THE ENERGY DETECTIVE

STUDY GUIDE

Presented by the
Educational Touring Theatre

Developed in partnership with Duck River Electric Membership Corporation

EDUCATIONAL
TOURING THEATRE
3006 Sutton Court
Old Hickory, TN 37138
615-773-4169
edtheatre@aol.com

The Energy Detective Study Guide

The attached study material is designed to help prepare students to attend the Educational Touring Theatre's program ***The Energy Detective.*** The following material is included:

For Students:

- **A Word From Jimmy Ruff** (An audience etiquette reminder to be read before attending the performance)
- **Vocabulary List**
- **Vocabulary Crossword Puzzle**
- **Vocabulary Word Find** (Easy)
- **Vocabulary Word Find** (Challenging – more words in more directions)
- **The Case of the Kilowatt Caper** (Introduction to worksheet)
- **Mr. Reznick's Kilowatt Caper** (Math worksheet)
- **The Real Energy Detective** (Story of home energy audit specialist)
- **Energy Web Sites**

For Teachers:

- **Goals & Standards**
- **Crossword Puzzle Key**
- **Word Find Keys**
- **Solutions for Mr. Reznick's Kilowatt Caper**

The ***Giants of Electrical Science Study Guide*** was written and prepared by the Educational Touring Theatre. It may only be duplicated for study purposes. If there are questions about ***The Energy Detective***, or about this Study Guide, please contact the Educational Touring Theatre.

A Word from Jimmy Ruff about seeing *The Energy Detective*

(To read before seeing the show.)

Hey you. Yeah you… Come here. I need your help.

My name is Jimmy Ruff. I'm a Private Detective. You may have seen my signs down at the bus station. You know, the ones that say, *No Case too Big – No Case too Small*. Yeah, that's me.

Look, I'm going to be coming to your school soon as one of the characters in a play called ***The Energy Detective***. What can I say? Things were a little slow in the detective business and they told me I could have the lead role. What's a guy supposed to do?

Anyways, the Educational Touring Theatre has spent a lot of time and money putting this ***Energy Detective*** show together for you. In fact, I got it on good word that one of the props we use in the show cost over $1,200.00! 12 hundred smackers for one prop – I wish they was paying me that much!

The thing is, this is one of those live performances. You know, a show where the actors are right there in front of you. Being a live performance makes ***The Energy Detective*** a lot different than a movie or a TV show. If you're sitting at home watching the tube, you can do anything you want, talk, eat Twinkies, tie knots in your little sisters hair, anything, and it won't change the show at all.

But, at one of these live performance thingys, anything that happens in the audience - that's you and your buddies watching the show – anything that happens in the audience changes the performance.

Hey, I know what I'm talking about here. We were doing the show at another school not too long ago, and there were these two guys sitting there in the second row talking and playing that tap someone on the shoulder game. You know the one I'm talking about, where you tap someone's shoulder and then act all innocent when they turn around. Well these two guys were so distracting, it made me completely forget my lines. Boy, did I feel stupid! The whole show came to a crashing halt while I tried to remember what to say next.

Besides that, these two bozos were so disturbing, that nobody else could enjoy the show. I'll tell you, I finally had to throw them out. They're probably still doing time down at the Principal's office right now!

So here's where you come in. When you come and see ***The Energy Detective***, I sure would appreciate it if you would practice what they call "good audience etiquette." That means none of that talking and playing around stuff during the show. