

Safety Smart® Science with Bill Nye the Science Guy®: Renewable Energy

Synopsis

Students in grades 4-8 join Bill Nye the Science Guy® as he explores the science of renewable energy. Bill explains what energy is, describes different sources of energy, and compares renewable and non-renewable energy sources. Activities in this Educator's Guide reinforce and expand on program concepts and provide opportunities for students to apply STEM (Science, Technology, Engineering, and Math) skills while researching, writing, and analyzing in teams. Worksheets, quizzes, and puzzles are provided for assessment opportunities.

Objectives

The content of the DVD addresses the following objectives:

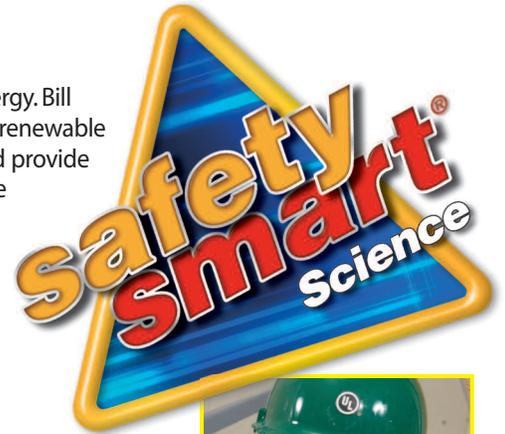
Students will understand that:

- Energy does work for us.
- Energy can never be created or destroyed; it can only be converted from one form to another - it's the Law of Conservation of Energy.
- There are many sources of energy; it's important to use sources that are readily available, safe, efficient, reliable, and have the most positive environmental impact.
- Fossil fuels take a long time to form, and are used up faster than they can be replenished; this is why the energy they produce is considered "non-renewable."
- Burning fossil fuels has increased the amount of greenhouse gasses in the atmosphere, leading to extra heat energy that changes weather patterns and ecosystems.
- Renewable energy sources produce almost zero greenhouse gasses and are constantly being renewed. Examples of renewable energy sources include: solar, wind, hydroelectric, biomass, geothermal, wave, and tidal.
- There are many things we can do to cut down on our use of fossil fuels.

Activities in this Educator's Guide address the following objectives:

Students will:

- Make pinwheels and come up with slogans for Newton's Three Laws of Motion.
- Label a solar cell diagram and write a description about how solar cells use the sun's renewable energy to create electricity.
- Use a "Wordle" to write about the content of the video prior to viewing it.
- Describe the difference between fossil fuels and renewable fuels by burning a candle and a faux candle.
- Calculate their "carbon footprint" by entering lifestyle data at the Nature Conservancy Website and list ways to reduce this footprint.
- Research and present information about renewable energy.
- Work in groups to create a song with artwork about renewable energy.
- Research animals that are harmed by global warming and track them on a world map.
- Develop artistic slogans related to renewable energy.
- Plan an Eco-City that uses renewable energy.



Safety Smart® is an initiative aimed at improving the awareness and understanding of students ages 4-14 in safety and in managing themselves and their surroundings as safely as possible—by conscious action, not chance. Toward that end, UL produces multimedia public service announcements; arranges for Safety Smart Ambassador visits for students to learn from professional safety experts; hosts field trips to its laboratories, where students see safety engineers at work and participate in their own hands-on safety experiments; regularly advocates on emerging safety issues, especially regarding products that may pose a risk to consumers; and supports the development of its youth safety education programs. Through its efforts, Safety Smart cultivates awareness, provides opportunities for students to learn and practice safe, healthy and environmentally friendly behaviors, and helps students learn to make more informed choices today and in the future.

Do your part!
Be **Safety Smart®!**



DVD or Activity	Arts Education (Nat'l. Arts Education Assns.)	Health (McREL)	Language Arts (NCTE)	Language Arts (Common Core State Standards)	Science (NSTA)	Social Studies (NCSS)
DVD Content	None addressed.	2. Knows environmental and external factors that affect individual and community health	None addressed.	None addressed.	B. Physical Science C. Life Science D. Earth and Space Science F. Science in Personal and Social Perspectives	III. People, Places, & Environments
Activity	"Winderiffic"	None addressed.	None addressed.	None addressed.	B. Physical Science	None addressed.
	"Solartastic"	None addressed.	None addressed.	4. Students adjust their use of spoken, written, and visual language...	Writing	B. Physical Science D. Earth and Space Science F. Science in Personal and Social Perspectives III. People, Places, & Environments VIII. Science, Technology, & Society
	"Wordle"	None addressed	2. Knows environmental and external factors that affect individual and community health	3. Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. 6. Students apply knowledge of language structure...	Writing Speaking and Listening	B. Physical Science C. Life Science D. Earth and Space Science F. Science in Personal and Social Perspectives III. People, Places, & Environments
	Candle vs. Candle	None addressed	2. Knows environmental and external factors that affect individual and community health	7. Students conduct research... 8. Students use a variety of technological and informational resources... 11. Students participate as knowledgeable, reflective, creative, and critical members...	Writing	B. Physical Science C. Life Science D. Earth and Space Science F. Science in Personal and Social Perspectives III. People, Places, & Environments
	Reduce Your Use	None addressed	2. Knows environmental and external factors that affect individual and community health	6. Students apply knowledge of language structure... 7. Students conduct research... 11. Students participate as knowledgeable, reflective, creative, and critical members...	Writing	B. Physical Science D. Earth and Space Science F. Science in Personal and Social Perspectives III. People, Places, & Environments VIII. Science, Technology & Society
	Team Energy	None addressed	None addressed	1. Students read a wide range of print and nonprint... 4. Students adjust their use of spoken, written, and visual language... 6. Students apply knowledge of language structure... 7. Students conduct research... 8. Students use a variety of technological and informational resources... 11. Students participate as knowledgeable, reflective, creative, and critical members...	Reading: Informational Text Speaking and Listening Writing	F. Science in Personal and Social Perspectives None addressed

