

ENERGY

ON STAGE

NEED's favorite energy plays to educate, entertain, and reinforce energy knowledge.



GRADE LEVEL

4-12

SUBJECT AREAS

Science

Social Studies

Language Arts

Performing Arts



NEED

2009-2010

Putting Energy into Education

NEED Project PO Box 10101 Manassas, VA 20108 1-800-875-5029 www.NEED.org

Teacher Advisory Board

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Teacher Advisory Board Vision Statement NEED Mission Statement

The mission of the NEED Project is to promote an energy conscious and educated society by creating effective networks of students, educators, business, government and community leaders to design and deliver objective, multi-sided energy education programs.

In support of NEED, the national Teacher Advisory Board (TAB) is dedicated to developing and promoting standards-based energy curriculum and training.

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Correlations to National Science Standards

PRIMARY (K–4) STANDARD–F: SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES

3. Types of Resources

- a. Resources are things that we get from the living and nonliving environment to meet the needs and wants of a population.
- c. The supply of many resources is limited. If used, resources can be extended through recycling and decreased use.

4. Changes in Environments

- b. Changes in environments can be natural or influenced by humans. Some changes are good, some are bad, and some are neither good nor bad.
- c. Pollution is a change in the environment that can influence the health, survival, or activities of organisms, including humans.

INTERMEDIATE (5–8) STANDARD–B: PHYSICAL SCIENCE

3. Transfer of Energy

- a. Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical.
- b. Energy is transferred in many ways.
- g. The sun is the major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches earth, transferring energy.

INTERMEDIATE STANDARD–D: EARTH AND SPACE SCIENCE

3. Earth in the Solar System

- b. The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle.

INTERMEDIATE STANDARD–E: SCIENCE AND TECHNOLOGY

2. Understandings about Science and Technology

- c. Technological solutions are temporary and have side effects. Technologies cost, carry risks, and have benefits.

SECONDARY (9–12) STANDARD–F: SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES

3. Natural Resources

- a. Human populations use resources in the environment to maintain and improve their existence.
- b. The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and depletes those resources that cannot be renewed.
- c. Humans use many natural systems as resources. Natural systems have the capacity to reuse waste but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.

General Teacher Guide

TO REINFORCE INFORMATION ON THE MAJOR SOURCES OF ENERGY, HOW ENERGY IS USED, CONSERVATION METHODS, AND OTHER ENERGY INFORMATION.

BACKGROUND

Energy on Stage plays use familiar stories and characters to convey energy facts and reinforce energy information learned by students. They can be used at all grade levels, and can be performed as reading plays or as more elaborate performances with props and costumes. Each play can be performed in ten minutes or less. Individual Teacher Guides with concepts, enriched vocabulary, assessment and extension activities are included with each play. It is suggested that you assign different plays to several groups.

TIME

One 45-minute class period, or a portion of five or six class periods.

MATERIALS

- One copy of the script for each participant, including a narrator, if required.
- Simple costumes and props, if desired.

PROCEDURE

- Divide the class into a number of groups equal to the number of plays you have chosen. If there are more students in the group than parts in the play, some students can be directors, costume designers or set decorators.
- Assign parts and have the students read and rehearse their parts. This can be done in class or as a homework assignment.
- If props and costumes will be used, have students make a list of what they will need, and who will provide them.
- At the conclusion of the activity, complete the Evaluation Form on page 67 with your students and return to NEED.

Teacher Guide

Sparkle White and the Seven Dwarfuels

KEY CONCEPTS

1. Using renewable energy sources provides energy and promotes a clean environment.
2. Renewable sources of energy include hydropower, biomass, solar, wind, and geothermal.
3. Ethanol is a clean burning transportation fuel made from corn and biomass waste.

ENRICHED VOCABULARY WORDS

alternative
carbon cycle
emissions
enabling
ethanol
photovoltaic cell
radiant energy
realm
soot
waste-to-energy plant

ASSESSMENT

1. List the five renewable energy sources. (*Biomass, geothermal, hydropower, solar, wind.*)
2. Describe the problems in Purestan and how the energy advisors solved them. (*Pollution created by wood burning stoves used to heat homes is solved by using solar collectors, using wind to pump hot water made with geothermal energy, and hydropower and biomass to make electricity for electric heat. Lack of a clean mode of transportation is solved by using biomass to make ethanol.*)
3. If you were to use one renewable energy source in your house, which would you choose and why?

EXTENSIONS

1. Design a house that utilizes as many renewable resources as possible. Write a paragraph describing your house and how each energy source is used.
2. Research which energy sources are used by your city for generating electricity, heating homes, and operating personal and mass transportation vehicles. Devise a plan for incorporating more renewable resources into the mix. Write a letter to City Council outlining your plan and encouraging the use of renewable resources.

Sparkle White and the Seven Dwarfuels

CAST OF CHARACTERS

Narrator:	Introduces and closes the story
King:	Ruler of Purestan
Drop:	Advisor for Hydropower
Sparkle White:	Princess of Purestan
Chorus:	Class
Sunny:	Advisor for Solar
Breezy:	Advisor for Wind
Steamy:	Advisor for Geothermal
Woody:	Advisor for Biomass
Wasteful:	Advisor for Biomass
Corny:	Advisor for Biomass

(Setting: The castle of the King of Purestan. The scene opens with the King pacing in his chamber as Drop, the chief advisor for hydropower, enters.)

NARRATOR:

Once upon a time, there was the Kingdom of Purestan. The kingdom was the cleanest and healthiest of all the kingdoms in the realm, because it only used renewable energy resources. It was ruled by a wise king who always sought the advice of his renewable energy advisors—the Seven Dwarfuels. They knew the value of using clean, renewable energy to provide Purestanians with the energy they needed. The King was so proud of his clean energy policy that he named his daughter Sparkle White.

KING:

Drop, my old friend, as the manager of the kingdom's hydropower plants, you have helped me more than any other advisor to provide the people of Purestan with energy and a clean environment.

DROP:

Well, sire, as you know, my 2,000 dams provide five to ten percent of our electricity, depending on rainfall, while my lakes offer great habitats for wildlife and opportunities for recreation.

KING:

It has been 16 years since Sparkle White's mother, Queen Fly Ash, was kidnapped by Ole King Coal. Since she's been gone, we have committed ourselves to having clean energy for Sparkle White.

DROP:

The Queen's love for that fossil fuel was nonrenewable! What's the matter now, sire? I'm sure with Woody's help, we can solve it.

KING:

Woody is the problem. Look at Sparkle White's dry cleaning bills. *(Holds up a stack of papers.)* Each month it costs more and more to keep her clothes looking white.

DROP:

I have noticed increased pollution from those popular wood-burning stoves that are all the rage here.

KING:

Exactly. It is Purestan's abundant and renewable biomass that is polluting our air!

(Sparkle White enters.)

SPARKLE WHITE:

Daddy, just look at my new dress. It has smudges and soot all over it, and I only took a short walk through the village. Did you fire that Dwarfuel Woody yet?

DROP:

Fire Woody! Sire, if you fire Woody, who will heat all the homes in the kingdom?

KING:

I don't know what else to do.

CHORUS:

Wind and solar—quite a pair, biomass is everywhere.
Hydropower hits the spot, geothermal's looking hot.
Clean, renewable energy, it is good for you and me.

DROP:

(Shouting) Sunny! Breezy! Steamy! Come quick. We need your help.

(Sunny and Breezy climb in the window.)

SUNNY:

What's up?

SPARKLE WHITE:

We're firing that dirty Dwarfuel Woody.

BREEZY:

Fire Woody? What did he do? Form a SPLINTER group?

DROP:

This is no joke. Sparkle White's clothes are dirty because of Woody's soot.

KING:

We need to find an alternative way to heat the kingdom's homes.

CHORUS:

Wind and solar—quite a pair, biomass is everywhere.
Hydropower hits the spot, geothermal's looking hot.
Clean, renewable energy, it is good for you and me.

DROP:

Sunny, can't you do it? You've got a lot of clean, free radiant energy.

SUNNY:

I can help a little, but I'm pretty spread out and I can't work twenty-four hours a day. It will take me years to design and build all the solar collectors we would need to heat the homes in Purestan.

BREEZY:

I can help some, too, but you can't count on me all the time. My wind turbines only operate about three-fourths of the time, and not always at full capacity.

NARRATOR:

(Offstage) SSSSSSHHHHHHHH!!!!

SPARKLE WHITE:

There's Steamy. Come on in, we need your help.

(Steamy enters.)

STEAMY:

Thanksss, Sssparkle White. I think I can assstist with thiss problem. I have enough hot water and sssteam ssstored underground to heat all the homesss in Puresstan. It'sss called geothermal energy.

BREEZY:

I've used windmills to pump hot and cold water for hundreds of years.

STEAMY:

We can also build a waste-to-energy plant which burns biomass to produce steam for making electricity.

KING:

If we use all of your powers together—Breezy, Steamy, Drop, and Sunny—we can heat all of the homes in Purestan without burning wood.

CHORUS:

Wind and solar—quite a pair, biomass is everywhere.
Hydropower hits the spot, geothermal's looking hot.
Clean, renewable energy, it is good for you and me.

SPARKLE WHITE:

Well, now that you have that problem solved, when are you guys going to let me drive? I'm the only princess around who doesn't own a car—it's embarrassing.

SUNNY:

Sparkle White, you know cars run on petroleum and fossil fuels aren't allowed in Purestan.

SPARKLE WHITE:

What we need is a renewable fuel source.

KING:

Who can provide it?

DROP:

I'm tapped out.

BREEZY:

I can't make enough electricity to power Purestan and vehicles, too.

STEAMY:

And my hot water supply isn't large enough.

SPARKLE WHITE:

Sunny, what about your photovoltaic cells?

SUNNY:

I'm afraid you can't count on me every day.

CHORUS:

Wind and solar—quite a pair, biomass is everywhere.
Hydropower hits the spot, geothermal's looking hot.
Clean, renewable energy, it is good for you and me.

SPARKLE WHITE:

You guys are no help. Where are Woody, Corny, and Wasteful? They might be able to fuel my car. *(Sparkle White stomps offstage to search for them.)*

KING:

Yes, let's get the biomass advisors in here. I want to hear their ideas.

BREEZY:

Wow. First, Woody was the problem, now he's the solution.

SUNNY:

Biomass as an energy source to power cars?

(Sparkle White rushes in, pulling Woody, Corny, and Wasteful behind her.)

KING:

Ahh, Woody. You are my oldest energy advisor. You have made it possible for Purestan to heat its homes with wood for centuries, but now it's time... (*Woody interrupts.*)

WOODY:

You're right, it's time we modernized. Usually we burn wood and use its energy for heating. But there are other ways to convert biomass energy into a usable energy source.

WASTEFUL:

Listen to the idea Woody, Corny, and I have enabling Sparkle White to drive a car.

CORNY:

I'm so excited, I'm about to pop!

WASTEFUL:

We can fuel Sparkle White's car using biomass.

DROP:

But won't a car burning biomass pollute the air, too?

WOODY:

Instead of burning our biomass, we will convert our corn, crop, and wood wastes to ethanol. Ethanol is a clean burning alcohol fuel for cars. It can also reduce total carbon dioxide emissions.

CORNY:

Ethanol is made from crops that absorb carbon dioxide and give off oxygen as they grow. This carbon cycle maintains the balance of carbon dioxide in the atmosphere when ethanol is used as a fuel.

SPARKLE WHITE:

Finally, a car that uses renewable energy! I'll be talk of the town.

CHORUS:

Wind and solar—quite a pair, biomass is everywhere.
Hydropower hits the spot, geothermal's looking hot.
Clean, renewable energy, it is good for you and me.

KING:

(*As they all exit.*) Now that we have solved those problems, let's talk about one of mine. What can we do about our football team...?

NARRATOR:

The seven Dwarfuels had once again found good solutions to Purestan's energy problems. The kingdom was clean and healthy again, and Sparkle White was happy. The football team, however, is a whole other story...

Teacher Guide

Energilocks

KEY CONCEPTS

1. There are many different ways to save energy.
2. Energy use has environmental and economic costs.

ENRICHED VOCABULARY WORDS

caulking
combustion
crucial
demise
demolish
destitute
hybrid vehicle
incandescent
programmable thermostat
savvy

ASSESSMENT

1. List three conservation tips from the story. *(Use public transportation. Install programmable thermostats. Use compact fluorescent light bulbs. Keep your car tuned. Don't make jackrabbit stops. Drive the speed limit. Keep vehicle weight low. Purchase a hybrid vehicle. Check tire pressure regularly. Install weather-stripping and caulking to keep drafts out of doors and windows. Plan trips. Take short showers. Use cold water instead of hot when possible. Install an insulating blanket around hot water heaters. Install proper insulation in walls and attics. Use microwaves instead of ovens to reheat or cook food.)*
2. Compare and contrast Goldilocks and Energilocks. *(Both stories involve three bears and a young girl. Goldilocks happened upon the Bears' house, Energilocks had an appointment. Goldilocks let herself in when it appeared no one was home while Energilocks was invited in by a note. Both Goldilocks and Energilocks helped themselves to the Bears' porridge.)*
3. Write a newspaper article summarizing what happened in Storyland. *(Student articles should include all major characters, the energy problems they had, and the solutions provided by Energilocks. Additional reporting could include background information about each character.)*

EXTENSIONS

1. Develop Storyland conservation brochures for Energilocks to hand out to other characters.
2. Add in what times Energilocks was at each scene. Have students calculate the elapsed time.
3. Write an additional scene to the play that includes more fairy tale characters such as Cinderella, Hansel and Gretel, or Beauty and the Beast.

Energilocks

CAST OF CHARACTERS

Energilocks:	The Storyland energy expert
Caretaker:	In charge of Sleeping Beauty's castle
Jack-Be-Nimble:	A great jumper with a hot problem
Simple Simon:	A pie delivery person
Chorus:	Class
Mama Bear:	The mother
Papa Bear:	The father
Baby Bear:	A young bear that learned about energy in school
Wolf:	A blowhard
Rubba:	A plumber
Dub (1):	Rubba's brother
Dub (2):	Rubba's brother

SCENE I

(Setting: A bus stop.)

ENERGILOCKS:

My name is Energilocks, and there is an energy problem in Storyland. It is my job to make sure that all the characters in Storyland are energy savers. I have a three o'clock appointment with the three bears to do an energy survey of their new house. I walked over to the bus stop to use public transportation to save energy. I was not surprised to see three other people waiting for the bus that would take me the three miles to the three bears' house.

(Three people at the bus stop recognize Energilocks—all shout about their energy problems at once.)

CARETAKER, JACK-BE-NIMBLE, SIMPLE SIMON:

Aren't you Energilocks? I've got an energy problem. You've got to help me, me first, no, me first, I was here first.

ENERGILOCKS:

Wait a minute! I can't help all of you at once. One at a time! Now what's your problem?

CARETAKER:

I'm the caretaker of Sleeping Beauty's drafty castle. Sleeping Beauty has been asleep in her room for two years. The king is getting destitute. Heating that castle uses a lot of energy. In fact, it's the number one energy-consuming job in all castles. If Prince Charming doesn't show up soon, we are going to be in trouble.

ENERGILOCKS:

Not to worry. Install programmable thermostats in the castle to control the heat for time of day and season. Cover her with lots of blankets and you won't have to set the temperature very high while she sleeps.

CARETAKER:

Good idea, thanks for your help.

JACK-BE-NIMBLE:

I'm Jack. You know, like Jack-be-Nimble, Jack-be-Quick, Jack jumped over the candlestick.

ENERGILOCKS:

Now, what's your problem?

JACK-BE-NIMBLE:

When I was younger, it was all about candles. Now it's Jack-is-Feeble, Jack-gets-Cramps, Jack jumps over incandescent lamps. Those light bulbs are too hot for me. Is there a more efficient light bulb that doesn't give off so much heat?

ENERGILOCKS:

Your problem is over, Jack. Switch to compact fluorescent light bulbs. They use one-fourth the energy, give off just as much light, and are cool to the touch.

JACK-BE-NIMBLE:

Thank you, Energilocks; you sure are energy savvy. Here is my friend, Simple Simon. Can you help him? He needs advice about energy savings on the way to the pie man.

SIMPLE SIMON:

I'm always on the road, and it's costing me a fortune in fuel. How can I save energy?

ENERGILOCKS:

The solution is simple. Keep your car tuned, don't drive over the speed limit, remove unnecessary pies from the trunk, never make jackrabbit starts and stops, and consider purchasing a hybrid vehicle as your next "Pie-Mobile."

