.14

d = 2r

r = radius

14534.275 cubic inches

Name _____

Directions: Read each statement and choose the answer that best answers the statement.

1. _____ **A solar panel array of 50 panels produces 150 kw/hr. This means that each part produces 10 kw/hr.**

   A. True

   B. False

2. _____ **A wind farm with 200 turbines has ¼ of the turbines inactive. This means 150 of the turbines are working.**

   A. True

   B. False

3. _____**If 1,000 cows produce 600 cuft of methane per day, 10 cows would be needed to increase methane production by 20%.**

   A. True

   B. False

4. _____**If an electric motor powered by a solar panel draws 2 amps of electricity at a volume of 7 volts, then 3 ohms of resistance will be generated by the motor using the formula ohms=Volts/Amps**

   A. True

   B. False