(continued)

Academic Standards Chart (Continued)

DVD or Activity	Arts Education (Natl. Arts Education Assns.)	Health (McREL)	Language Arts (NCTE)	Language Arts (Common Core State Standards)	Science (NSTA)	Social Studies (NCSS)
Activity	Energy Songs	Theater 2: Acting by assuming roles and interacting in improvisations	2. Knows environmental and external factors that affect individual and community health	4. Students adjust their use of spoken, written, and visual language... 5. Students employ a wide range of strategies as they write... 6. Students apply knowledge of language structure... 11. Students participate as knowledgeable, reflective, creative, and critical members...	Speaking and Listening Writing	F. Science in Personal and Social Perspectives III. People, Places, & Environments
	Who Am I?	None addressed	2. Knows environmental and external factors that affect individual and community health	1. Students read a wide range of print and nonprint... 6. Students apply knowledge of language structure... 7. Students conduct research... 8. Students use a variety of technological and informational resources...	Reading: Informational Text Writing	C. Life Science F. Science in Personal and Social Perspectives III. People, Places, & Environments
	Energetic Art Slogans	None addressed	2. Knows environmental and external factors that affect individual and community health	4. Students adjust their use of spoken, written, and visual language... 5. Students employ a wide range of strategies as they write... 6. Students apply knowledge of language structure...	Writing	F. Science in Personal and Social Perspectives None addressed
	Eco-City	None addressed	2. Knows environmental and external factors that affect individual and community health	1. Students read a wide range of print and nonprint... 3. Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. 5. Students employ a wide range of strategies as they write... 7. Students conduct research... 8. Students use a variety of technological and informational resources...	Reading: Informational Text Writing	B. Physical Science C. Life Science D. Earth and Space Science F. Science in Personal and Social Perspectives III. People, Places, & Environments VIII. Science, Technology & Society
	Word Jumble	None addressed	None addressed	3. Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts.	Writing	B. Physical Science C. Life Science D. Earth and Space Science F. Science in Personal and Social Perspectives III. People, Places, & Environments



Preview Questions

1. What is energy? Why is energy important?

Answer: Energy is the ability to do work; it's the ability to move an object by the use of force. Energy causes things to happen around us; it can be used to light our homes and run our cars. The food we eat has stored energy, and we use it to move and keep ourselves warm.

2. What is the difference between renewable and non-renewable sources of energy?

Answer: Renewable energies are derived from sources that can be replenished in a short time. An example is hydroelectricity, which uses water to power generators that create electricity. Water can be replenished by waiting for rain to re-fill rivers, so it is considered "renewable." Other examples include wind and solar energies, which are replenished constantly by sunlight. Non-renewable sources of energy, however, take a lot of time to replenish. Two examples are oil and coal, both of which takes hundreds of millions of years for the earth to replenish.

3. What are some examples of fossil fuels?

Answer: The word "fossil" refers to something that is dug up out of the ground. Oil, coal and gas are fossil fuels because they are buried underground.

4. What do you already know about solar energy? About wind energy?

Answer: Solar energy is readily abundant around the world. In fact, every square meter of the earth collects the approximate energy equivalent of almost a barrel of oil every year. Architects can design buildings that effectively utilize solar energy to heat the buildings without using fossil fuels. Solar energy can also be used to convert light directly into electricity through the use of photovoltaic panels (i.e., solar panels). Wind is produced by the uneven heating of the earth; wind energy is produced by giant turbines that capture wind and then spin a generator to create electricity.



Postviewing Questions

1. Can energy be created or destroyed?

Answer: Energy cannot be created and it cannot be destroyed, that is the Law of the Conservation of Energy. However energy and mass are closely related and it is possible to annihilate matter to create energy. In a closed system, energy is transferred from one thing to another, keeping the total amount of energy the same at all times.

2. What are the problems with using fossil fuels as a source of energy?

Answer: All fossil fuels are derived from carbon-based plants and animals. These fossil fuels got their energy from the sun hundreds of millions of years ago (by eating, growing, etc.). The carbon was removed from the atmosphere and stored underground as the earth changed. Burning fossil fuels at a rapid pace places the carbon back into the atmosphere in a very short amount of time – time that is far too short for the carbon to be absorbed and buried by today's plants and animals. Therefore, the carbon stays in the atmosphere. This process causes sunlight that would normally bounce back into space to be trapped, which in turn heats the earth. Not only does this heat change weather patterns, but it also threatens species by destroying their habitats.