SIMPLE SIMON:

A hybrid vehicle? Is that like half pumpkin, half apple?

ENERGILOCKS:

Silly Simon. A hybrid vehicle uses both gasoline and a battery as its energy source. A hybrid generally gets better gas mileage than a similar-sized vehicle powered only by an internal combustion engine.

CARETAKER, JACK-BE-NIMBLE, SIMPLE SIMON:

(Walking off) Thank you so much.

ENERGILOCKS:

You're welcome. *(Looks at watch)* Oh dear. It's 3:33. I was supposed to be at the three bears' house at three o'clock. I hope they waited for me. *(Runs off.)*

CHORUS:

Saving energy is smart! Now is the time to start! Switch to fluorescent light. Energy savings will be bright!

SCENE II

(Setting: A road. Three bears in a car enter.)

MAMA BEAR:

What's the matter, Papa? We are BEARly moving.

PAPA BEAR:

The car just stalled. Oh, I can't BEAR being late for our energy survey appointment with Energilocks.

MAMA BEAR:

Do you think it has any BEARing on the old oil and air filters I told you to change last week?

BABY BEAR:

I bet it does. Last week, Energilocks came to our school to tell us about ways to save energy. She said cars that BEAR clean oil and air filters get better gas mileage. Checking your tire pressure often helps save gasoline, too.

PAPA BEAR:

It's emBEARassing to break down like this, especially when all you need is a tune up.

MAMA BEAR:

Now our porridge is going to get cold and be BEARly edible by the time we get home.

BABY BEAR:

I can BEAR to eat our porridge cold if you can.

CHORUS:

Saving energy is smart! Now is the time to start! Switch to fluorescent light. Energy savings will be bright!

SCENE III

(Setting: The Three Bears' house. Energilocks knocks. No answer.)

ENERGILOCKS:

What's this, a note?

(Reading) Took Baby Bear, went to pick up Mama Bear, who carpools to work with the Three Blind Mice. If we are late, BEAR with us and please wait inside. The door is unlocked. Papa Bear. *(Enters house. A moment later there is pounding at door.)*

ENERGILOCKS:

Who could that be? Yes?

WOLF:

Open up in there, or by the hair of your chinny-chin-chin, I'll huff and I'll puff and I'll blow your house in.

ENERGILOCKS:

Who are you and what do you want?

WOLF:

I am THE BIG BAD WOLF, and I am looking for the third little piggy!

ENERGILOCKS:

(Letting him in.) Well, this is not the third little piggy's house. It's the three bears' house.

WOLF:

Well, that's a relief!

ENERGILOCKS:

Why do you say that?

WOLF:

This house looks strong and well insulated, I'm not sure I could demolish it. The first two pigs' houses were a breeze.

ENERGILOCKS:

I don't doubt it. I warned those pigs that they needed to install weather-stripping and caulking around their windows and doors to keep energy in and trouble out.

WOLF:

Today will be the demise of the third little piggy's house.

ENERGILOCKS:

How many times have I told you characters you can save energy if you plan your trips carefully? Was this third trip to the forest really crucial? You could have huffed and puffed and blown all their houses down in one energy-saving trip.

CHORUS:

Saving energy is smart! Now is the time to start! Switch to fluorescent light. Energy savings will be bright!
(Door opens)

RUBBA, DUB (1), AND DUB (2):

Oh, hi, Energilocks. We were looking for you.

WOLF:

I'm the BIG BAD WOLF. Who are you?

RUBBA:

How do you do? My name is Rubba, this is my brother Dub, and this is my other brother Dub.

ENERGILOCKS:

How can I help you?

DUB (1) AND DUB (2):

You know the three of us promote saving energy in our plumbing and bathroom supply business. (*Hand a card to Wolf.*) Here is our card.

WOLF:

(*Reading*) THREE MEN IN A TUB!

RUBBA:

We were only thinking about saving the energy used to make hot water—that's about one-fifth of a home's energy budget.

ENERGILOCKS:

Well, I must say that the three of you know many good ways to save energy when heating water.

DUB (1) AND DUB (2):

We give everyone we meet advice on how to save energy. Like don't take long hot showers, and use cold water whenever possible.

ENERGILOCKS:

Did you guys finish that job over at the third pig's house?

RUBBA:

Yes, we just installed an insulating blanket around the hot water heater to save energy. In fact, his house is one of the most energy efficient houses in Storyland. He told me, my brother Dub, and my other brother Dub that we could show it to Storyland characters who want to save energy. It has plenty of insulation in the walls and attic, too.

WOLF:

Are you telling me that his house is so well built and energy efficient that my huffing and puffing can't blow it in?

ENERGILOCKS:

Exactly. Let's go over to the pig's house and see all the ways he saves energy.

WOLF:

Is anyone hungry?

ENERGILOCKS:

The three bears did leave these bowls of porridge cooling here on the table. But the porridge is too cold.

DUB (1) AND DUB (2):

The three bears have the latest energy saving appliances. We can heat the porridge up efficiently in the microwave.

WOLF:

Do you think they'll mind if we have just a little?

ENERGILOCKS:

I don't think they'll mind...do you?

CHORUS:

Saving energy is smart! Now is the time to start! Save on energy everywhere. The time has come...

WE ALL SHOULD CARE!!!!

(*Entire cast lines up for the curtain call. Repeat chorus several times.*)

CAST AND CHORUS:

Saving energy is smart! Now is the time to start! Save on energy everywhere. The time has come...

WE ALL SHOULD CARE!!!!

Teacher Guide

Charlie Brown

KEY CONCEPTS

1. There are many different ways to save energy.
2. Each person is responsible for making educated energy decisions.

ENRICHED VOCABULARY WORDS

admirably
compact fluorescent
conservation
counselor
deciduous tree
efficient
incandescent
materialistic
programmable thermostat
recycle

ASSESSMENT

1. List at least three energy saving tips from the play. (*Deciduous trees shade the sun's rays in the summer, but allow light through in the winter. Installing programmable thermostats saves energy. Recycling one aluminum can saves enough energy to power a TV for three hours. Riding bikes is an efficient mode of personal transportation. Compact fluorescent light bulbs cost more money initially, but save money in energy costs in the long run. Taking a bath in the winter can help to heat the room. You can save one-third of a home's heat loss through windows by installing and using drapes. Decide what you want before you open the refrigerator door. To stop drafts, you should install weather-stripping and caulk windows. If you have to wait in your car more than 60 seconds, it saves energy to turn off the engine. You can save three percent on your energy bill for every degree you lower your thermostat in winter.*)
2. Charlie shows which character traits throughout the story? Use details from the play to back up your opinions. (*Hope, as evidenced by his positive outlook on the beginning of the ball season. Fair play, as evidenced by his unwillingness to throw a "bean ball." Lack of self-confidence, as evidenced by phrases such as, "I'm a failure. I can't do anything right. I'm a born loser." Hard work, as evidenced by going home to study for the contest. Self-confidence, as evidenced by his attitude changes during the energy contest.*)
3. What are some energy saving activities you could do in your home or in your daily life? (*Answers will vary.*)

EXTENSIONS

1. Add in dialogue for the Adult. Make sure to look at sentences around the adult's words to put in things that would make sense.
2. Make a Charlie Brown brochure for Saving Energy at Home. Try to put at least 10 tips into the pamphlet.
3. Which character would you most like to be friends with? Why?

Charlie Brown

CAST OF CHARACTERS

Charlie Brown:	A not-so-confident student
Lucy:	A sometimes overly confident student
Peppermint Patty:	An athletic student
Linus:	Lucy's younger brother
Chorus:	Class
Adult Voice:	Class
Schroeder:	A deep thinking student
Franklin:	A student
Pig Pen:	A rather messy student
Sally:	Charlie Brown's younger sister
Little Redheaded Girl:	A student
Contestant One:	A student
Contestant Two:	A student
Contestant Three:	A student

SCENE I

(Setting: The pitcher's mound on the ball field that has seen all of Charlie Brown's losses. It is the first day of a new season. Charlie Brown is standing alone on the pitching mound contemplating a ball in his hand.)

CHARLIE BROWN:

I love the first day of a new season. Hope springs eternal. I love the smell of the new mown grass in the outfield, the crisp white lines in the infield. This could be the season for Team Peanuts.

(Lucy enters from left, Linus and Peppermint Patty enter from right.)

LUCY:

Look at you, Charlie Brown. You're dreaming again, aren't you? It's NOT going to happen! You'll still throw the same old pitches, the other team will still hit them, and Peppermint Patty is still the only one that'll get a hit for our team.

PEPPERMINT PATTY:

Hi, Chuck. Are you ready to throw today?

(Lucy lies down on the mound, looking up at the sky.)

LINUS:

I can't wait for the game to start. It's always good to get that first loss behind us.

LUCY:

Hey, guys. Look at these cloud formations.

(They all lie down on the mound.)

CHARLIE BROWN:

I could spend all day watching the clouds.

PEPPERMINT PATTY:

You know, Chuck, if you use your imagination, you can see all sorts of things in clouds.

LUCY:

What do you see, Patty?

PEPPERMINT PATTY:

(Pointing) I see a tree right over there.

CHORUS:

Saving energy's smart. Here's one way to start.

CHARLIE BROWN:

That would be a deciduous tree the way its branches spread out. Do you know a deciduous tree is good for saving energy? In the summer, it provides shade from the sun. In the winter when its leaves are gone, it lets the sun shine on your house.

PEPPERMINT PATTY:

What do you see, Linus?

LINUS:

(Pointing) That looks like a thermostat to me.

CHORUS:

Saving energy's smart. Here's one way to start.

CHARLIE BROWN:

Do you know that if you install a programmable thermostat in your house you can save a lot of energy?

LUCY:

That looks like a can of soda over there.

CHORUS:

Saving energy's smart. Here's one way to start.

CHARLIE BROWN:

If you recycle one aluminum can, the energy you save could run a TV set for three hours.

LINUS:

Boy, Charlie Brown, you sure know a lot about energy.

CHARLIE BROWN:

I learned great stuff at that NEED workshop last month.

LUCY:

Oh, yeah, plant a tree. In twenty years you'll get some shade. Great stuff, Charlie Brown, did they teach you anything you can do in real life, like how to pitch?

(The rest of Team Peanuts enters. Everyone talks, high-fives, etc.)

ADULT VOICE:

Wah...wah!

PEPPERMINT PATTY:

Okay, team. We can beat these guys. A little hustle now.

CHORUS:

Saving energy's smart. Here's one way to start.

CHARLIE BROWN:

(To Linus) Look, Linus. The other team rode their bikes to the game. Do you know bikes are the most efficient form of personal transportation?

LUCY:

Never mind that useless information. I've got a plan. I know their first batter. He's good. I want you to throw a bean ball at him.

CHARLIE BROWN:

I can't do that.

LINUS:

Sure you can, Charlie Brown. Just try to throw a strike.

CHARLIE BROWN:

No, I mean it wouldn't be right.

LUCY:

(Yelling) Wouldn't be right? Look who's getting moral on us. You wanna win, don't you? *(To team)* Ol' wishy-washy, here, won't throw a bean ball.

SCHROEDER:

Moral? How exactly would you define moral? Do you consider our materialistic consumer-driven society moral?

FRANKLIN:

What about the morality of wasting energy?

PIG PEN:

Is it more immoral to throw a bean ball than to waste energy?

LINUS:

What is the relative morality of a spitball?

PEPPERMINT PATTY:

Chuck, just do your best, I always say.

ADULT VOICE:

Wah...wah...wah...wah...wah.

(Team spreads out around the stage. Charlie Brown remains on mound.)

CHARLIE BROWN:

Good Grief. We might not win any games, but we sure have interesting discussions at the mound.

(Charlie Brown throws first pitch. Everyone exits.)

SCENE II

(Setting: Charlie Brown's room. Linus and Charlie Brown are working on a lamp.)

LINUS:

I think this is gonna be a great project, Charlie Brown.

CHARLIE BROWN:

The best, Linus. We'll show everybody how energy-efficient lighting can save lots of energy. Did you get that compact fluorescent bulb from the store?

LINUS:

I got it, Charlie Brown. But it sure was expensive when the old incandescent bulbs are so cheap.

CHORUS:

Saving energy's smart. Here's one way to start.

CHARLIE BROWN:

They might seem expensive, Linus, but they last so much longer and use so much less electricity that, in the long run, you save a bundle of energy AND money using compact fluorescents. *(Pause)* Now, if I can only get this thing wired up we'll be done. Maybe this time I can get something right. I'm tired of being a failure. There! That ought to do it.

LINUS:

Can I try it out, Charlie Brown?

CHARLIE BROWN:

Go for it, Linus. *(Linus claps his hands twice. Nothing happens.)* See, I can't even get the Clapper to work.

(Charlie Brown buries head in his hands.)

LINUS:

(Solemnly) We are so close to controlling millions of light bulbs in homes all across America.

(Sally enters.)

SALLY:

Hi, Linus. You look very nice today. What's the matter with you, big brother? *(Begins to fiddle with lamp.)* You're looking a little depressed. How's your energy project going?

CHARLIE BROWN:

I am depressed. I can't do anything right. First, I lost the ball game and now I can't get my Clapper to work.

SALLY:

It wasn't your fault the other team scored. The ball knocked you out.

CHARLIE BROWN:

But it was my first pitch. I'm a born loser. Watch this. *(Claps hands twice. The light comes on.)* Oh, good grief. Even my little sister is better than I am. I'm a failure.

LINUS:

Charlie Brown, I'm sure you can be a winner at something.

ADULT VOICE:

Wah...wah...wah...wah...wah.

CHARLIE BROWN:

A bath! See what I mean? Baseball players get sent to the showers. I have to take a bath.

LINUS:

Lucy says baths waste energy. She takes showers instead. Is she right, Charlie Brown?

CHORUS:

Saving energy's smart. Here's one way to start.

CHARLIE BROWN:

Not necessarily, Linus. Long showers waste hot water, too. And in the winter, the hot water in the tub can help heat the room, saving energy.

LINUS:

You sure know a lot about energy conservation, Charlie Brown.

CHARLIE BROWN:

(There is a knock at the door.) Come in.

(Lucy enters.)

LINUS:

Gee, Charlie Brown, if you could help all those energy losers learn about conservation, you'd be a winner, then, wouldn't you?

LUCY:

Charlie Brown, a winner? That's a joke. What about that ball game this morning? You shoulda beaned that guy, like I told you. You need professional help, Charlie Brown. *(Lucy sets up "The Psychiatrist Is In" sign.)*

CHARLIE BROWN:

Maybe I do need help.

LUCY:

You can tell me anything.

CHARLIE BROWN:

Anything! That's just it. I can't succeed at anything. I'm a failure. I'd be happy if I could just dread one day at a time.

LUCY:

Well, look on the bright side. At least you don't carry around a dumb ole' blanket like my goofy brother over there.

LINUS:

My blanket is a necessity. It's my best friend!

LUCY:

Let me tell you, Charlie Brown, it isn't easy going through life with a brother like that. It's so embarrassing to have everybody at school always asking me why he carries around that stupid blanket. I get depressed, too, you know. Why, just last week....

CHARLIE BROWN:

Hey, I thought I was supposed to be telling you MY problems.

LINUS:

Charlie Brown, I think you can be a winner.

LUCY:

A winner at what, little brother? Tell me just one thing Charlie Brown can do.

LINUS:

Energy! That's what! I know you could win that Energy Conservation Contest, Charlie Brown. You know everything about energy.

LUCY:

He'll choke, Linus. Without my professional help, he'll choke.

CHARLIE BROWN:

You really think I could win that contest, Linus?

LINUS:

I know you can. Didn't that NEED workshop teach you how to be a leader? You can do it, Charlie Brown.

CHARLIE BROWN:

I can? *(Pause)* I can. I know I can! I'm gonna be a winner!

LUCY:

Wait'll I tell the gang about this.

(Lucy exits.)

LINUS:

I'll even let you borrow my blanket for luck.

CHARLIE BROWN:

I'd better start studying right away. Thanks, Linus, for your confidence.

(Both exit.)

SCENE III

(Setting: A classroom. The whole gang is sitting in chairs. Linus is in the front row beside Charlie Brown, Lucy is seated behind him.)

LUCY:

You're not really gonna enter this contest, are you, Charlie Brown? As your counselor, I must tell you I don't think you're ready.

CHARLIE BROWN:

(Loudly) I can do it!

ADULT VOICE:

Wah...wah...wah...wah...wah?