3. What are three ways to reduce your use of fossil fuels?

Answer: Recycle products so that energy is not used to create new products. Reduce your consumption of materials so that less energy is needed to support your day-to-day activities. Reuse materials whenever you can so that energy is not used to make something you already have.

4. How is solar energy produced?

Answer: Solar electric energy is produced using photovoltaic panels. These panels convert sunlight directly into electrical energy. Solar heat energy is produced by collecting the sun's heat and then using that heat to produce hot water. Solar heat can be used in homes to offset the cost of heating water. Solar heat can also be used in large power plants by boiling water to generate electricity.

5. How is wind energy produced?

Answer: Wind energy is produced using giant turbines located in windy areas. These wind turbines are connected to an electric generator. The generator converts the kinetic energy to electric energy.

6. How is hydroelectricity produced?

Answer: Hydroelectricity is produced by water that spills over dams. The water is guided through a set of pipes toward an electric generator that spins as the water goes through it, which in turn creates electricity.

7. What are the advantages of solar energy and wind energy? What are the disadvantages?

Answer: Solar and wind power are both renewable, so as long as the sun shines, we will have both sources and never run out. They are also both relatively easy to capture. The disadvantage to solar energy is that it is only available in the daytime, it has low efficiency, and is currently expensive to produce. The disadvantage to wind energy is that it is only available when the wind blows.



Suggested Classroom Activities

Winderiffic

Distribute copies of the Winderiffic Worksheet. Explain Newton's Three Laws of Motion, and then have students watch the "Winderiffic" video (found in the Bonus Features on the DVD/CD ROM).

After watching the video, explain to students why they will be making the pinwheels (i.e., pinwheels have pockets that catch wind and harness its power to spin the blades, so the pinwheel is actually a small wind turbine). Then have students follow the directions on the Winderiffic Worksheet in order to create their own pinwheels.

Once students have finished their pinwheels, have them pair up to share and discuss their slogans.

Solartastic

Distribute copies of the Solartastic worksheet. Explain that solar cells (which are used on solar panels) convert the sun's energy directly into electricity, and then have students watch the "Solartastic" video (found in the Bonus Features on the DVD/CD ROM).

After watching the video, explain to students that they will be labeling a solar cell diagram that looks like the animated solar cell in the video; they will also be writing a description about how solar cells work. Then have students follow the directions on their Solartastic worksheets.

Once students have finished their worksheets, have them pair up to check the accuracy of their diagrams and discuss how solar cells work.

Wordle

Distribute copies of the Wordle Worksheet with the Wordle printed on the back. Have students complete the "Before Watching the Video" section of the worksheet and then review the Wordle art. Explain that the words in the Wordle were taken from the video script. The larger the word, the more frequently it is used in the video.

Have pairs of students read each other's work. Ask the first student to read while the other student listens, and then switch. After the lesson, watch the video. The next period, take a pre-assessment of your students by having them make a T-chart in their science journals or on a blank piece of paper, comparing and contrasting renewable and non-renewable energies.

Candle vs. Candle?

Divide students into equal-sized groups and sit each group at a table. Provide a normal candle (labeled "A") and a faux candle made from a cored potato and an almond sliver (labeled "B"). A video http://sciencesquad.questacon.edu.au/activities/edible_candle.html explains in detail how this works.

Ask students to look at the candles and explain in their own words what the difference is between a renewable and non-renewable energy source (in this case biomass). The worksheet asks for three other renewable candle ideas. These could be beeswax, vegetable oil lamps, or grain alcohol lamps. Most students do not know how candles work, and will hypothesize that the wick is burning. This assumption is incorrect. The wax is what burns by melting and “wicking” up the wick. However, for the almond candle, it is the almond sliver that burns; the potato is just for show.

Reduce Your Use

Go to <http://www.nature.org/greenliving/carboncalculator/index.htm> and have students calculate their carbon footprint. As they do the exercise, have students make a histogram to display their data for the entire class. Then calculate the average footprint size for the class. Discuss ways in which students can reduce their carbon impact.

Have students use the worksheet provided to list ways to reduce their use of fossil fuels (per Bill Nye’s description). See if they can think of any other ways. You might create a class list and post it in the classroom.

Optional Extension: Bring 60 pounds of carbon into the classroom as an assignment. Assuming there are thirty kids in a classroom, this is about two pounds each. The “carbon” can be charcoal, wood or wood stove pellets, or anything biomass. The point is to create a visual representation of what one human expels into the atmosphere each year.

Team Energy

Use the “jigsaw method” to have students research and present information about renewable energy. Jigsaw is a cooperative learning method in which each member of a class team joins an “expert group” (i.e., a second class group) to become knowledgeable about a topic. Experts on like topics work together to do research and then meet with their class teams to share research findings. A wonderful way kids can work in groups and present in an intuitive format is to use Prezi software (free). The learning curve is brief and the results are fun: <http://prezi.com/>

Assign groups of four students to teams. Describe the activity, then assign one person from each team to an “expert group” in order to research one of the following topics:

- Solar energy
- Biomass
- Wind energy
- Geothermal
- Hydroelectricity

After expert groups complete their research, have students meet with their teams to create a presentation about renewable energy that includes research findings about all five topics.

Energy Songs

As Bill Nye talks about renewable energy, he points out that energy must first be captured, then transferred, and then used. Have groups of students rap or write songs that describe this process for each type of energy. For example: “solar” rhymes with “polar” and “roller”; “wind” with “skinned” or “twinned”; “hydro” with “hypo,” “micro,” “silo,” etc.

Who am I?

In the program, Bill Nye names some animals that are being threatened by global warming. Have students choose one of these animals (listed below) and use the worksheet provided as they research their animals. Make sure to have a world map in the classroom for students to post the geographical location of each animal.

- Polar bear
- Emperor Penguin
- Pika
- Panda
- Akikiki

Energetic Slogans

Have students use the worksheet provided to develop slogans related to renewable energy. You might develop this into an art assignment with the slogan used in a drawing. For example, a popular Internet search engine often re-themes their corporate logo for holidays and events like Earth Day.



Eco-City

Go to Chevron's Energyville website (<http://www.energyville.com/energyville/>), have students play the game and learn more about the different sources of energy needed to power a city. As a class project, design a community that maximizes renewable energy. Ideas might include the recycling of biomass to generate electricity, geothermal heating of homes, wind turbines on the hills, solar cells on roofs, hydroelectric power from a river, and passive solar design systems for buildings. Students can use children's construction toys, interlocking brick sets, or other materials to simulate how these systems would work. As an extension, you can teach about LEED certification (leadership in energy and environmental design). Also, a great discussion might center around the Biosphere (<http://www.b2science.org/>), a self contained ecosystem at the University of Arizona.

Word Jumble

For a fun puzzle about renewable energy sources, have students complete the Word Jumble activity sheet.

Assessment

Quiz and Crossword Puzzle

Have students complete the quiz and crossword puzzle to demonstrate what they learned from the program.



Resources

Books

Drummond, Allan. **Energy Island: How One Community Harnessed the Wind and Changed Their World.** Farrar, Straus & Giroux, 2011. Grades 3-5. A true story about how a Danish community attained energy independence using the sustainable power of wind.

Jefferis, David. **Science Frontiers: Green Power—Eco-Energy Without Pollution.** Crabtree Publishing, 2006. Grades K-8. Explains advantages and disadvantages of different types of green energy options. Each two-page overview is accompanied by pictures or diagrams.

Krohn, Katherine. **A Refreshing Look at Renewable Energy with Max Axiom, Super Scientist.** Graphic Library, 2009. Grades 3 and up. Scientist Max Axiom examines various forms of alternative energy.

Internet

Winderiffic (from UL)
<http://www.youtube.com/watch?v=wcv4yfrGEHk&feature=plcp>

Solartastic (from UL)
<http://www.youtube.com/watch?v=BkG1iDrGpNg&feature=plcp>

UL Safety Smart (from UL)
<http://ulsafetysmart.com>

Energy Kids (from the U.S. Energy Information Administration)
http://www.eia.gov/kids/energy.cfm?page=renewable_home-basics

Energy Savers (from the U.S. Department of Energy)
http://www.energysavers.gov/renewable_energy/

Kids Saving Energy (from the U.S. Department of Energy)
<http://www1.eere.energy.gov/kids/>

National Energy Education Development Project
<http://need.org/>

PBS: Renewable Energy—Need to Know
<http://www.pbs.org/wnet/need-to-know/tag/renewable-energy/>

Student Resources on Renewable Energy (from the National Renewable Energy Laboratory)
http://www.nrel.gov/learning/student_resources.html

The Roots and Shoots foundation has projects for kids and communities which are focused on minimizing society's impact on the earth.
<http://www.rootsandshoots.org/kidsandteens>

Earthwatch has a few scholarships to bring kids outdoors to research the environment.
<http://www.earthwatch.org/aboutus/education/studentopp/>

The Nature Conservancy has resources for getting kids outside.
<http://www.nature.org/newsfeatures/kids-in-nature/index.htm>

Alliance to Save Energy has lesson plans on energy conservation.
<http://ase.org/lessonplans>

Surfrider has fun volunteer opportunities.
<http://www.surfrider.org/take-action>



TED Talk videos on interesting energy ideas.

Saul Griffith, an inventor who has created giant kite turbines.
http://www.ted.com/talks/lang/en/saul_griffith_on_kites_as_the_future_of_renewable_energy.html

Sample Activity: Try to get kids to understand how high the jet stream is. Then have them try to see how high they can fly a kite by measuring how much string is let loose, along with the angle of the string.

Jennifer Indovina, a social entrepreneur who created an app for phones so people can adjust the energy usage of their homes or offices when they are away. The link is for an interview.
<http://blog.ted.com/2011/04/15/fellows-Friday-with-jennifer-indovina/>

Sample Activity: Purchase the Kill-a-Watt meter for around twenty dollars. Go through the classroom and measure the energy use of all the things in the room, such as the overhead, Smartboard, fish tank, computers, refrigerator, microwave, etc. Note that the computer uses more energy when running a complicated program. Extend this experiment to the entire school. You could start by accessing your school's online energy bill, and then comparing your class' measurements to the numbers on the bill.

Rob Harmon, an expert on energy and natural resources policy who introduced the concept of green energy retail credits. The link is for a bio.
http://www.ted.com/speakers/rob_harmon.html

Sample Activity: Have students debate how businesses can be encouraged to stop burning fossil fuels and instead start using renewable energies. Debate the idea of a carbon tax.