CHARLIE BROWN:

Actually, ma'am, I'd like to be in the contest.

(Lucy covers her face with her hands.)

SCHROEDER:

He'll be competing against the best energy students in the school. But it seems to me that Charlie Brown really knows his stuff.

LINUS:

He went to that energy workshop last month, remember?

CHARLIE BROWN:

I went over my Infobook and notes last night. I know I can be a winner with NEED information.

PEPPERMINT PATTY:

I'll be rootin' for you, Chuck.

FRANKLIN:

Me, too, Charlie Brown. Score a big one for the team.

LITTLE REDHEADED GIRL:

You can do it, Charlie Brown.

PIG PEN:

Clean sweep, Charlie Brown.

ADULT VOICE:

Wah...wah...wah...wah...wah.

(Contestants One, Two, and Three move to front of room. They have numbers on their chests.)

LINUS:

Here's my blanket, Charlie Brown. Good luck.

ADULT VOICE:

Wah...wah?

CHARLIE BROWN:

Yes, ma'am, I'm coming. *(Charlie Brown moves to end of line.)* *(To Linus)* I hope I don't mess this up.

ADULT VOICE:

Wah...wah...wah...wah...wah...wah...wah?

CHORUS:

Saving energy's smart. Here's one way to start.

CONTESTANT ONE:

(Loudly) You can save one-third of a home's heat loss through windows by installing and using drapes.

ADULT VOICE:

Wah...wah...wah...wah...wah...wah?

CONTESTANT TWO:

The EnergyGuide labels on appliances that let consumers compare cost and energy usage are...RED?

ADULT VOICE:

Wah...wah...wah...wah...wah. *(Contestant Two sits down. Charlie Brown raises his hand.)* Wah...wah...wah?

CHARLIE BROWN:

I believe the labels are yellow, ma'am.

ADULT VOICE:

Wah...wah...wah...wah...wah...wah?

CHORUS:

Saving energy's smart. Here's one way to start.

CONTESTANT THREE:

(Loudly) Decide what you want before you open the refrigerator door. *(Class cheers.)*

LINUS:

It's Charlie Brown's turn.

SCHROEDER:

I'm sure he will perform admirably.

ADULT VOICE:

Wah...wah...wah...wah...wah...wah?

CHARLIE BROWN:

(Nervously, but loudly) New passenger cars today average 30 miles per gallon.

(Long pause. Everyone looks to right where adult voice is located.)

ADULT VOICE:

Wah...wah. *(Class cheers.)*

LINUS:

Nice going, Charlie Brown.

ADULT VOICE:

Wah...wah...wah...wah...wah...wah?

CONTESTANT ONE:

One tenth?

ADULT VOICE:

Wah...wah...wah...wah.

(Contestant One sits down. Charlie Brown holds up his hand.) Wah...wah?

CHARLIE BROWN:

(Loudly with more confidence) One-fifth of the energy used in the home is to heat water.

ADULT VOICE:

Wah...wah. *(Class cheers.)*

LUCY:

Wow! I can't believe he's doin' it. There are only two contestants left. Go, Charlie Brown. You CAN do it.

ADULT VOICE:

Wah...wah...wah...wah...wah...wah...wah?

CHORUS:

Saving energy's smart. Here's one way to start.

CHARLIE BROWN:

(Loudly, proudly) To stop drafts, you should install weather-stripping and caulk windows. *(Class cheers loudly.)*

SCHROEDER:

Way to go, Charlie Brown.

ADULT VOICE:

Wah...wah...wah...wah...wah...wah?

CHORUS:

Saving energy's smart. Here's one way to start.

CONTESTANT THREE:

If you have to wait in your car more than 60 seconds, it saves energy to turn off the engine. *(Class cheers.)*

ADULT VOICE:

Wah...wah...wah...wah...wah...wah...wah?

PEPPERMINT PATTY:

Come on, Chuck, you can do it!

CHORUS:

Saving energy's smart. Here's one way to start.

CHARLIE BROWN:

You can save three percent on your energy bill for every degree you lower your thermostat in winter. *(Class cheers.)*

ADULT VOICE:

Wah...wah...wah...wah...wah?

CONTESTANT THREE:

Umm...incandescent bulbs are more efficient than fluorescent?

ADULT VOICE:

Wah...wah.

CHARLIE BROWN:

The right answer is that fluorescent bulbs are more efficient—four times more.

LINUS:

If Charlie Brown gets this one right, he'll be the winner.

ADULT VOICE:

Wah...wah...wah...wah...wah...wah?

CHARLIE BROWN:

The purpose of home insulation is... *(He drops Linus' blanket.)*

LUCY:

He's choking. I knew he'd choke. I told him he'd choke. I can't look! *(Head in hands again.)*

CHARLIE BROWN:

(Picks up blanket.) Blanket...blanket... *(Shouting)* That's it. Insulation acts like a blanket for your home. It keeps the heat in during the winter and keeps it out during the summer. *(Class cheers loudly. Congratulations, Yea, Charlie Brown.)*

LINUS:

You did it, Charlie Brown.

CHARLIE BROWN:

I did it! I really did it! I'm a winner!

ADULT VOICE:

Wah...wah...wah...wah...wah...wah!

(Linus, Schroeder, and Peppermint Patty crowd around Charlie Brown. Other students exit.)

LINUS:

You're a winner, Charlie Brown. I knew you could do it.

SCHROEDER:

Congratulations, you did a fine job, Charlie Brown.

PEPPERMINT PATTY:

Great job, Chuck. Home run.

CHORUS:

Saving energy's smart. That's why we should start.

Teacher Guide

Aladdin

KEY CONCEPTS

1. Natural gas is made of methane, propane, and butane.
2. Methane is found as a gas and must be transported by pipeline.
3. Propane and butane are found as gases but can be easily compressed into liquids for transportation.

ENRICHED VOCABULARY WORDS

abundant
brine
Btu
compressed
desalinate
envious
malcontent
portable
sustainable
vapor

ASSESSMENT

1. Which of the gases that compose natural gas can be easily turned into liquids? (*Propane and butane*)
2. Which gas is most abundant? (*Methane*)
3. Where in the world do you think the country of Skuwatt would be located? Support your answer. (*The country of Skuwatt is most likely located in the Middle East. A country such as Iran, Saudi Arabia, Oman or Yemen would have similar energy resources, desert land, and salt water nearby.*)

EXTENSIONS

1. Make a solar water desalination plant.
 - a. Fill a large plastic bowl with one inch of water mixed with two tablespoons of salt.
 - b. Place one empty glass upright into the middle of the bowl making sure it remains empty.
 - c. Cover the bowl with plastic wrap and seal with tape. Place a small rock in the middle of the plastic wrap directly over the glass but not touching it.
 - d. Place the bowl in a sunny location. Record observations over the next few days.
2. Research how industry uses natural gas, methane, propane, and butane.

Aladdin

CAST OF CHARACTERS

Aladdin:	A poor commoner
Jasmine:	Aladdin's love and daughter of the Sultan
Earth Genies:	Class
Gen Propane:	Methane's brother, an Earth Genie
Gen Butane:	Methane's sister, an Earth Genie
Gen Methane:	The Earth Genie of Natural Gas
Sultan:	Ruler of Skuwatt

(Setting: The country of Skuwatt [pronounced "Squat"]. Jasmine and Aladdin are walking together along a shore.)

ALADDIN:

Your father will never accept me, Jasmine. He does not understand our love.

JASMINE:

It has been so long since love touched his heart, he does not remember.

ALADDIN:

But why has he not loved for so long?

JASMINE:

He spends all his time trying to find enough water to supply his country. He says he has no time for love.

EARTH GENIES:

Water, water everywhere, but not a drop to drink.

ALADDIN:

(Pointing to the sea.) Jasmine, look at all that water and yet the land of Skuwatt is a desert.

JASMINE:

This land would be a paradise if we could only free the water from its salty brine.

ALADDIN:

There must be a way to make the water useful to us.

JASMINE:

There is, Aladdin. But it takes enormous energy to desalinate the water—energy we do not have.

ALADDIN:

If only I could find an abundant energy source—surely your father would accept me then.

(Aladdin trips on a metal cylinder buried in the sand. He picks it up and shakes it.)

JASMINE:

What have you found, my love? Listen! It has a liquid inside. I hope it's something to drink. I'm thirsty, aren't you?

(Aladdin struggles to open bottle. As the top comes off, there is a giant commotion—lights, noise, confetti, and Propane and Butane appear dressed as genies.)

PROPANE:

(Gloriously loud and stretching) Free! Free at last after so many years bottled up as a liquid.

BUTANE:

Free, my brother! You're a real gas again.

ALADDIN:

Who are you?

JASMINE:

What are you?

PROPANE:

I am none other than the awesome Gen Propane and this flaming beauty is my sister, Gen Butane. We are twin brother and sister to the Grand Vapor of the Earth Genies—Gen Methane. I'm sure you've heard of him.

EARTH GENIES:

Ooohhh, the Grand Vapor.

JASMINE:

Of course, I was taught all about Gen Methane when I was a child—he's the powerful Earth Genie of Natural Gas. He and the Earth Genies of Coal and Petroleum are the Great Fossil Fuel Gens.

ALADDIN:

And we were also taught about the Great Sky Genies—Oxygen and Hydrogen. It is legend how they combined their power to form the most important resource of all—water.

JASMINE:

But why have we never heard of you two? You must be a family secret.

PROPANE:

Probably because we have been trapped in that bottle for thousands of years.

BUTANE:

Our powerful and abundant brother, Methane, was jealous of our power and put a spell on us in the form of moderate pressure—that's all it takes to turn us into liquids. He put us in this bottle and buried us underground.

EARTH GENIES:

Malcontent Methane makes up the natural gas majority.

ALADDIN:

Why was he envious of you?

PROPANE:

I guess he wanted to be the only Gen to provide the gift of clean burning energy. My sister and I are able to do most of the jobs he does.

JASMINE:

What kinds of jobs?

BUTANE:

Heating buildings, cooking food, heating water, and generating electricity, to name a few.

PROPANE:

Not to mention we have about the same Btu content.

ALADDIN:

What's a Btu?

EARTH GENIES:

A British thermal unit.

(Butane holds up cue cards that read: Btu=British thermal unit/1 Btu =/the energy to heat/one pound of water/one degree Fahrenheit.)

PROPANE:

But the real reason Methane is so jealous is that we can go anywhere, and he can only go where there is a pipeline. You see, we're portable. Put a little pressure on us and you can take us anywhere. We're known in the family as the Bottled Gases.

EARTH GENIES:

Pressurizing Propane makes him portable.

BUTANE:

That's right. When we're compressed into a liquid, we take up 270 times less space than as a gas, so we can fit into a small bottle.

EARTH GENIES:

Bottling Butane makes her beneficial.

JASMINE:

No wonder Methane is jealous if you can go anywhere and he can't. I'll bet there are a lot of places where it doesn't make sense to build a pipeline, like in wilderness areas and sparsely populated areas like farming communities. I'll bet you make great travelers.

ALADDIN:

How long have you two been in that bottle, anyway?

PROPANE:

Ever since we were formed from the remains of plants and animals millions of years ago.

ALADDIN:

You must be really angry with your brother.

BUTANE:

Well, we were for the first million years or so—the pressure really got to us. Then, we decided to just go with the flow and reward our discoverer with five wishes upon our release.

JASMINE:

Five wishes? Aladdin gets five wishes? *(To Aladdin)* What will you wish for, my darling?

PROPANE:

Riches beyond belief?

BUTANE:

Your name in Arabian lights?

PROPANE:

To be a star in a Disney movie?

ALADDIN:

Hummm! *(Aladdin looks at Jasmine)* Naah! I do wish Jasmine's father would accept our love.

PROPANE:

I can do that. Let's see, one little POOF and...

ALADDIN:

Wait, wait. I want the Sultan to accept us without magic. *(Jasmine nods in agreement.)*

BUTANE:

Now, brother. Don't put so much pressure on him.

ALADDIN:

Well, I don't want to wish for something just for myself. I do wish that the land of Skuwatt had an abundant energy source.

PROPANE:

That's a mighty powerful wish. Let's see what I can do. *(Methane enters with the same commotion as Propane and Butane.)*

METHANE:

That wish is too much for you to handle on your own, Mister and Miss Energy-in-a-can. So the family secret has finally come out of the bottle.

PROPANE:

Well, big brother, you still think your Btu's are better than ours, I see.

METHANE:

It's as plain as the chart in your hand. *(Propane holds up a pie chart that shows the breakdown of natural gas is 90 percent methane, five percent propane, and five percent butane and other gases.)*

METHANE:

Methane wins by a landslide.

EARTH GENIES:

Malcontent Methane makes up the natural gas majority. Pressurizing Propane makes him portable. Bottling Butane makes her beneficial.

BUTANE:

Try to build a pipeline in some areas and you might cause a landslide, hot head. You might be big, but there's a real need for us out there, too. Why don't we work together as a family, big brother? We'd make a hot team.

ALADDIN:

Hey, wait! Do I get my wishes or not?

(The three genies put their heads together and whisper.)

METHANE:

We will arrange with the rest of the Earth Genies to give this land energy in abundance—oil and natural gas—the sources of propane.

ALADDIN:

Oh, thank you. I'll dream of genies the rest of my life. I just wish the Sultan of Skuwatt were here to witness this day.

EARTH GENIES:

POOF!

PROPANE:

Heeeeeeeeeeeeeere's Sully! *(The Sultan appears.)*

SULTAN:

What am I doing here? *(Pointing to Aladdin)* What are you doing here with that commoner?

JASMINE:

Wait 'til you hear what Aladdin's done for Skuwatt...

SULTAN:

I don't want to hear squat from him. *(Noticing Butane)* Who might this be?

BUTANE:

I am Gen Butane.

SULTAN:

And I am the Sultan of Skuwatt. I have built this kingdom with the sweat of my brow using the lumber from the Arabian Forest.

BUTANE:

You mean the Arabian Desert, don't you?

SULTAN:

Well, maybe I used a little too much wood. I guess I worked too hard for our own good.

BUTANE:

Come with me, Sire, and I'll explain what is going on. *(They move upstage.)*

PROPANE:

Don't get your hopes up, Aladdin. I don't think good deeds can melt that old man's heart. Only love can do that.

METHANE:

He's right, my boy. Propane and I can heat two-thirds of the homes and fuel power plants to light whole cities, but we can't warm the Sultan's heart. I will go to speak with the rest of the Earth Genies. *(Methane exits.)*

ALADDIN:

There must be some way to warm his heart. Speaking of warm—I'm burning up. I sure wish you could make me an ice cream shake.

PROPANE:

Your wish is my command.

EARTH GENIES:

POOF!

(Aladdin begins to scream and shake.)

JASMINE:

(Yelling) He didn't say make him scream and shake—he said an ICE cream shake.

ALADDIN:

(Still screaming and shaking.) I wish I were back to normal.

EARTH GENIES:

POOF!

PROPANE:

You're back to normal. Sorry about that, Al. You've used up four wishes. What will your last one be? *(Butane and the Sultan return. Speaks to Butane)* Hey, Sis. One last wish to fill and we can blow this Popsicle stand.

SULTAN:

Butane, I don't want you to go. I think I have fallen in love with you. You really light my fire.

BUTANE:

And I have warm feelings for you, too, Sire.

ALADDIN:

Jasmine, let's talk about this together. *(They huddle together talking; then Aladdin speaks to Propane.)* My last wish is that Butane be turned into a cartoon character.

PROPANE:

But that's impossible. She is my sister and a genie. *(To Butane)* Is the Sultan pressuring you?

BUTANE:

Do I look like a liquid? Please, my brother.

PROPANE:

As you wish. You shall be a cartoon character.

EARTH GENIES:
POOF!

(Butane and the Sultan embrace.)

SULTAN:

And now a gift for you, Aladdin. I give you and Jasmine my blessing. I return Butane's warmth to you both. We're off to develop sustainable energy resources for Skuwatt. Maybe I can even reclaim the Arabian Forest in time.

ALADDIN:

Thank you, Sire. I wish you both a warm and happy life.

Teacher Guide

The Jetsons: Trouble in the Sea of Tranquility

KEY CONCEPTS

1. Energy use in the future may be different than energy use today.
2. Using nonrenewable energy sources wisely can increase the time they are used.
3. Different energy sources are best suited for different locations and uses.

ENRICHED VOCABULARY WORDS

bellowed
emulate
erratic
ionosphere
manufacturing
photovoltaics
sabotage
traitor
tranquility
waste-to-energy

ASSESSMENT

1. What is the real reason behind Luna Spacely needing to refund ticket prices? (*Employees are calling off sick so rides are unable to operate. The employees are calling off to make Mr. Spacely aware of their unhappiness with his policy on dumping garbage in craters.*)
2. List three different energy sources from the play and describe how they are used. (*Solar is used to heat water and generate electricity, biomass, or waste-to-energy, is used to make electricity, lunathermal energy is used to generate heat, fossil fuels are used to make products, hydropower is used to generate electricity.*)
3. Draw a picture of the amusement park. Use details from the story to make it accurate.
4. Make a VENN diagram comparing the Jetson's world to ours. How have things changed? What things are still the same? (*Changed: fusion energy being used on earth, trips to the moon are commonplace, fossil fuels used only for manufacturing. Same: waste disposal is an issue, amusement parks are family vacation destinations, photovoltaics are used to generate electricity, brothers and sisters pick on each other.*)

EXTENSIONS

1. Write another scene for the play where the Jetson's house is shown with the sources of energy they use there.
2. Write a story about Judy or Elroy time traveling to visit you. What things would you show them?
3. There are several examples of alliteration in the play. Find at least five; then use the enrichment words in sentences that use alliteration.
4. How would Martin Luther King, Jr. have reacted to the situation at Lunar Spacely? What might he have suggested the employees do?

The Jetsons: Trouble in the Sea of Tranquility

CAST OF CHARACTERS

Cosmo Spacely:	President of Spacely Entertainment, Inc.
RoboBoss:	Mr. Spacely's executive management android
George Jetson:	An employee of Mr. Spacely
Jane Jetson:	His wife
Judy Jetson:	Their daughter
Elroy Jetson:	Their son
Tour Guide:	An employee at Luna Spacely
Cher Nobyl:	An employee at Luna Spacely
Tourists/Employees:	Class

SCENE I

(Setting: The Spacely Entertainment, Inc. office headquarters.)

SPACELY:

I have just been informed we are not making a profit at Luna Spacely Amusement Park. What is going on?

ROBOBOSS:

We have had to refund ticket prices because some of the rides are unable to operate.

SPACELY:

It must be sabotage! I need to find out what is at the bottom of this. *(Yells)* Jetson!!

(George enters office.)

GEORGE:

You bellowed, Mr. Spacely?

SPACELY:

(Jumping with fright) Jetson, don't ever sneak up on me like that. Now what do you want?

GEORGE:

You called for me, sir.

SPACELY:

I did? What did I want you for? RoboBoss, why did I want Jetson?

ROBOBOSS:

We were discussing the sabotage at Luna Spacely, sir.

SPACELY:

Right. But why did I want Jetson?

ROBOBOSS:

Perhaps you wanted to send one of your most loyal and competent employees to Luna Spacely to investigate the unrest, sir.

SPACELY:

Right. But what did I want Jetson for?

ROBOBOSS:

To send to Luna Spacely, sir.

SPACELY:

Let's not debate the issue. *(To George)* Jetson, since all the competent employees are on vacation right now, and at least you are loyal, I want you to go up to Luna Spacely immediately and find out who is sabotaging my park. RoboBoss will fill you in.

GEORGE:

Yes, sir, Mr. Spacely. Right away, Mr. Spacely. You can count on me, sir. I'll round up those saboteurs. They're no match for me, sir. Just call me the Eliminator!

SPACELY:

No name games, Jetson. Just go.

GEORGE:

Yes, sir. I'm going, sir.

(George and RoboBoss move to right of stage, talking softly. There is a noise offstage to the left.)

SPACELY:

(Glances up from his desk) What was that? Maybe it's one of those saboteurs. *(He runs offstage and pulls Jane back in, screaming.)* I've got you now, you traitor.

JANE:

Mr. Spacely, you've made a mistake, it's me...

GEORGE:

(Running back to Spacely and Jane) Jane! Mr. Spacely, that's my wife.

(Mr. Spacely lets go of Jane.)

JANE:

(Angrily) Well, I never...George, I came to surprise you for lunch and your boss accuses me of being a traitor!

SPACELY:

No, no. You misunderstood me. I didn't say traitor...I...uh...uh...I said, "Take her."

JANE:

(Still angry, with hands on hips glaring at Spacely.) Take her?

SPACELY:

Yes, George. Take her. Why don't you take her with you to Luna Spacely on this assignment? As a matter of fact, why don't you take the kids, too? Make it a family affair.

ROBOBOSS:

That's an excellent idea, sir. Traveling with the family will provide a good cover. *(To Jetson)* You can use the new MTV Astrocar for the trip.

JANE:

A car that can tune in Music Television?

GEORGE:

No, Jane. This car is a Megahertz Teleportation Vehicle. It tunes in energy waves broadcast from today's modern, efficient fusion power stations.

ROBOBOSS:

Mrs. Jetson, please excuse Mr. Spacely's somewhat erratic behavior today. He has spent the last two days previewing the movies to be shown at the Alternate Energy Pavilion next month. He's beginning to emulate some of the characters, I'm afraid.

(All exit.)

SCENE II

(Setting: The Jetsons are in their Astrocar in route to Luna Spacely located near the Sea of Tranquility on the moon. Judy and Elroy are in the back seat.)

JUDY:

Elroy's touching me. Make him stop.

ELROY:

Am not. You're touching me.

GEORGE:

If I have to slow down to sub-orbital speed, you two won't be allowed to go to the Blockbuster Atom Smasher tonight. Just settle down.

JUDY:

Are we there yet? I'm hungry.

ELROY:

Are we there yet? I need to, you know, go.

GEORGE:

Cut it out, kids. It won't be long now. You know there aren't any rest stops in the ionosphere. Just relax and watch for the Interluna Spaceway signs. *(Signs are held up one at a time: Speed Limit 23,000 MPH - Strictly Enforced, Slow - Black Holes Ahead, Caution - Flying Asteroids, Yield to Unmanned Satellites, No Passing Through Meteor Showers, Turn on Laser Beams in Time Tunnels, Last Chance to Get Your Photovoltaics Ahead)*

ELROY:

Photovoltaics everywhere. Why doesn't the moon have fusion energy like Earth, Dad?

GEORGE:

With the moon's airless surface, solar power is very efficient. All the sunlight can reach the surface, without being deflected by the atmosphere like it is on Earth.

ELROY:

But what about on the dark side of the moon, Dad? What do they do for energy?

GEORGE:

Well, right now the dark side isn't populated. But there are plans to sink shafts deep into the moon's core to look for lunathermal energy. If lunathermal energy can be used to heat the dark side—it's very cold, you know, without heat from the sun—then it can be colonized, too.

JUDY:

Geothermal and solar energy were once used on Earth, weren't they, Dad?

GEORGE:

Oh, yes, Judy. All the alternate energy sources—solar, geothermal, wind, hydropower, and biomass—were widely used over the last 100 years to bridge the energy gap between the fossil fuels and today's fusion power.

ELROY:

Dad, we must be almost there. I can see lunar craters from here. Wait, it looks like that crater to the right is filled with garbage. That can't be right!

GEORGE:

Oh, you're right, Elroy. Those are Spacely Enterprise's garbage dumps. Studies have shown that there are enough craters on the moon to hold 1,000 years' worth of trash.

JUDY:

But, Dad, it looks awful. We've had laws about garbage for years on Earth. Why are they allowed to use landfill craters here?

GEORGE:

Mr. Spacely owns the property and is the boss here. We're about to land. Fasten your seat belts. Luna Spacely, here we come.

(They land, get out of their Astrocar, and stretch.)

JUDY:

Can we eat now? I'm starved. Can we please go to the Photosynthesis Food Court? It's my favorite place.

JANE:

Let's go, George. They're featuring their Biomass Buffet today. *(They exit.)*

SCENE III

(Setting: The loading platform for the Yesterday in Energy Time Travel Tram Ride. Tour guide enters with a group of tourists.)

TOUR GUIDE:

Well, folks, I hope you enjoyed your visit to the windmills from 17th century Holland all the way to wind farms in 21st century California.

TOURISTS:

It was very informative, if a bit long-winded.

TOUR GUIDE:

To continue your whirlwind tour, follow me to the wind simulator. In here, we replicate the conditions on Earth to show how wind is produced—right down to the uneven heating of the Earth's surface. Please walk this way. *(Tour guide walks in a funny way—swinging his arms like a windmill—and all the tourists walk the same way as they exit. The Jetsons enter.)*

GEORGE:

Boy, that sure was a great buffet. I really liked the AgriWaste Salad. The fruit pits, corncobs, and rice hulls really hit the spot.

JANE:

And I'm glad they use the alcohol produced from the biomass over at the hospital.

GEORGE:

Well, what do you all want to see first?

ELROY:

I want to go to the Crater Critter Corral Petting Zoo.

JUDY:

I want to go to the Meteor Merchandise Mall.

JANE:

Well, why don't we ride the Yesterday in Energy Time Travel Tram first, since we're right here?

GEORGE:

That's a good idea. And keep your eyes peeled for strange behavior by the employees. I'm here to work, remember.

(The Tour Guide and some Tourists return.)

TOUR GUIDE:

All Aboard! *(Tourists, Judy, Elroy, and Jane get on tram. George is still looking offstage.)* Come on, Jetson, if you want to ride. The Tram is leaving. *(George hurries on.)*

GEORGE:

I wonder how he knew my name.

TOUR GUIDE:

Welcome to the Yesterday in Energy Time Travel Tram Ride. This trip will take you back to 2007 in the U.S.A. Here we go! (*Lights, confetti, or other special effects.*)

TOURISTS:

This is so fascinating. (*Begin coughing and rubbing eyes.*)

ELROY:

(*Coughing and rubbing his eyes.*) Hey, my eyes are burning and my throat feels raw. What is this?

TOUR GUIDE:

We're traveling through a traffic jam in the city. That smell and smoke come from the combustion of fossil fuels—the main source of energy at the time.

JUDY:

Fossil fuels—they used to burn them? Gross! We use them to make lots of different products now.

JANE:

Right, dear. We make lightweight plexiluminum for astrocars and space stations.

GEORGE:

And don't forget the super hard styrosteel we use to build our skyscrapers.

TOURISTS:

Those fossil fuels sure are useful.

JANE:

I'm glad we stopped burning them over the last 100 years, so we have some left for manufacturing.

ELROY:

Dad, is it true that astronauts burned liquid fuels in rockets back then?

GEORGE:

Yes, Elroy. Liquids like oil, solids like coal, and gases like methane, were all burned for energy.

JUDY:

I'm getting hot and thirsty. Can you take us to Niagara Nozzle?

TOUR GUIDE:

I sure can. You can see what rivers looked like in 2007 when they were dammed to provide hydropower. More than 2,000 hydropower plants produced between 5-10 percent of the electricity in the U.S.A. at that time, depending on the amount of rainfall.

JUDY:

I want to ride on the Penstock Flume Ride that connects the storage pool with the lower reservoir.

JANE:

Be careful, dear. It looks dangerous.

TOUR GUIDE:

I'm sorry; it's not in service today.

ELROY:

Can I go surfing in the Tidal Wave Pool that's powered by the tidal energy of the moon?

TOUR GUIDE:

It's out of order, too.

TOURISTS:

Why, is the water too cold?

TOUR GUIDE:

No, the water is always warm, thanks to the abundant solar energy here on the moon. The employees who operate these rides called in sick today. It's happening all over Luna Spacely, Mr. Jetson.

GEORGE:

What's making the employees sick? Is there a lunar virus going around? And how do you know my name?

TOUR GUIDE:

Rumors travel faster than the speed of light up here, sir. We heard Mr. Spacely was sending somebody up here to investigate. We need your help, sir.

GEORGE:

Help with what? I don't engage in sabotage!

TOUR GUIDE:

Neither do we, Mr. Jetson. We think this is the greatest amusement park in the solar system.

GEORGE:

Then why are the employees not working?

TOUR GUIDE:

Because Mr. Spacely won't stop using the moon's craters as garbage dumps, though we've asked him to several times.

(Cher Nobyl and several employees enter, carrying protest signs: Clean Up the Craters/Recycle Now/Burn that Biomass/No More Dirty Dumping.)

EMPLOYEES:

(Chanting) Spacely makes us sick! Spacely makes us sick!

CHER NOBYL:

Mr. Jetson, I'm Cher Nobyl, from the Ukraine. I'm spokesperson for the group. I have a petition signed by all the employees of Luna Spacely asking Mr. Spacely to stop dumping the garbage from the park in the moon craters. We want him to set up a program to recycle as much trash as possible and build a waste-to-energy plant to make electricity with the materials that can't be recycled.

GEORGE:

You're right. We shouldn't be dumping garbage. I'll convince Mr. Spacely that recycling and making energy from trash is just good business.

ELROY:

Dad, if you put the waste-to-energy plant on the dark side, you could provide heat and electricity for energy.

GEORGE:

Good idea, Elroy. I'll talk to Mr. Spacely right away.

CHER:

Get him to sign this conservation contract. *(Hands George a piece of paper.)* Then we'll all go back to work.

GEORGE:

I'm on my way.

CHER:

It'll be so nice to have the Sea of Tranquility back that way again. Thank you, Mr. Jetson.

(Jetsons exit left, waving. Employees exit right.)

Teacher Guide

Midas and the Black Gold Touch

KEY CONCEPTS

1. Petroleum is a nonrenewable energy source.
2. Petroleum is used for transportation.
3. Petroleum is used for manufacturing many products.

ENRICHED VOCABULARY WORDS

asphalt
befuddling
descendants
faux
foiled
manufacture
reasonable
significance
synthetic
vinyl

ASSESSMENT

1. Why is petroleum an important resource? Give at least three examples to support your opinion. (*Answers will vary but may include: Petroleum is used for the majority of transportation in the United States. Petroleum is used to manufacture a variety of goods. Petroleum is used to make medicines.*)
2. List all the things you have used so far today that were made possible because of petroleum. (*Answers will vary, but may include things made of plastic, medicines, and transportation.*)
3. Which do you think is more valuable, gold or oil? Why?

EXTENSIONS

1. Choose five items that are made using petroleum. Research how they were made or if they were in use 50 years ago.
2. Write an imaginative narrative, play or poem about someone who receives a touch that is opposite of the "Black Gold Touch."
3. Compare and contrast Minus' story to that of King Midas.

Midas and the Black Gold Touch

CAST OF CHARACTERS

Minus Midas:	Restaurant owner
Minos Midas:	The son
Addie Midas:	Minus' wife
Minnie Midas:	The daughter
Chorus:	Class

(Setting: The Midas home. Minus is looking through a box. Minos is doing his homework. Addie is surveying the situation from the side.)

MINUS:

Minos, as soon as you finish that report on petroleum, come and help me with this box of old stuff for the garage sale.

MINOS:

(Enters holding book) Pop, it says here that petroleum is a nonrenewable energy source. What does that mean?

MINUS:

It means we can't make more oil and it won't last forever—like my patience—now put that book down and help me! I found this real old stuff in the attic that we might be able to sell.

MINOS:

Is the restaurant doing that bad?

MINUS:

Nobody wants good food served at a reasonable pace anymore. All they want is fast food. Even the new sign I had made doesn't stop people from driving by.

(Holds up sign which reads "Marvelous Meals by Midas.")

MINOS:

(Looking through the box) Hey, Pops, here's a real old letter. It might be worth something. What does it say?

MINUS:

I don't know. It's Greek to me. Go get your sister—she can translate it for us.

ADDIE:

Are you still looking for proof that you are the great, great, great, great, great grandson of King Midas?

MINOS:

We can always hope.

MINNIE:

(Upon entering, Minnie is handed the letter by her mother.) It's a letter from somebody named Midas to his descendants.

ADDIE:

(Looks amazed) Oh, my!

MINOS:

What Midas? THE King Midas?

MINNIE:

It doesn't say, but he must have been important. It has a gold seal at the bottom.

MINUS:

Then it's true. What did I tell you?

CHORUS:

We're rich, we're rich, we're rich!!!!

MINNIE:

What does this mean, Pop?

MINUS:

There is a story in my family that King Midas was my great, great, great, great, great grandfather.

MINNIE:

The guy with the touch of gold? Awesome!

ADDIE:

What does the letter say?

MINNIE:

It says this letter grants the holder King Midas' power to touch anything and change it to the most valuable substance in the world.

MINOS:

Does it tell how to turn things into gold?