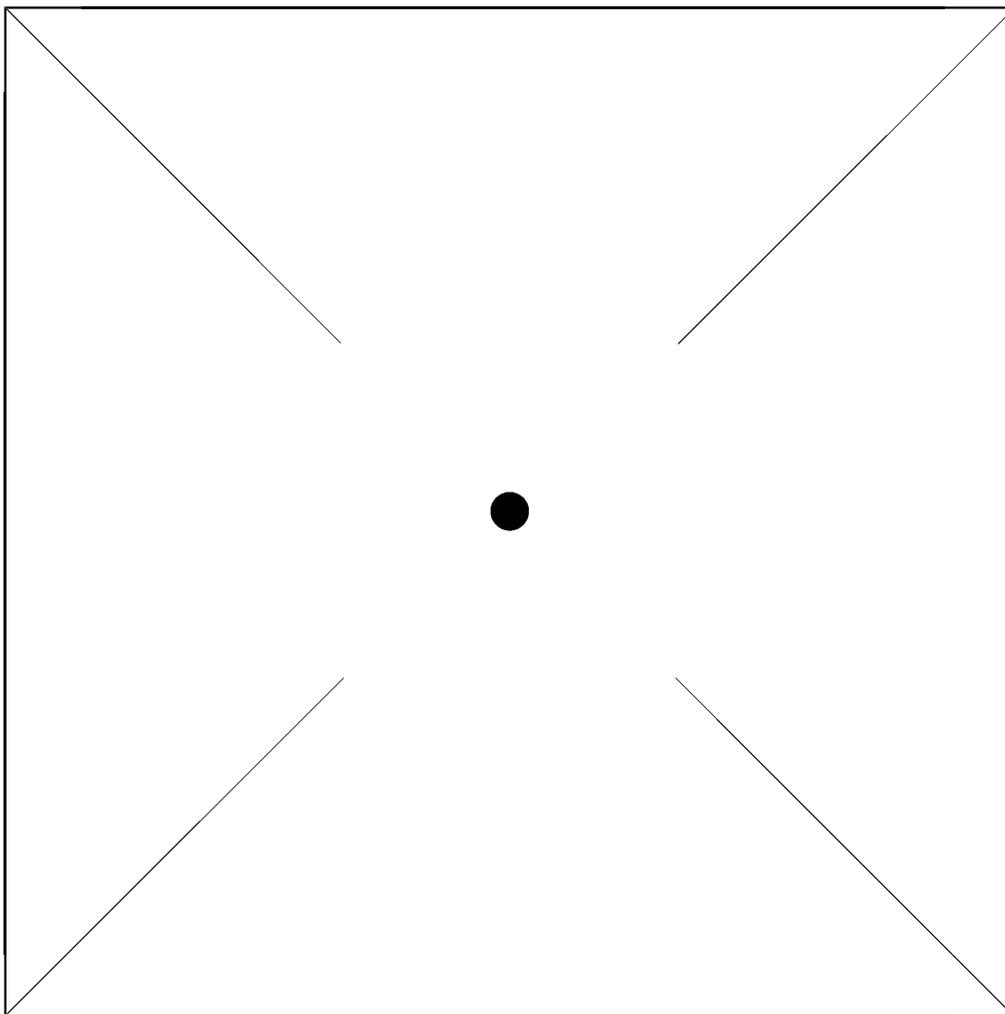
Bilal Bomani, a NASA researcher working on biofuels that do not require arable land or fresh water to grow.
http://www.ted.com/talks/bilal_bomani_plant_fuels_that_could_power_a_jet.html

Sample Activity: See if you can locate someone in your community who runs their diesel truck from leftover fryer oil. Invite someone like this into the classroom to discuss the pros and cons of harvesting biofuels in lieu of growing it for food.

Winderiffic

What you need

- Scissors
- Straight pin
- Pencil with eraser
- Colored pencils/pens/markers

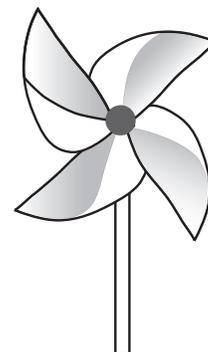
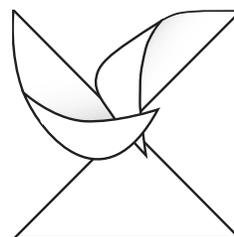


How to get started

- Cut out the pinwheel square shown above.
- On one side of the paper, write down each of the Three Laws of Motion (one per quadrant).
- In the last quadrant, create a fun slogan for the Three Laws of Motion and write it down.
- Following the lines on the template, cut in from all four corners, leaving about 2 inches of the center uncut.