MINNIE:

First, it gives a warning. It says a person is wise who knows the true value of things in the world. Then it says that if you touch an object and say the words "Midas touch" that object will...

MINUS:

...turn to gold.

CHORUS:

We're rich, we're rich, we're rich!!!

MINNIE:

It doesn't say gold. It says the most valuable substance in the world.

MINUS:

Well, that's gold, isn't it?

ADDIE:

I'm not so sure.

MINOS:

What else could it be, plastic??

(They all laugh.)

MINOS:

Try it, Pops.

MINUS:

OK. What should I try first?

MINNIE:

Well, rock stars have gold records; why don't we have one? Here is one of my CDs.

ADDIE:

Be careful, Minus! Remember what happened to your great, great, great, great, great grandfather Midas.

MINUS:

I'll be careful. All I have to do is pay attention to what I'm doing. (*Hugging Addie*) The important thing is not to say...

MINNIE/MINOS:

(*Shouting*) Pops!

ADDIE:

(*Shouting*) Minus!

MINUS:

(*Picking up CD*) Gotcha! You thought I was going to say Midas touch. (*Minus drops CD as if it were hot.*)

ADDIE:

What happened?

MINUS:

(*Picking up CD*) Nothing! This isn't working. It didn't change into anything valuable.

MINNIE:

Maybe it doesn't work on everything.

MINUS:

Ask my great, great, great, great, great aunt. It worked on her. What's this CD made of, anyway?

MINOS:

It's plastic, which, according to my report, is made from petroleum.

ADDIE:

Really? They make a lot of CDs—where does all the oil come from?

MINOS:

The big oil-producing states are Texas, Alaska, Louisiana, California, and New Mexico.

MINUS:

Enough about oil. I want the stuff I touch to change into something of value. I have an idea. Hand me that bag. I will need it to put the gold in once I have figured out this Midas touch thing and...

MINNIE:

This bag? Mom, isn't this a faux leather bag?

ADDIE:

Yes, and I just bet I know what material this artificial leather is made out of.

CHORUS:

Oil!!!

MINUS:

This is very befuddling. Is everything made from oil?

MINOS:

A lot of things are. We use so much oil that we have to import two-thirds of our supply from other countries.

ADDIE:

Isn't our own oil good enough?

MINOS:

Sure, but we need more than we produce. We even drill offshore. A fourth of U.S. oil comes from offshore wells.

MINNIE:

Minus, Pop can't concentrate with all this noise—come on, Pop, try again.

MINUS:

OK...hmmmm, I know. Give me a pair of Minos' old shoes. Most families have their children's shoes bronzed. Ours will be made gold by my Midas touch... Foiled again!!

ADDIE:

What now?

MINOS:

Sneakers! Awesome, Pop. I've wanted a new pair of Skechers for weeks. How did you know?

MINUS:

Will you stop that? Your shoes turned into sneakers, but, why?

ADDIE:

And don't give us that oil bit again, because I know for a fact that sneakers are made from rubber, not oil.

MINNIE:

Not so fast, Mom. Today, most rubber is synthetic and synthetic rubber is...

CHORUS:

...made from oil!!

MINUS:

I thought that oil was just a transportation fuel.

MINOS:

About two-thirds of it is used for transportation.

ADDIE:

But a lot of petroleum is used to manufacture products, too, like medicines, fertilizers, plastics, all kinds of things we use every day. I learned that while I was helping Minos with his report.

(Minus picks up a bottle of spring water.)

MINUS:

All this talk has made me thirsty. Let me have some of that water. This Midas touch thing is worthless!

ADDIE:

Minus, don't drink that!

MINUS:

Why not?

ADDIE:

Because if I'm right, it is oil. *(She takes the bottle and looks at it.)* Just as I thought. Your Midas touch does work. But today, gold isn't the only valuable substance. Oil is very, very valuable. Many people call it black gold.

MINNIE:

It says in the letter that the magic touch ends at midnight.

MINOS:

You mean we aren't going to be rich?

MINUS:

Well, I don't need the Midas touch to tell me how valuable oil is. I've learned how oil is important to our business.

MINOS:

Yeah, with our plastic chairs and tables, vinyl floors, and paint on the walls. Even the asphalt in our parking lot was made using petroleum.

MINUS:

It's not just that, Minos. In this modern world, you don't need gold to succeed. All you need is brains. The Midas touch may be gone soon, but I have something better, an idea.

ADDIE:

What is it, Minus?

MINUS:

If people want fast food, we'll give it to them. We'll give them good food fast. I need to call the sign painter.

MINNIE/MINOS:

Why, Pops?

MINUS:

I have learned a valuable lesson about the significance of petroleum today, and we are going to put its energy to work for us.

ADDIE:

I have the sign painter's number right here.

MINUS:

I'm going to tell him to come over and add something to our new sign.

CHORUS:

What?

MINUS:

We deliver!

Teacher Guide

The Simpsons: A Nuclear Outing

KEY CONCEPTS

1. A nuclear power plant operates using uranium for fuel.
2. Spent fuel rods are radioactive and must be stored in sealed containers to keep people and the environment safe.
3. Uranium 235 atoms are split to release energy as heat in the reactor to boil water. This creates steam to drive a turbine generator to make electricity.

ENRICHED VOCABULARY WORDS

blubbering
containment barriers
generator
megawatt
neutron
nuclear
radioactive
reactor
turbine
uranium

ASSESSMENT

1. What fuel source do nuclear power plants use to generate electricity? (*Uranium 235.*)
2. List one advantage and one disadvantage to using nuclear energy to generate electricity. (*Advantage: does not pollute the air. Disadvantages: nonrenewable resource, creates radioactive wastes.*)
3. Explain how nuclear power plants generate electricity. Draw a diagram to help explain your answer. (*Uranium 235 atoms are split and release heat in a reactor. The heat is used to boil water into steam. The high-pressure steam spins a turbine generator to make electricity.*)

EXTENSIONS

1. Use a map of the United States to mark where nuclear power plants and Yucca Mountain are located.
2. Use a world map to mark where nuclear power plants are located.
3. Do research to answer the following questions:
What natural physical feature does a nuclear plant need in order to be sited in a particular area?
How does the United States compare to other countries in the world in nuclear power use?
Where is the next new nuclear power plant proposed to be built?
Where is uranium found? How is it extracted? How much energy goes into this process?
4. List some of the safety features a nuclear power plant must have in place. Who regulates the nuclear power industry and makes sure our plants are operating as safely as possible?
5. Engage in a class debate about where radioactive wastes should be stored. Be sure to discuss the attitude of NIMBY—not in my backyard.

The Simpsons: A Nuclear Outing

CAST OF CHARACTERS

Mr. Burns:	Homer's boss, owner of the nuclear power plant
Lisa Simpson:	The daughter
Homer Simpson:	The father
Bart Simpson:	The son
Marge Simpson:	The mother
Control Operator #1:	An employee of the nuclear power plant
Control Operator #2:	An employee of the nuclear power plant
Chorus:	Class

SCENE I

(Setting: The Simpsons' home. Pounding on the door and Mr. Burns yelling offstage.)

MR. BURNS:

Simpson! Where are you? Simpson!!!

(Lisa crosses the stage to the door and opens it.)

LISA:

Your hat, sir?

MR. BURNS:

Of course it's my hat! Where is your father? Simpson!

HOMER:

Yes, sir, Mr. Burns, come in, come in, please come in!

MR. BURNS:

I am in, you idiot! Now, stop blubbering and listen to me. I've been asked to go to Washington, D.C. to testify about using nuclear power and I must leave right away!

HOMER:

So what does that have to do with me?

MR. BURNS:

I asked you for a report, you idiot! Where is it?

HOMER:

It was right here a minute ago....Bart!

BART:

Hey, man. What's up?

HOMER:

You used my report to put under the dog food bowl!

BART:

Sorry. You said that I needed to clean....

HOMER:

Never mind....here you go, Mr. Burns. As you can see, although our nuclear power plant doesn't use fossil fuels that pollute the air when burned, we do use a nonrenewable fuel called uranium.

MR. BURNS:

So, Simpson, what does that mean?

HOMER:

It means that it doesn't replenish itself as we use it. But the good news is that we have about a 500-year supply of uranium.

MR. BURNS:

Sounds good to me! Thanks Simpson. Now all I need to do is find someone to manage the plant while I'm away.

MARGE:

Mr. Burns, nuclear power is in Homer's blood. Did you know that he was born in Shippingsport, Pennsylvania in 1957? That's the same year they began operating the world's first nuclear power plant there! He'd be the perfect boss while you are gone!

MR. BURNS:

Is that right? Well, we will see!

HOMER:

Yes, sir! It would be a piece of cake!

MR. BURNS:

No, thanks, I'm not hungry.

LISA:

Mr. Burns, what do they do with all the spent radioactive waste that is produced at the plant?

MR. BURNS:

It's stored at the plant right now... I think.

HOMER:

That reminds me. Mr. Burns, while you are in Washington, maybe you can find out when the Yucca Mountain storage facility in Nevada will be opening. We sure can't store all our radioactive waste at the plant forever! A national storage facility sure would make it easier to keep track of all that waste.

BART:

Boy am I glad we don't live in Nevada! I'd be glowing in no time.

LISA:

Don't be silly, Bart. There are a lot of safety measures for radioactive waste storage.

MR. BURNS:

Well, I'm off to Washington.

MARGE:

Mr. Burns, aren't you forgetting something?

MR. BURNS:

Well, I guess I'll take that piece of cake now...

MARGE:

No, Mr. Burns. Who is going to run the plant while you're gone?

MR. BURNS:

Well, I'd planned to leave the plant in good hands while I was gone, but I'm running late. I guess I'll have to leave you in charge, Simpson.

HOMER:

You have nothing to worry about, Mr. Burns. That plant's like my second home.

MR. BURNS:

(Looking at the audience) That's what I'm afraid of. There are 100 nuclear reactors in this country producing 20% of the electricity we use, and Homer Simpson has to work at mine!

BART:

Hey, the back-up safety systems and containment barriers will handle most disasters Homer might cause. *(Mr. Burns exits.)* I hope!

HOMER:

I told you, don't call me Homer! Call me Boss! Tomorrow, you're all in for a big treat. I'm taking you to the plant to see how it works.

CHORUS:

We split the atoms to use nuclear energy.
They are radioactive so we must store them carefully.

SCENE II

(Setting: Springfield Nuclear Power Plant Control Room. Two control operators are at their stations.)

OPERATOR 1:

Water level? Steam pressure? Neutron flux?

OPERATOR 2:

OK...Nominal....Normal.

OPERATOR 1:

How about that? So far, so good. How come everything's workin' right?

OPERATOR 2:

It must be Homer's day off.

(The Simpsons enter.)

LISA:

(To Marge) Is this where Dad makes electricity?

MARGE:

That's right, honey. He splits uranium 235 atoms into lighter atoms. This releases heat in the reactor.

BART:

Homer really cracks me up, too.

LISA:

Be quiet, marshmallow-head. This is interesting! *(To Marge)* What do they do with the heat?

MARGE:

I'm not really sure. Let's ask one of the operators. *(Looks to Operator 1)* What happens with all that heat?

OPERATOR 1:

It's used to heat water. The water turns into high-pressure steam that drives a turbine generator. The generator makes electricity.

LISA:

Hum....splitting atoms to make heat, to boil water, to make steam, to turn turbines, to make electricity.....

BART:

...and the green grass grew all around....

LISA:

You are such a knucklehead.

OPERATOR 2:

That's right, Lisa. Nuclear generators supply more than 20 percent of the electricity we use in this country. Just think! In 1882, when Edison opened the first power station in New York City, it only had 85 customers using his new light bulbs.

LISA:

Doesn't coal make half of all our country's electricity?

MARGE:

That's right, dear. How did you know that?

LISA:

Dad told me.

MARGE:

See, that's why they made your father the boss for today.

HOMER:

(Wakes up from having fallen asleep at his station.) Huh, boss? Is Mr. Burns back? What day is it?

BART:

Yeah, because he is thirty-five percent efficient—just like power plants.

HOMER:

Well, I hope you enjoyed this little field trip. It's not every family that gets the opportunity to see a 1,000-megawatt nuclear power plant.

LISA:

Yes, we learned a lot.

MARGE:

Good. It's just about dinnertime. Let's go home and be a nuclear family!

CHORUS:

We split the atoms to use nuclear energy.
They are radioactive so we must store them carefully.

Teacher Guide

Harry Spotter and the Chamber of Windy Myths

KEY CONCEPTS

1. Wind turbines do not produce excess sound.
2. Properly sited wind turbines do not kill birds and bats.
3. Wind energy is reliable and predictable.
4. Siting a wind turbine is critical to its success.

ENRICHED VOCABULARY WORDS

anemometer	bickering
efficiently	hideous
menagerie	migration
reliable	rhythmical
siting (a wind farm)	sustained

ASSESSMENT QUESTIONS

1. Why did Professor Dieseldore invite Professor Huggdatreaz to teach the windseekers class at Hogwatts? (*Huggdatreaz is an expert in siting wind turbines. Hogwatts is looking to increase their electric capacity by installing a wind turbine.*)
2. What makes a location a good spot for a wind turbine? (*Predictable, consistent, parallel winds of at least 13 miles per hour; wildlife that won't be disturbed by the wind turbines; dual-use locations that can be used for farming or grazing, as well as the turbines.*)
3. What makes a location a bad spot for a wind turbine? (*Inconsistent winds; wind speeds that are too high; winds that blow in a direction the blades cannot use; migration routes for birds or bats; locations with many other tall structures.*)
4. What is one myth most people believe about wind turbines? How would you convince them this is not true? (*Myths may include: bats or birds are killed by the spinning blades; wind turbines are noisy; electricity generated by wind power is unreliable; and a wind turbine may be successfully put anywhere.*)

EXTENSIONS

1. The principal of your school is thinking about adding a wind turbine to the property to generate electricity. Your class is responsible for deciding if this is a good idea and where the turbine should be located. Write a persuasive speech convincing your principal why she should or should not add a wind turbine.
2. Research wind energy and wind turbine technology. Prepare informative expo boards on these topics:
 - Wind, a renewable energy resource
 - Parts of a wind turbine
 - Siting a wind farm
 - Wind turbines generate electricity
 - Wind energy myths
3. Perform Harry Spotter and the Chamber of Windy Myths for other students in your school and teach them about wind energy using the expo boards.

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Harry Potter and the Chamber of Windy Myths

CAST OF CHARACTERS

Roni:	An intelligent student
Herman:	A student that sometimes struggles academically
Harry Potter:	A student that enjoys flying
Professor Huggdatreaz:	The science teacher
Cloudia:	A student
Breezus:	A student
Class:	Class

SCENE I

(Setting: A classroom at Hogwatts School.)

RONI:

I'm so excited about this new class. This professor is really supposed to be energetic!

HERMAN:

I just hope I pass this one.

HARRY:

We'd better hurry, or we're going to be late.

(They enter the classroom and find seats.)

PROFESSOR HUGGDATREAZ:

Welcome to Windseekers Class. This is a new class at Hogwatts. Your first project will impact the entire school. Due to increased enrollment, our current electrical capacity is no longer meeting our needs.

RONI:

(Waving hand excitedly) Is that why the lights went off in our dorm last night? I couldn't finish reading ahead for my classes.

PROFESSOR HUGGDATREAZ:

Yes, Roni. Professor Dieseldore invited me to teach this class since I'm an expert in siting wind farms. You are going to assist me in picking the perfect location for a wind turbine.

CLOUDIA:

Cool.

HERMAN:

(Quietly to Harry) Do you know what he's talking about?

RONI:

Shhhhh...

PROFESSOR HUGGDATREAZ:

Can anyone tell me what wind energy is?

(Roni waves her hand wildly.)

PROFESSOR HUGGDATREAZ:

Harry?

HARRY:

The stuff that blew out the candle last night.

PROFESSOR HUGGDATREAZ:

One point for Harry. But, wind is much more. Breezus?

BREEZUS:

Wind is magic. It helps our broomsticks fly and fills dragons' wings.

RONI:

(Shouts) Wind is moving air.

PROFESSOR HUGGDATREAZ:

One point for Breezus. Yes, wind does seem like magic. Roni, you would receive points too, if you'd waited to be called on. Yes, wind is moving air that we can harness to do work. Class, repeat after me: wind is moving air—energy is there.

CLASS:

Wind is moving air—energy is there.

PROFESSOR HUGGDATREAZ:

For homework tonight, everyone needs to find the perfect location for us to build a wind turbine here at Hogwatts. Class dismissed.

HERMAN:

A wind what?

HARRY:

A wind turbine. It's a modern windmill. The blades catch the wind and turn it into electricity.

RONI:

It converts nature's mechanical energy into electrical energy.

HERMAN:

Thank you, HARRY. Roni, how far ahead did you read?

HARRY:

Stop bickering, let's get this homework done.

CLASS:

(As they exit the classroom) Wind is moving air—energy is there. Wind is moving air—energy is there.

SCENE II

(Setting: The Next Day in Windseekers Class.)

PROFESSOR HUGGDATREAZ:

It's time to share your ideas. Where should we build the wind turbine?

(Roni waves her hand wildly.)

PROFESSOR HUGGDATREAZ:

Breezus?

BREEZUS:

In the middle of the Frightening Forest, so we don't have to see it. The giant tower and spinning blades will blend right in with the hideous trees and won't ruin our view.

CLOUDIA:

But I think the wind turbine will look cool. I don't want to go into the Frightening Forest to see it.

PROFESSOR HUGGDATREAZ:

Although some people don't like the look of turbines, that shouldn't be our first consideration.

RONI:

And the trees in the forest would block the wind, so it would defeat the purpose.

HERMAN:

(Sighs loudly) So I guess that means my idea of putting the turbine inside of the science building wouldn't work either?

PROFESSOR HUGGDATREAZ:

That's right, Herman. Any other suggested site locations? Remember what wind is?

CLASS:

Wind is moving air—energy is there.

CLOUDIA:

How about near Zagrid's house, or even on his roof?

HARRY:

But won't the noise keep him and his menagerie up at night?

PROFESSOR HUGGDATREAZ:

Actually, the sound from a wind turbine isn't as loud as you might think given how big it is and how much energy it makes. The sound it makes is a rhythmical whooshing, sort of like the sound of a dragon's wings flapping—*whoosh, whoosh, whoosh*. Who can see why building it on the roof wouldn't work?

BREEZUS:

Same reason as the woods, because the wind could be blocked. There can't be anything near it that would block the wind before it gets to the blades. His house is so tiny, even some of the trees are taller.

RONI:

How about the roof of the school? It is the tallest building at Hogwatts, so nothing will block the wind's path.

PROFESSOR HUGGDATREAZ:

Good suggestion, Roni, however it won't work.

HERMAN:

Roni's wrong?

PROFESSOR HUGGDATREAZ:

Sure, Hogwatts' roof is tall, but does anything else use that airspace?

CLOUDIA:

The Owlery is up there. Our owls could be hit by the spinning blades!

BREEZUS:

Good thing I don't have an owl.

PROFESSOR HUGGDATREAZ:

Bird flight paths are a major consideration in siting a wind project. We've learned from past mistakes that wind turbines shouldn't be built near migration routes. By avoiding these areas, there is a much smaller chance of wildlife being injured.

HARRY:

This shouldn't be that hard. It's just wind—you can't even see it!

CLASS:

Wind is moving air—energy is there.

HERMAN:

Does this mean that if we find a perfect location, we'll only have power when there is a storm and it's really windy?

RONI:

No, Herman. Current technology allows a large wind turbine to run efficiently on winds as low as 13 miles per hour.

CLOUDIA:

So, we need to find a location away from tall structures that might block the wind, with a wind speed of at least 13 miles per hour, and in a place that won't disturb wildlife.

BREEZUS:

Maybe there's a windseeker spell to help figure this out!

PROFESSOR HUGGDATREAZ:

Five points to Cloudia for summing up the discussion so nicely. For homework tonight, you can take anemometers out to check wind speed at various locations. Remember, the tower could be up to 100 meters high, so you will have to find a way to get to that height to accurately check the speed.

HARRY:

Wooo...flying time!

SCENE III

(Setting: The Next Day in Windseekers Class.)

PROFESSOR HUGGDATREAZ:

Good morning, class.

CLASS:

Wind is moving air—energy is there.

PROFESSOR HUGGDATREAZ:

It seemed to be pretty windy last night. Did you have fun using the anemometers to measure the wind speed?

BREEZUS:

It was great, until I fell off my broomstick trying to get a reading.

CLASS:

(Laughs)

BREEZUS:

The edge of the cliff had sustained gusts up to 80 miles per hour. We'd get tons of energy from that!

RONI:

Actually, that's too much wind. Those gusts would shut the turbine down. They need to protect themselves from incredibly strong winds, so when the wind gets too powerful they shut down. Also, did you notice what direction the wind was blowing?

HARRY:

The wind came right up the face of the cliff. I actually leaned out over the edge, holding my broom tight in case I fell, and the wind held me up! My cap blew off and flew up, up, up into the air.

PROFESSOR HUGGDATREAZ:

This is actually another reason why the edge of a cliff will not work. Wind turbines are designed to capture air that is moving parallel to the ground. They cannot capture wind that is moving upwards.

CLOUDIA:

The field where the gardens are got between 15 and 25 mile per hour winds the whole time we were there.

HERMAN:

But would we have to move all those plants? Some of them take years to bloom.

PROFESSOR HUGGDATREAZ:

Many wind farms use the land under the towers for farming or grazing. We could continue to use the area around the turbine for plants. There is plenty of room for both.

HARRY:

I know from flying that the wind changes depending on the weather and the season.

PROFESSOR HUGGDATREAZ:

Ten points to Cloudia for finding a good spot and a point to Harry for noticing that the wind isn't always constant. We only took measurements for one night, which really isn't sufficient for determining a good site, but since it was windy, it will give us a good idea of where to look.

RONI:

Wind measurements should really be taken at a site for at least one full year to get an idea of what the wind is like at all times. Many people who are considering where to put a turbine will measure the wind speeds for three years or more!

BREEZUS:

If wind isn't reliable, why use it?

PROFESSOR HUGGDATREAZ:

A point for Roni. As she said, you really need long term data to determine if a site is a good one for a wind turbine. A team of our professors has just finished reviewing Hogwatt's many years worth of weather records and has determined that winds in the garden area are very reliable. The average wind speed is calculated to be 15 miles per hour. The wind doesn't blow over the garden all of the time, but it is predicted that the turbine will be generating some power for the school 80 percent of the time. What other benefits does this location have?

CLOUDIA:

It isn't near the owls or any other normal bird route.

BREEZUS:

There are no tall buildings or trees near it.

HERMAN:

We probably won't even hear the sound from the turbines when we're inside mixing potions.

RONI:

By using wind power, we are using a renewable energy source. We'll never run out of wind energy, and we're taking care of the environment.

PROFESSOR HUGGDATREAZ:

I'm proud of all of you for putting the facts together and deciding on the same site the experts did. We know we will need reliable energy to meet the electrical needs of our growing population of students. For our next assignment...

(Lights go out.)

HARRY:

I guess Professor Dieseldore was right. We need to use wind energy at Hogwatts.

CLASS:

Wind is moving air—energy is there, and that's why we should care!

Teacher Guide

Harry Spotter and the Quest for the Right Light

KEY CONCEPTS

1. Compact fluorescent bulbs are more energy efficient than incandescent bulbs.
2. ENERGY STAR® qualified light bulbs and appliances are the most energy efficient you can purchase.
3. Spending more to purchase an efficient product now will save more money in the long run on utility costs.

ENRICHED VOCABULARY WORDS

appliance	antiques
efficient	emissions
flummoxed	humanitarian
initially	lumens
pledge	qualified
quarrelling	unique

TEACHER TIP

Stop your class after Scene 2. Have the students predict what kind of deal Roni is planning.

ASSESSMENT

1. Draw a blueprint of your house, indicating the light bulbs in each room. Compute how much your parents could save on their electric utility bill by switching to CFLs. What impact would changing this many bulbs have on the environment? *Go to www.energystar.gov and follow the link to "Lighting" for helpful information and resources.*
2. Name three ways to save energy mentioned in the play.
3. Write a letter to your parents giving them suggestions on how they could reduce their electric and/or utility bills.
4. Draw a picture cause/effect chart showing what happens in Professor Dieseldore's office.

EXTENSIONS

1. Conduct a survey of your school. Are there ways you could save energy? Write a proposal to your principal with your suggestions.
2. If your class or energy club is participating in the ENERGY STAR® Change a Light Pledge campaign, discuss how you will get your message out to your parents and the community. Set a class goal for the number of Pledges you want to collect. Write a script that you will use when you approach someone (a friend, relative, or neighbor) about signing the Pledge. Practice the script with a classmate until you feel comfortable sharing what you have learned about energy efficient lighting.
3. Continue the story. What do you think should be done with the additional money saved?

Harry Potter and the Quest for the Right Light

CHARACTERS:

FLUORENZO:	a prankster who loves to stir up trouble
RONI:	extremely intelligent student, passionate about causes
HERMAN:	easily frustrated student, passionate about saving energy
HARRY:	student with a calming influence on his friends
NEVI:	a curious friend
PROFESSOR DIESELDORE:	headmaster
FRIENDS:	the rest of the class

SCENE 1 – HANGING OUT IN THE POTION ROOM

(Roni is sitting at a table with newspaper ads spread around her, reading and occasionally circling items with a quill. Herman sits nearby with his head in his hands. Fluorengo, Nevi, and friends are mixing potions.)

FLUORENZO:

Hey, Roni, are you wishing on the stars all over that newspaper ad that your potion will mix itself?

RONI:

It's the ENERGY STAR®. This mark indicates which household appliances are most energy efficient. And BTW, I mixed my potion yesterday!

FRIENDS:

ENERGY STAR® light, ENERGY STAR® bright,
Energy efficiency is always right.
I wish I may, I wish I might,
Save energy and money with the STAR tonight!

(Harry enters the room. Herman's head pops up.)

HERMAN:

Harry! About time! Maybe you can talk some sense into her.

HARRY:

What has she done now?

RONI:

SHE is right here. And SHE is just doing the humanitarian thing. Of course, it takes a HUMAN to understand that.

HERMAN:

Did...did...did she just say I wasn't HUMAN?

HARRY:

What are you doing, Roni, *(Shuffles through newspapers)* looking at kitchen stuff?

NEVI:

Hogwarts just received a big grant and Professor Dieseldore is asking students to submit proposals on how to spend the money. Roni and Herman are quarrelling over how to spend it.

FLUORENZO:

Let's propose a new headmaster! *(Chants)* Dieseldore is a bore, Dieseldore is a bore.

FRIENDS:

(Giggle quietly in the background.)

HERMAN:

Harry, you know we need brighter lights on the sports field. During the last match, the crowd didn't realize the game was over for fifteen minutes!

RONI:

Although sports are entertaining, they aren't as important as the House Elves' working conditions.

NEVI:

Here we go again...

RONI:

During my chore time in the kitchens, I saw the appliances the House Elves use. They're antiques!

HERMAN:

So let them sell the antiques for money to buy new ones!

RONI:

(Giving Herman a dirty look.) As I was saying, they have to run the dishes through the dishwasher twice after every meal, because the old dishwasher doesn't work. Do you know how many dirty plates there are after all the students eat? And furthermore, the washing machines can only wash one robe at a time and the refrigerators are ancient!

NEVI:

But they can still do their jobs using the old appliances. We NEED those lights—our athletes can't perform in the dark!

RONI:

You are all impossible! *(Exits the room.)*

HARRY:

I'm flummoxed; they both sound like important causes.

HERMAN:

Give me those advertisements, I need to look up how much new lighting will cost.

SCENE TWO – LUNCH TIME IN THE DINING ROOM

(Nevi, Herman, Fluorenzo, Roni, and Harry are sitting at a table. Other friends are eating nearby.)

NEVI:

Hey, Herman, what did you find out about the new lights for the athletic field?

HERMAN:

Did you know there are different kinds of light bulbs?

FLUORENZO:

Like red and blue?

RONI:

I think he means incandescent, compact fluorescent, halogen...

HARRY:

Or maybe he's talking about the ENERGY STAR® qualified lighting from the newspaper ads.

FRIENDS:

ENERGY STAR® light, ENERGY STAR® bright,
Energy efficiency is always right.
I wish I may, I wish I might,
Save energy and money with the STAR tonight!

HERMAN:

The incandescent bulb, Thomas Edison's light bulb from 1879, is really inefficient. In an incandescent bulb, 90 percent of electric power is converted into heat, not light.

FLUORENZO:

We don't want those for our sports field, it's too hot down there already!

HARRY:

I'll bet you found a better option.

HERMAN:

Compact fluorescent bulbs are much more energy efficient, and they don't make as much wasteful heat. ENERGY STAR® qualified bulbs use about 75 percent less energy than standard incandescent bulbs and last up to ten times longer. They produce about 75 percent less heat, too, so they're safer to operate and can cut energy costs associated with home cooling.

NEVI:

Are those the funky looking spiral bulbs?

RONI:

They're usually called CFLs for short. And there is nothing wrong with looking a little unique.

FLUORENZO:

(Quietly to the friends.) Roni knows all about looking unique.

FRIENDS:

(Giggle quietly in the background.)

HERMAN:

Actually, ENERGY STAR® qualified CFLs come in many shapes, sizes, and shades.

NEVI:

Why isn't everyone using them if they save money?

HERMAN:

You see an incandescent bulb is initially pretty cheap to buy, while a CFL is more expensive. But, if you consider that ENERGY STAR® qualified CFLs last longer and use less electricity to operate, over the life of an average CFL bulb, you save about 30 dollars!

HARRY:

You can SAVE money by SPENDING money?

NEVI:

If you multiply 30 dollars by all the bulbs we have now...why that's A LOT OF MONEY saved!

HERMAN:

I did some research online too. ENERGY STAR® has a website with information about energy-efficient lighting. I even signed the Change a Light Pledge.

HARRY:

What's a Pledge?

RONI:

It's like a promise.

NEVI:

What did you pledge to do?

HERMAN:

Just what it says – Change a Light. I promised to change one light bulb in my house from an incandescent to an ENERGY STAR® qualified compact fluorescent.

FLUORENZO:

What kind of difference would that make?

HERMAN:

Let me break it down for you guys. *(Turn on overhead projector with these facts already written out. Herman points a wand at the wall as if he is magically projecting the image as he talks.)*

INCANDESCENT

1600 lumens = 100-watt bulb

Lifetime cost = \$60.48

ENERGY STAR® QUALIFIED CFL

1600 lumens = 25-watt bulb

Lifetime cost = \$15.12

LIFETIME ENERGY COST SAVINGS

\$60.48 - \$15.12 = \$45.36

691 pounds of carbon dioxide emissions

HERMAN:

I removed the 100-watt incandescent bulb from my dorm room and replaced it with an ENERGY STAR® qualified 25-watt CFL. They both give off the same amount of light, or lumens, so I can't tell the difference when I'm doing my homework. This one change will save Hogwatts \$45 in energy costs over the life of the bulb. And, it saves 691 pounds of carbon dioxide emissions.

HARRY:

You save money and you help the environment. Very cool.

RONI:

Is there information on ENERGY STAR® qualified appliances on that website, too?

HERMAN:

There sure is. Go to www.energystar.gov. There's information on clothes washers, dishwashers, refrigerators, freezers, dehumidifiers, and room air conditioners, and lots of other suggestions on how to save energy.

RONI:

You know, Herman, I'm thinking we can work out a deal on this proposal.

SCENE THREE – THE MEETING IN PROFESSOR DIESELDORE'S OFFICE

(Herman and Roni are sitting at his desk, the rest of the friends gather around the office.)

PROFESSOR DIESELDORE:

I understand the two of you are submitting a joint proposal for the grant money.

HERMAN:

We want to use the money to buy ENERGY STAR® qualified compact fluorescent light bulbs for the playing fields, classrooms, and dorms.

PROFESSOR DIESELDORE:

Those are pretty expensive bulbs, Herman.

HERMAN:

We learned that they may cost more initially but, in the long run, Hogwatts will save on its electric bill.

FLUORENZO:

We also want to share what we've learned with the community during Friday's half time show. There will be flying tricks and a band...

HARRY:

We'll just give a short presentation about energy efficient lighting and appliances, and we'll have a booth where we can answer questions and collect Change a Light Pledges.

NEVI:

If every family at Hogwatts would change their five most used 60-watt light bulbs to ENERGY STAR® qualified compact fluorescents, they would save \$35 in energy costs each year.

PROFESSOR DIESELDORE:

Saving money sounds like an excellent idea. But Roni, what about new appliances for the House Elves?

RONI:

Our proposal is actually a two-part plan.

HARRY:

With the new efficient lighting, Hogwatts will save lots of money on its utility bill.