Construct pinwheel

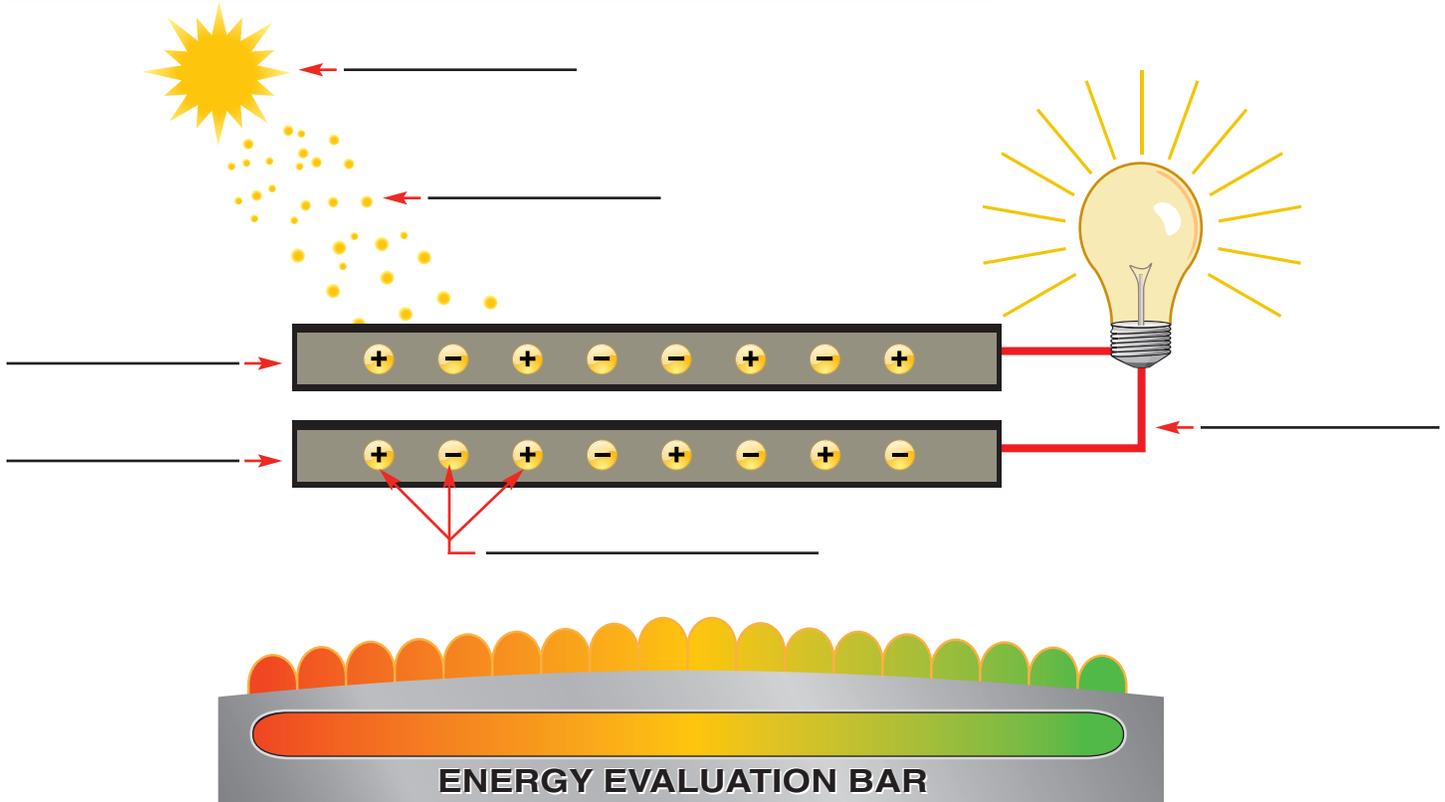
- Gently bend (don't fold) one cut corner to the center point.
- Skip the next cut corner, and bend the third one.
- Skip and bend until four points meet in the center.
- Then stick the straight pin through all four points and the back of the pinwheel.
- Stick the pin into the pencil eraser.



Solartastic

As you saw in the *Safety Smart Science: Renewable Energy* and *Solartastic* videos, solar cells convert sunlight directly into electricity. Use the words below to label the solar cell diagram, and then circle the section of the Energy Evaluation Bar that identifies whether or not solar energy is efficient (orange is "not efficient" and green is "very efficient").

PHOTONS	P-LAYER	N-LAYER
SUN	ELECTRONS	ELECTRICAL CONDUCTORS



In the space below, describe how solar cells use the sun's renewable energy to create electricity. Make sure to include the words "capture," "transfer," and "convert."

“Wordle”

Before Watching the Video:

Look at the Wordle on the back of this worksheet. It contains all the words that Bill Nye uses in *Renewable Energy*. Some words are larger than others, which means they are used more often. Select five to ten words, and use them to write a few sentences that describe the topics you think the video will address.

My sentences:

- 1) _____
- 2) _____
- 3) _____
- 4) _____

While Watching the Video:

Think about what you wrote and how close you were to the actual content presented. Enjoy the show!

After Watching the Video:

Write down three major points that Bill Nye made.

- 1) _____
- 2) _____
- 3) _____

How close were you to predicting what the video content would be?

Candle vs. Candle?

Your teacher will provide your group with two candles (A) and (B), which are made of different materials.