PROFESSOR DIESELDORE:

I'm guessing you have plans for that money?

RONI:

We want to use our savings to buy ENERGY STAR® qualified appliances for the House Elves. While doing our research on the ENERGY STAR® website, we learned that when buying an appliance, it has two price tags: what you pay to take it home, and what you pay for the energy and water it uses. ENERGY STAR® qualified appliances incorporate advanced technologies that use 10–50 percent less energy and water than standard models. The money Hogwatts saves on its utility bills will more than make up for the additional cost of buying efficient ENERGY STAR® models.

PROFESSOR DIESELDORE:

Sounds like a great proposal!

HARRY:

But wait—there's more!

HERMAN:

With the money we save using the energy-efficient appliances, we want to buy everyone new winter robes. Then we can turn down the thermostat next winter.

RONI:

And that will save Hogwatts even more money.

PROFESSOR DIESELDORE:

OK, I'm convinced. You get your new lights and your new appliances. This is the first time I've given away money and saved at the same time!

FRIENDS:

ENERGY STAR® light, ENERGY STAR® bright,
Energy efficiency is always right.
I wish I may, I wish I might,
Save energy and money with the STAR tonight!

Teacher Guide

Today's Special Report: Splish, Splash Hydropower

KEY CONCEPTS

1. Using moving water to create energy is called hydropower.
2. Hydropower is a renewable source of energy.
3. Some types of hydropower include: dams, wave energy and tidal power.
4. There are advantages and disadvantages to using hydropower as an energy source.

ENRICHED VOCABULARY WORDS

drought	ecology
economical	irrigate
meteorologist	migration
precious	reservoir
spawning grounds	suspiciously

ASSESSMENT

1. Explain why hydropower is considered a renewable source of energy.
2. Choose one source of hydropower and explain how it is used to generate electricity.
3. Name two advantages and two disadvantages to using hydropower as an energy source.

EXTENSIONS

1. Break students into small cooperative groups to research hydropower as a renewable source of energy in the United States. Assign each group one of the following topics:
 - The water cycle and its role in hydropower
 - The history of hydropower and modern day statistics
 - Parts of a dam and hydropower plant and how electricity is generated
 - Wave energy
 - Tidal power
 - The future of hydropower technology
 - The advantages and disadvantages of using hydropower as an energy source
 - Careers in the hydropower industry

Assign groups to prepare informative expo boards and short oral presentations about their topics.

Let students perform *Today's Special Report: Splish, Splash, Hydropower* for other students in your school, and to share what they have learned about hydropower as a renewable source of energy using the expo boards.

2. As a class, research the Three Gorges Dam, one of the world's most amazing engineering feats. On chart paper, list as many advantages and disadvantages of the project as possible. Discuss the advantages and disadvantages as a class. Assign each student to write a one page persuasive essay supporting or opposing the building of the dam.

Today's Special Report: Splish, Splash Hydropower

CAST OF CHARACTERS

HYDE ROE:	clueless news anchor	MISTY RAINES:	intelligent news anchor
WILL SPRINKLER:	meteorologist	SPACEY JONES:	roving reporter
RILEY RIVERTON:	roving reporter	ELSIE SPARKS:	roving reporter
TIDE TURNER:	roving reporter	SPLASH WAVERLY:	surfer dude
CITIZENS:	the class		

The scene is a television studio of Channel One News

HYDE ROE:

Good afternoon. This is Hyde Roe reporting for Channel One News.

MISTY RAINES:

And I'm Misty Raines. We're bringing you a special report today about a precious natural resource that is vital to our everyday lives.

HYDE ROE:

Sure, naturally everyone watches TV.

MISTY RAINES:

No, today we're talking about water. H₂O. All living things need water to survive. It covers 75 percent of the earth as either a liquid, solid or gas.

HYDE ROE:

Solid water?

MISTY RAINES:

Water is found in three states. The liquid state is water. The solid state is ice or snow. The gas state is invisible; it is called water vapor. We've sent our roving reporters out on location today to tell us all about water and how we use moving water as a clean source of energy.

HYDE ROE:

I only drink clean water.

MISTY RAINES:

I mean that moving water is a clean energy source. It doesn't produce any emissions or increase greenhouse gases in the atmosphere. Using moving water to generate electricity is called hydropower.

CITIZENS:

Water flows through a hydro dam, Electricity made at any hour,
Clean, renewable energy, Splish, splash, hydropower.

HYDE ROE:

Let's go to Will Sprinkler for an in-depth look at the bicycle.

WILL SPRINKLER:

Hyde, I spent the day following a water droplet through the WATER cycle. It was quite a wild ride.

HYDE ROE:

I wonder where I can get a wild, water bicycle...

WILL SPRINKLER:

In our earth system, water is continually moving between the earth's surface and atmosphere. Today I interviewed this great guy, Dewey Drop. I met him out in the ocean at daybreak. We began the day as liquid water. Then the sun rose and its energy evaporated us, changing us into water vapor.

WILL SPRINKLER CONTINUES:

We rose higher and higher into the atmosphere, where we joined more vapor and became a large cloud. Then we ran into cooler temperatures.

As we cooled, we condensed back into a liquid state. That's when the party really started. We joined other water drops and formed big drops. We were so heavy that we fell from the cloud as rain drops and landed in a river. We floated down the river for awhile until the energy from the sun evaporated Dewey again.

HYDE ROE:

I wasn't invited to any party.

WILL SPRINKLER:

The water cycle is powered by the sun. Hydropower is a renewable energy source.

MISTY RAINES:

The total amount of water in our earth system doesn't change, but it's continually moving between glaciers and oceans, lakes and streams, through the atmosphere, and through plants and trees, too.

WILL SPRINKLER:

I'm wondering where Dewey Drop will end up next. Maybe frozen in a glacier, splashing around a swimming pool, or being slurped up in your cup of coffee?

HYDE ROE:

Now I'm really getting thirsty. Can I get a drink?

MISTY RAINES:

Thanks for your report, Will. Hyde, did you know that we have been using water as a renewable source of energy for over 2,000 years? Back then, waterwheels powered mills and dams irrigated crops and controlled flooding.

CITIZENS:

Water flows through a hydro dam, Electricity made at any hour,
Clean, renewable energy, Splish, splash, hydropower.

HYDE ROE:

Speaking of dams, let's go to Spacey Jones, reporting live from a local dam.

SPACEY JONES:

Thanks, Hyde. I've been trying to interview the dam's operator, but he hasn't been too talkative. He is pretty busy right now gathering branches and mud.

MISTY RAINES:

Uh, Spacey?

SPACEY JONES:

Yes, Misty?

MISTY RAINES:

Are you talking to a beaver building a dam?

SPACEY JONES:

Hmmm. He has brown fur and a flat tail and does look suspiciously like a beaver now that you mention it.

MISTY RAINES:

Spacey, you were supposed to go to Hoover Dam.

SPACEY JONES:

Oops.

HYDE ROE:

Did the beaver share anything with you?

SPACEY JONES:

One of the disadvantages of damming a river is that it changes the natural ecology of the river and large areas of land both upstream and downstream.

HYDE ROE:

How so?

SPACEY JONES:

When a dam is built on a river, a reservoir of water collects behind the dam, flooding a large area of land upstream. Downstream, the natural ecology of the river and surrounding land is changed, too. Less fertile soil is deposited downstream, which can be a problem for farmers.

There might be less oxygen in the water, which can be harmful to fish and riverbank habitats. Finally, some fish migrate upstream to reach spawning grounds and migrate downstream to return to the ocean. A dam can block fish from completing this natural migration process.

MISTY RAINES:

Thanks for pointing out some of the disadvantages of damming a river, Spacey. Let's cut now to Riley Riverton. I'm told she's reporting live from an actual man-made dam.

CITIZENS:

Water flows through a hydro dam, Electricity made at any hour,
Clean, renewable energy, Splish, splash, hydropower.

RILEY RIVERTON:

This is Riley Riverton, reporting live from an actual dam. Don't be surprised by its small size. While there are more than 500,000 dams worldwide, most of them are small structures less than three meters high. As for large dams more than 15 meters high, about 40,000 exist.

HYDE ROE:

What are some of the uses for dams?

RILEY RIVERTON:

Most dams are built to control flooding, to support the public water supply, to irrigate crops, to make inland waterways accessible to ships and barges, or for recreation, like boating and fishing. Of course, some dams have hydropower plants to generate electricity. We have about 80,000 dams in the United States, but less than 2,400 of them generate electricity.

MISTY RAINES:

Thanks, Riley. We've got Elsie Sparks standing by at a hydropower plant to continue our special report.

HYDE ROE:

Do you have anything shocking to share with us?

ELSIE SPARKS:

Almost 20 percent of the world's electricity is produced by hydropower. In the United States, we generate 5-10 percent of our electricity from hydropower, depending on the supply of water. It's important to remember that hydropower plants are dependent on water supply. When there is a drought, hydropower plants cannot produce as much electricity.

HYDE ROE:

Doesn't electricity come out of the wall? I've never seen water in my walls at home.

MISTY RAINES:

Electricity is generated at a power plant. Since moving water is the energy source, we call it a hydropower plant.

ELSIE SPARKS:

Let me explain how a hydropower plant works. There are three main parts of a typical plant: the reservoir, the dam and the power plant. The reservoir holds water behind the dam until it is needed. The dam controls the flow of water into the power plant. The power plant converts the energy of moving water into electricity.

HYDE ROE:

But how does water generate electricity?

ELSIE SPARKS:

The process begins with water flowing from the reservoir into large pipes, called penstocks, on the upstream side of the dam. The water flows down the penstocks to turbines at the bottom, spinning the turbines to power the generators. The generators produce electricity, which is sent to transmission lines, where it begins its journey to consumers. Water that entered the penstocks returns to the river below the dam and continues its downstream journey.

HYDE ROE:

Fascinating stuff. I had no idea water was so powerful.

ELSIE SPARKS:

Hydropower is a really efficient way to produce electricity. The average hydropower plant is about 95 percent efficient at converting the energy in moving water into electricity.

HYDE ROE:

Any other advantages to generating electricity with hydropower?

ELSIE SPARKS:

Sure. Hydropower is usually available when we need electricity fast. Engineers can control the flow of water through the turbines to produce electricity on demand. And hydropower is economical, too. Once a hydropower plant is built, there are low maintenance costs. The water flow that powers it is free. Electricity generated by hydropower is the cheapest electricity in the country.

CITIZENS:

Water flows through a hydro dam, Electricity made at any hour,
Clean, renewable energy, Splish, splash, hydropower.

MISTY RAINES:

Thanks for your report, Elsie. We generate electricity using other types of water energy, too.

HYDE ROE:

Like what?

MISTY RAINES:

Our roving reporter, Tide Turner will continue our special report right now.

TIDE TURNER:

Hi, folks. This is Tide Turner reporting to you from the ocean shore. If you've ever visited the ocean, you know it is huge and powerful. The ocean is constantly in motion and it contains an enormous amount of energy. It's tricky to harness all of the ocean's energy, though. There is a special kind of power station that generates electricity using the rising and falling of the tides. This power station is called a tidal barrage.

HYDE ROE:

What makes the tides rise and fall?

TIDE TURNER:

Tides are caused by the gravitational forces between the earth and the moon. The moon pulls on the ocean water closest to it, creating a bulge in the surface of the water. The bulge of water is a high tide. The opposite side of earth will have the same high tide, and the area between the bulges will experience a lower water level, or a low tide.

HYDE ROE:

So how do tides generate electricity?

TIDE TURNER:

A tidal barrage is built across an estuary, the area where a river runs into the ocean. The water here rises and falls with the tides. As the tide rises, water flows through the barrage, spinning turbines, and collects in the estuary. When the tide drops, water trapped in the estuary flows back to the ocean. The water again turns the turbines, which are built to generate electricity no matter which way water is flowing.

MISTY RAINES:

Thanks for your report, Tide. Our roving reporter, Splash Waverly, was out at the ocean shore today, too. Splash, what have you learned about the energy of the ocean?

SPLASH WAVERLY:

What's up, dudes? The surf is for sure. I've been working on my tan today by the ocean shore. Not on the beach, dudes, but by the cliffs. There's a most rad electricity generating device fixed to the cliff called an oscillating water column. That's a mouthful, dude.

MISTY RAINES:

Splash, can you tell us how an oscillating water column works?

SPLASH WAVERLY:

Sure, dude. Wave energy. See the oscillating water column is a chamber partially submersed in the ocean. As waves flow in and out of the chamber, the air inside the chamber is compressed and decompressed. The forced air spins a turbine. The generator attached to the turbine produces electricity. It's really awesome, dude.

HYDE ROE:

Generating electricity from ocean waves is such a good idea.

SPLASH WAVERLY:

Dude, you're so right. Unfortunately, there are only a few places where you can build wave energy devices. And those devices produce electricity on a very small scale. Maybe enough energy to supply a small village on a remote island, for example. I've got to go catch one last wave before I head back to the newsroom. Later, dudes.

MISTY RAINES:

Ok, Splash. Thanks for that special report. And don't forget to reapply your sun screen; I'm afraid you're getting burned.

CITIZENS:

Water flows through a hydro dam, Electricity made at any hour,
Clean, renewable energy, Splish, splash, hydropower.

HYDE ROE:

Thanks to all of our roving reporters for their hard work today. We sure have learned a lot about using moving water as a source of energy.

MISTY RAINES:

There's always more to learn. Scientists are exploring new technologies to harness tidal, current and wave energy. They're also working on improved turbine designs and improving the efficiency of dams. The hydropower industry is an exciting field for anyone thinking about a career in the energy industry.

HYDE ROE:

I do love to swim; maybe I should consider changing careers...

MISTY RAINES:

That's our special report for today. Thanks for watching Channel One News.

Teacher Guide

Bathman

KEY CONCEPTS

1. Renewable sources of energy include biomass, geothermal, hydropower, solar and wind.
2. The United States relies on renewable and nonrenewable sources of energy to meet our needs.
3. Many different sources of energy can be used to heat the water used in your home. Some generate electricity (fossil fuels, wind, hydro) and some can heat water directly (burning biomass, geothermal and solar water heating).

ENRICHED VOCABULARY WORDS

Covert	Peril
Dilemma	Reservoir
Dire	Scheme
Drought	Sinister
Fermentation	Subterranean
Frigid	Villain

ASSESSMENT QUESTIONS

1. Explain why the United States depends on ten sources of energy to meet our energy needs.
2. What is baseload power? How does the electric utility's management of baseload power affect you?
3. In your opinion, is Bathman a super hero or super clueless? Why do you think so? Cite at least one example from the play that supports your point of view.

EXTENSION ACTIVITIES

1. Have students write a few paragraphs describing what they think will happen when Ray talks to the fossil fuels. Will the energy sources cooperate and share energy-making duties? Will Bathman and Bobbin need to come in and save the day again? Let students read their story endings to the class.
2. Visit your school's boiler room and have the custodian explain how hot water is made in your school. What source of energy is heating your water? Have students find out how their water is heated at home and compare. As a class, brainstorm ways to use less hot water at home and school. Discuss why it is important to conserve hot water.
3. Break into small groups and prepare informative posters or info boards for each renewable source of energy. Use the NEED Energy Infobooks found on the NEED website at www.need.org. Share the posters with the class.
4. Present Bathman to an audience:
 - a. Brainstorm costumes to represent each energy source. For example, Ray (Solar Energy) could wear yellow clothes, a lot of shiny bling (gold jewelry) and sunglasses. Gather the materials for the costumes and make simple scenery.
 - b. Use the informative posters to teach your audience about the renewable sources of energy before the play begins. Then, perform the play.

Bathman

CAST OF CHARACTERS

NARRATOR:	Dramatic voice offstage
MAGMA:	Leader of the geothermal energy cartel and owner of the Hot Rock Spa
BOBBIN:	Bathman's partner in his liquid capers (wears any swimming garb)
BATHMAN:	Super hero specializing in hot water (wears shower cap and towel for cape)
CITIZENS:	Chorus
FLO:	Hydropower energy leader
RAY:	Solar energy kingpin
GALE:	Wind energy head honcho
PEAT:	Biomass energy chief

SCENE 1 - THE HOT ROCK SPA

NARRATOR:

Right this very minute there are super heroes living among us. These marvelous meddlers are always saving the day. They protect the public. They do good deeds. They outwit evil-doers at every turn. Without these super heroes we would live in sheer chaos. Not too long ago, on a day just like today, the fearless duo of Bathman and Bobbin saved us from chilling peril and certain doom. This, dear citizens, is their story.