Candle A



Candle B



<p>What are the base and wick of candle (A) made of?</p>	<p>What are the base and wick of candle (B) made of?</p>
<p>What fuel is burning to make candle (A) light? How long can the candle stay lit?</p>	<p>What fuel is burning to make candle (B) light? How long can the candle stay lit?</p>
<p>Is candle (A) renewable? Why or why not?</p>	<p>Is candle (B) renewable? Why or why not?</p>
<p>Make a list of at least three ways to make a "candle" out of renewable energy in the box to the right.</p>	<p>1)</p> <p>2)</p> <p>3)</p>

STUDENT WORKSHEET

Safety Smart® Science with Bill Nye the Science Guy®:
Renewable Energy

Reduce Your Use

There are many websites that calculate the amount of carbon you place into the air from burning fossil fuels. This makes for an excellent math lesson as kids can graph their usage and compare their numbers to one another and to current world averages.

Basic:

<http://www.cooltheworld.com/kidscarboncalculator.php> (excellent and simple to use)

<http://www.earthday.org/footprint-calculator>

(very cool graphics, students make an avatar, look carefully at the end to see the total amount of carbon produced)

Advanced:

http://www.epa.gov/climatechange/emissions/ind_calculator2.html#c=theBasics&p=reduceOnTheRoad&m=calc_currentEmissions

(this is more college-like and is very detailed)

<http://www.nature.org/greenliving/carboncalculator/index.htm> (decent website, easy to navigate)

Sample questions to ask students to generate data and discussion:

Record the total tons of CO₂ you emit each year here _____

Why does changing the types of lights you use save energy?

Why does checking tire pressure on your car save energy?

What does eating meat have to do with greenhouse gasses?

What can composting do to save on fossil fuels?

Now ask other students to help fill out the histogram on the next page by placing an X on the column where their emissions fall.

What is the average of all students? _____

What is the national average as posted on the website? _____

Who am I?

In *Renewable Energy*, Bill Nye names some specific animals that are being harmed by global warming.

Choose one of the animals listed below (circle your choice) and do some research to answer the questions that follow:

- Polar bear
- Pika
- Akikiki
- Emperor Penguin
- Panda

Research Questions	Answers
1. Who am I? (Describe my characteristics.)	
2. Where do I live? (Post a picture of your animal on the world map provided by the teacher.)	
3. What do I eat?	
4. How do I get my food?	
5. How is global warming negatively affecting me?	

Energetic Slogans

A slogan is an efficient way to communicate a message. In *Renewable Energy*, some of the messages Bill Nye communicates could be considered slogans. For example, “**Energy... it does work for us...**” and “**Renewable Energy... It’s Safety Smart®!**”

Develop your own slogans related to the following topics, and then incorporate them into a work of art (e.g., a poster, poem, plaster or clay model, interlocking models, etc.):

Topic	Slogan
Fossil Fuels	
Solar Energy	
Wind Energy	
Hydroelectricity	
Biomass	
Geothermal	

Word Jumble

Unscramble the letters to make words that are related to renewable energy. Use the circled letters to make a sentence that also relates to renewable energy.

S	E	L	T	I	A	N	U	S	A	B
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	○			○	○	○
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A	R	L	S	O
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○			○	○
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R	O	P	E	W
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			○	○
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D	I	W	N
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O	P	R	W	E
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			○	○
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E	M	H	E	T	G	R	L	A	O
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W	L	N	F	G	I	O
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A	R	T	W	E
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		○	○	
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E	R	Y	L	D	O	H	E	T	R	T	Y	I	C	C	I
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	○				○		○								○
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SENTENCE Made From Circled Letters:

Clue: The first two words are used **very** frequently in the program (check the Wordle!), and the last two words are what we're all about!

		N					E
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						Y
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I	
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S					Y
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S						!
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Word Jumble Answer Key

S E L T I A N U S A B

S U S T A I N A B L E

O M S I B S A

B I O M A S S

A R L S O

R O P E W

S O L A R

P O W E R

D I W N

O P R W E

W I N D

P O W E R

E M H E T G R L A O

G E O T H E R M A L

W L N F G I O

A R T W E

F L O W I N G

W A T E R

E R Y L D O H E T R T Y I C C I

H Y D R O E L E C T R I C I T Y

SENTENCE Made From Circled Letters:

R E N E W A B L E

E N E R G Y

I S

S A F E T Y

S M A R T !

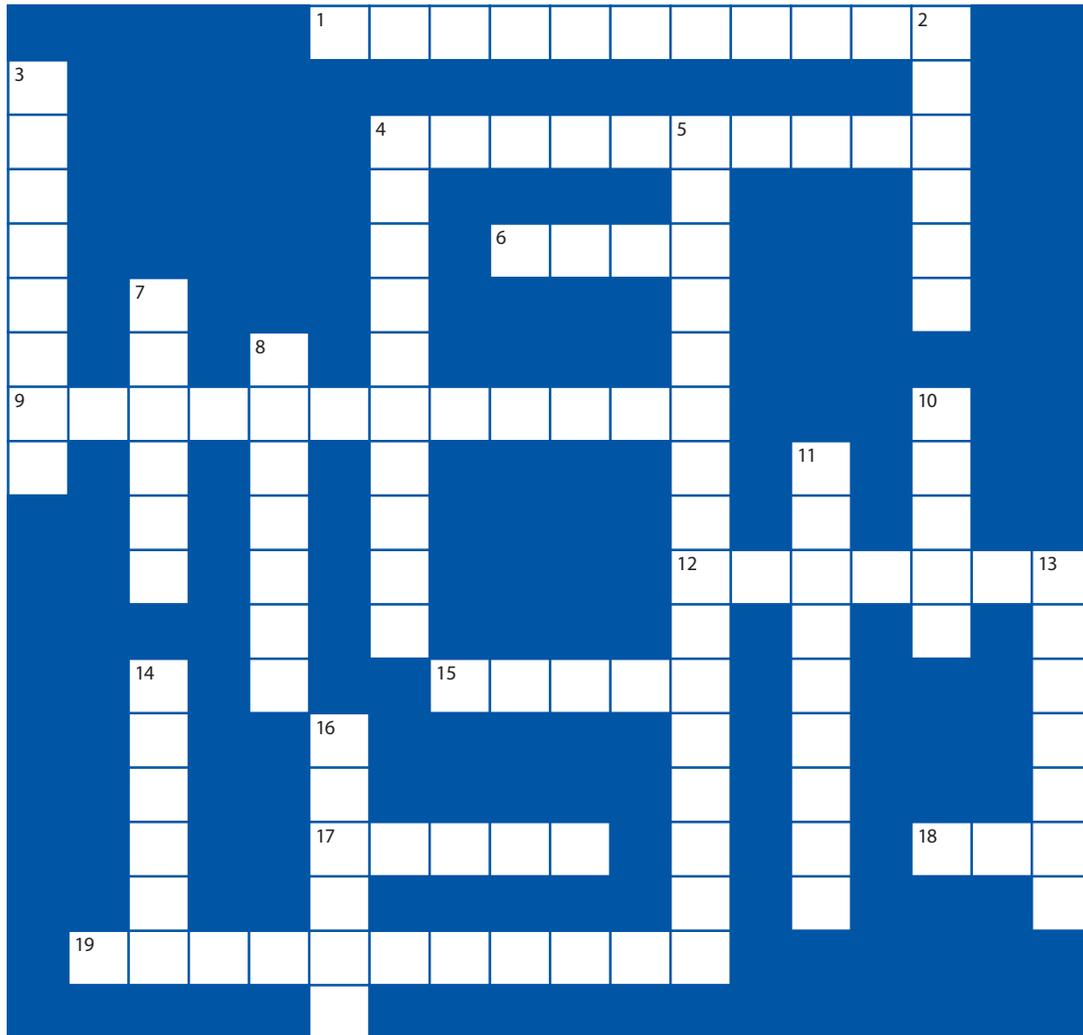
Quiz**True or False? Circle T or F**

- | | | |
|--|----------|----------|
| 1. Energy can never be created or destroyed. | T | F |
| 2. Fossil Fuels are renewable. | T | F |
| 3. Burning fossil fuels has increased the amount of greenhouse gasses in the atmosphere. | T | F |
| 4. Renewable energy can be renewed as quickly as we use it. | T | F |
| 5. Renewable energy produces greenhouse gasses. | T | F |
| 6. The sun is a source of renewable energy. | T | F |
| 7. Wind power is a new renewable energy source. | T | F |
| 8. Wind energy has nothing to do with the sun. | T | F |
| 9. Hydroelectricity is often generated at dams. | T | F |
| 10. Niagara Falls generates enough hydroelectricity to power 1 million light bulbs. | T | F |

Quiz Answer Key**True or False?**

- | | |
|--|----------|
| 1. Energy can never be created or destroyed. | T |
| 2. Fossil Fuels are renewable. | F |
| 3. Burning fossil fuels has increased the amount of greenhouse gasses in the atmosphere. | T |
| 4. Renewable energy can be renewed as quickly as we use it. | T |
| 5. Renewable energy produces greenhouse gasses. | F |
| 6. The sun is a source of renewable energy. | T |
| 7. Wind power is a new renewable energy source. | F |
| 8. Wind energy has nothing to do with the sun. | F |
| 9. Hydroelectricity is often generated at dams. | T |
| 10. Niagara Falls generates enough hydroelectricity to power 1 million light bulbs. | F |

Crossword Puzzle



ACROSS

- 1 A word that means indefinitely reliable is _____.
- 4 Gasses in the atmosphere that reflect heat back down are called _____ gasses.
- 6 The spinning Earth and the sun's heat generate _____.
- 9 Fossil fuels are _____ sources of energy.
- 12 Solar panels _____ the sun's energy to a form we can use.
- 15 Currently the fastest growing source of renewable energy.
- 17 Geothermal energy harnesses energy from decaying _____.
- 18 The _____ is a source of renewable energy.
- 19 Solar panels convert the energy from photons into _____.

DOWN

- 2 _____ can never be created or destroyed.
- 3 This fossil fuel is used in many vehicles.
- 4 This energy is generated from decaying uranium atoms in the Earth's core.
- 5 This is generated at dams.
- 7 These are used to capture solar energy.
- 8 Three ways to cut down on fossil fuels are to reduce, reuse, and _____.
- 10 This is a source of renewable energy.
- 11 These energy sources produce no greenhouse gasses.
- 13 The blades of this capture some of the wind's energy.
- 14 This means "buried."
- 16 Biomass captures energy from the sun that is stored in decomposing _____.

STUDENT WORKSHEET

Safety Smart® Science with Bill Nye the Science Guy®:
Renewable Energy

Crossword Puzzle Answer Key