(Bobbin is sipping a hot drink and enjoying a spa treatment when Magma enters and rushes over.)

MAGMA:

Taking some time off from fighting crime, Bobbin?

BOBBIN:

I'm just enjoying my annual spa day, Magma. This is a nice place you have here. I love the steam bath.

MAGMA:

Thanks to my geothermal energy I have all the hot water and steam I need to keep the spa running forever.

BOBBIN:

Geothermal is clean energy from underground, right?

MAGMA:

If you and your energy wasting partner, Bathman, weren't still wet behind the ears, you would know about my renewable way of turning the heat up by drilling down. Geothermal energy comes from heat within the earth. People around the world use geothermal energy to produce electricity, to heat homes and buildings, and to provide hot water for a variety of uses, such as cooking and bathing.

BOBBIN:

No need to get steamed! So, what's up, or should I say, what's down, Magma?

MAGMA:

Bathman, our city's favorite super hero, is down...down the drain that is. I'm turning off the major sources of energy that heat our city's water.

BOBBIN:

You can't do that.

MAGMA:

It's already happening. My subterranean connections have helped me with some earthquakes around your oil and gas pipelines and coal mines.

BOBBIN:

The earthquakes will shut them down! We won't have the fossil fuels we need to make electricity.

MAGMA:

Exactly. People will need to conserve hot water. Without fossil fuels, there will be a shortage of hot water. Now I, and the other renewables, will get the respect we deserve in the energy market! And as a bonus, everyone will run to the Hot Rock Spa for a steam bath.

BOBBIN:

I've got to warn Bathman.

MAGMA:

Not even Bathman can stop me.

BOBBIN:

It's not that. I've got to warn him before he takes his afternoon bubble bath. *(Runs out.)*

CITIZENS:

Without a way to heat up water, we would freeze indeed.
Each source of energy plays a part, to meet our daily needs.

SCENE 2 - BATHMAN'S LIVING ROOM.

NARRATOR:

Bobbin hurried over to Bathman's house as fast as he could pedal his bicycle. But when he arrived, the situation was dire. Very, very, dire.

BOBBIN:

Bathman! Hey, Bathman!

BATHMAN:

(Offstage.) Is that you, Bobbin, my trusty companion? Speak up. You know I can't hear you when the water is running. By the way, have you seen my rubber duckyyyyyyyyyooooowwwww!

BOBBIN:

What's the matter?

BATHMAN:

(Enters wearing his shower cap, towel cape, towel wrap, and flip-flops.) It's the end of the world as we know it! There's no hot water!

BOBBIN:

That's why I'm here. I just ran into Magma at the Hot Rock Spa.

BATHMAN:

Don't tell me he's carried out his threat to get into hot water by cutting off the fossil fuels.

BOBBIN:

He has. Oh, Bathman, why are we always in hot water? I mean cold water.

BATHMAN:

The life of a super hero is never easy. Our city is in danger, Bobbin. It is up to us to stop Magma's sinister plot before we're doomed to a frigid, hot waterless existence.

BOBBIN:

Let's go to the source of all water, hot or cold.

BATHMAN:

I'm not going down to the sewer!

BOBBIN:

No, Bathman. The city reservoir. We'll talk to Flo, the leader of the hydropower energy network, about our problem.

BATHMAN:

Right, Bobbin. Hydropower is the biggest name in renewable energy.

BOBBIN:

Flo generates more electricity than all the other renewable energy sources combined. Five to ten percent of our electricity needs are generated by hydropower. Hopefully, Flo can connect us with the other renewable energy sources: wind, solar and biomass. If we work together, maybe we can undo what Magma has done.

BATHMAN:

And I can get back to my bubble bath. *(They exit.)*

CITIZENS:

Without a way to heat up water, we would freeze indeed.
Each source of energy plays a part, to meet our daily needs.

SCENE 3 – THE RESERVOIR

NARRATOR:

The city reservoir has long been known as a hot spot for secret meetings and covert operations. Today is no exception. The renewable energy leaders are soaking up the sun. And it appears they have been water skiing, too.

(Flo is splashing around in the lake as Bathman and Bobbin arrive. Ray, Gale, and Peat are sunning nearby.)

FLO:

Water, water everywhere...

BATHMAN:

(Bathman and Bobbin enter.) But none of it is hot.

FLO:

So you know about Magma's plot to control our city's hot water? I'd love to splash his evil plan right down the drain.

BOBBIN:

Since Magma cut off our fossil fuel supplies, we need to find renewable sources of energy that can make hot water.

FLO:

We'd better speak to the leader of the renewables.

BATHMAN:

I thought hydropower was boss.

FLO:

Actually, all renewables get their energy from the sun. Lucky for us, Ray is just over there soaking up some sun. *(Flo yells across the stage to Ray.)* Put down the sun block and come over here quick! We need your help. *(Ray, Gale and Peat rush over.)*

RAY:

How cool. It's Bathman and Bobbin. Great job solving the rubber duck kidnapping last week. Did you come to the reservoir to cool off?

BATHMAN:

We're facing a terrible situation, Ray. Magma ruined my tub time. His latest scheme shut down our city's fossil fuels and we're left without any way to heat our water.

BOBBIN:

We're hoping you can help.

RAY:

Of course we'll help. Geothermal energy is just one way to heat water. My solar energy can make hot water using a solar water heater. In fact, Bathman, you really ought to install one on your house.

BATHMAN:

How does it work?

RAY:

A solar collector is mounted on the roof of your house. It collects sunlight and converts it to heat. When the collector becomes hot enough, heat transfer fluid is pumped through the collector. The heated fluid goes to a storage tank where it heats water. And snap, you have hot water for you shower, directly from the sun.

BATHMAN:

That's great when the sun is out, but how can we make hot water when it's cloudy outside?

GALE:

My wind energy can help out, too. Wind is produced when the sun heats the surface of the earth unevenly. For example, land heats up faster than water. Warm air over land expands and rises, and heavier, cooler air over water rushes in to take its place. The moving air is wind.

BOBBIN:

How does wind make hot water?

GALE:

We need a machine called a wind turbine to generate electricity. Then we can use the electricity produced to heat our water. The more turbines we build, the more electricity we can generate. A lot of wind turbines working together to produce electricity is called a wind farm.

BATHMAN:

Using the wind to make electricity sounds like a good idea, but you rely on the sun to make the wind. How will we make hot water all day and all night?

GALE:

That's a good point, Bathman. Wind turbines depend on the availability of the wind, as well as the speed of the wind. So, wind turbines can't operate all the time. In fact, my wind turbines have the capacity to make electricity only about three-fourths of the time.

BOBBIN:

We need a more constant supply of electricity.

RAY:

You know demand for electricity is not steady; it goes up and down. People use more electricity during the day when they're awake and less at night when they're asleep. We use more electricity when the weather is very hot or very cold.

BOBBIN:

(Looks pointedly at Bathman.) And when you take a lot of bubble baths.

RAY:

Electric utility companies have to produce electricity to meet these changing demands. Baseload power is the electricity that utilities have to generate all the time. Baseload power has to be cheap and reliable.

FLO:

I can help with that. My hydropower is not only the cheapest way to generate electricity, it is very energy efficient, too. I'm 95 percent efficient at converting the kinetic energy of moving water into electricity. And hydropower is reliable, because my fuel supply, flowing water, is always available. Although, if our city is facing a drought, I can't produce as much electricity.

BATHMAN:

What other options do we have?

PEAT:

Don't forget about me! I can heat water, too. I have the sun's energy stored in all parts of me—from the wood in trees to paper and other organic waste in our garbage.

BATHMAN:

How can we use your energy?

PEAT:

My fires were probably man's first energy source. Today, much of the three percent of the energy I provide comes from burning wood and sawdust. My fires can heat hot water.

BOBBIN:

But like coal, oil, and natural gas, don't you pollute the air?

PEAT:

Yes, but there are ways of turning biomass into liquids and gases that burn much cleaner. Through fermentation, corn can be made into ethanol, a gasoline additive. As organic material decays at the city landfill, it produces methane. This gas is collected and used as an energy source. Burning garbage in a waste-to-energy plant makes steam that can generate electricity. As long as we have biomass around, I can help provide hot water.

BATHMAN:

It sounds good, but we can't sit around waiting for trees to grow. I need hot water now!

BOBBIN:

All of the renewable sources of energy have something to offer when it comes to generating electricity and making hot water. But none of them is the perfect solution to our hot water dilemma.

FLO:

Magma can be pretty hot under the collar, but maybe he'd be willing to work with us to be part of the solution.

RAY:

Let's try to convince him to change his mind. It's time to pay a visit the Hot Rock Spa. *(They all exit.)*

CITIZENS:

Without a way to heat up water, we would freeze indeed.
Each source of energy plays a part, to meet our daily needs.

SCENE 4 - THE HOT ROCK SPA

NARRATOR:

So Bathman and his trusty side kick Bobbin ventured out in search of Magma at the Hot Rock Spa. The renewable energy leaders went along to support the water obsessed super heroes. Bathman and Bobbin have learned a lot about renewable sources of energy. Hopefully, their new knowledge will be enough to save us.

(Magma is relaxing in his Hot Rock Spa. Bathman, Bobbin, Ray, Flo, Gale and Peat enter.)

MAGMA:

It's the washed up duo of Bathman and Bobbin. Here to enjoy a steam bath?

FLO:

We're here too, Magma. It is time for you to stop giving renewables a bad name.

MAGMA:

I'm doing it for all of us. We renewables have been second-class energy sources for too long. Today, we provide only seven percent of U.S. energy. Twenty years from now, we could provide much more of the nation's energy needs. We must fight the powerful fossil fuels.

BATHMAN:

But, the fossil fuels are not the enemy. We need them, too.

MAGMA:

What do you mean? I've got all the heat I need for my steam baths and soaking pools.

RAY:

True, but where are your customers? *(Magma looks around puzzled.)*

PEAT:

They're staying home because there's no gasoline for their cars.

GALE:

And they're home because there's no electricity or natural gas to wash and dry their clothes.

FLO:

And they are probably huddled together for warmth because there's no heat for their homes.

RAY:

You hurt everyone, including yourself, by shutting down the fossil fuels.

BATHMAN:

Don't you see, Magma, we all must work together—the fossil fuels and the renewables—for abundant energy.

MAGMA:

What do you mean, work together?

PEAT:

Converting my biomass into ethanol can provide transportation power, so I can work with gasoline.

FLO:

We can help coal and uranium make electricity using my hydropower.

GALE:

And using my wind energy, too.

RAY:

And, with my ability to make heat and electricity, I can help all the fossil fuels warm our homes and power industry.

BOBBIN:

Magma, a geothermal power plant is an excellent source of baseload power. You'll be able to produce cheap electricity and sell it to utilities all of the time. I can see it now, the Hot Rock Spa and Geothermal Power Plant.

BATHMAN:

Unless we all work together, we all lose.

MAGMA:

But if I release the fossil fuels, who will make them work with us so that we can all benefit from safe, clean, renewable energy sources?

RAY:

They need us, too. After all, the fossil fuels are nonrenewable. And we play soccer together on Saturdays, so I should be able to convince them.

BOBBIN:

Well, Bathman. It looks like this one is all cleaned up. Good work!

MAGMA:

And with the fossil fuels back on line, there is no excuse for you not to take a bath...MAN! *(They all hold their noses and slowly drift away from Bathman.)*

CITIZENS:

Without a way to heat up water, we would freeze indeed.
Each source of energy plays a part, to meet our daily needs.

NARRATOR:

Our sizzling super heroes did it again, saving our citizens from chilly showers and icy baths. And life as we know it returned to normal. Until Bathman's tub overflowed and his rubber ducky floated away. But we'll save that story for another day.

Teacher Guide

Pecos Bill

KEY CONCEPTS

1. Renewable energy sources provide cleaner energy options.
2. The renewable energy sources are hydropower, wind, solar, biomass, and geothermal.

ENRICHED VOCABULARY WORDS

corralled	lassoed	reservoir
switchgrass	turbine	whirled

ASSESSMENT

1. List three renewable energy sources and how Pecos Bill used them. (*Hydropower was used to make electricity and create a reservoir for recreation. Wind was used to spin turbine blades which generate electricity. Solar energy was used for cooking, light, and heat. Biomass was used to make biofuels, or ethanol. Geothermal energy was used for heating.*)
2. Which renewable energy source do you think was used the most in the “Old West?” Support your opinion with examples.

EXTENSIONS

1. Research the ways renewable energy sources were used in the West during the expansion of the United States. Which sources are used for the same purposes today? Which sources are used differently?
2. Write a poem about the nonrenewable energy sources and a legendary American character.

Pecos Bill

Pecos Bill is a legend of old
A greater story has never been told
Whirled his lasso over his head
Filled polluters' hearts with dread
Renewable energy – YAHOO!

Pecos' renewable energy stand
To bring clean power to all the land
Lassoing water, wind, and sun
Harnessing energy for everyone
Renewable energy – YAHOO!

He lassoed a river and built a dam
Creating a reservoir where people swam
Moving water is hydropower
Clean electricity for every hour
Renewable energy – YAHOO!

He lassoed a twister and corralled the air
Had engineers put a turbine there
Blowing wind spins the turbine blades
An energy source that will never fade
Renewable energy – YAHOO!

The sun was next on his lassoing list
A clean power source he couldn't resist
To use for cooking, light, and heat
Solar energy can't be beat
Renewable energy – YAHOO!

Lassoed some biomass from the plains
Switchgrass, corn, and sugar cane
Turned these plants into ethanol
Biofuels help meet the call
Renewable energy – YAHOO!

He threw out his lasso one last time
Heating his ranch was on his mind
Captured the heat from under the ground
Where geothermal can be found
Renewable energy – YAHOO!

"Pecos Bill" all cowboys sing
"Made renewable energy the IN thing"
Can be found near and far
Made renewable sources stars.
Renewable energy – YAHOO!

ENERGY ON STAGE

Evaluation Form

State: _____ Grade Level: _____ Number of Students: _____

- | | | |
|--|-----|----|
| 1. Did you conduct the entire activity? | Yes | No |
| 2. Were the instructions clear and easy to follow? | Yes | No |
| 3. Did the activity meet your academic objectives? | Yes | No |
| 4. Was the activity age appropriate? | Yes | No |
| 5. Were the allotted times sufficient to conduct the activity? | Yes | No |
| 6. Was the activity easy to use? | Yes | No |
| 7. Was the preparation required acceptable for the activity? | Yes | No |
| 8. Were the students interested and motivated? | Yes | No |
| 9. Was the energy knowledge content age appropriate? | Yes | No |
| 10. Would you use the activity again? | Yes | No |

How would you rate the activity overall (excellent, good, fair, poor)?

How would your students rate the activity overall (excellent, good, fair, poor)?

What would make the activity more useful to you?

Other Comments:

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National Association of State Energy Officials
National Association of State Universities
and Land Grant Colleges
National Hydropower Association
National Ocean Industries Association
National Renewable Energy Laboratory
Nebraska Public Power District
New Jersey Department of Environmental
Protection
New York Power Authority
New Mexico Oil Corporation
New Mexico Landman's Association
North Carolina Department of
Administration–State Energy Office
Offshore Energy Center/Ocean Star/ OEC
Society
Offshore Technology Conference
Ohio Energy Project
Pacific Gas and Electric Company
PECO
Petroleum Equipment Suppliers
Association
Poudre School District–CO
Puerto Rico Energy Affairs Administration
Puget Sound Energy
Roswell Climate Change Committee
Roswell Geological Society
Rhode Island State Energy Office
Sacramento Municipal Utility District
Saudi Aramco
Sentech, Inc.
Shell
Snohomish County Public Utility District–WA
Society of Petroleum Engineers
David Sorenson
Southern Company
Southern LNG
Southwest Gas
Spring Branch Independent School
District–TX
Tennessee Department of Economic and
Community Development–Energy Division
Toyota
TransOptions, Inc.
TXU Energy
United Technologies
University of Nevada–Las Vegas, NV
United Illuminating Company
U.S. Environmental Protection Agency
U.S. Department of Energy
U.S. Department of Energy–Hydrogen,
Fuel Cells and Infrastructure Technologies
U.S. Department of Energy – Wind for
Schools
Virgin Islands Energy Office
Virginia Department of Mines, Minerals
and Energy
Virginia Department of Education
Virginia General Assembly
Wake County Public Schools–NC
Washington and Lee University
Western Kentucky Science Alliance
W. Plack Carr Company
Yates Petroleum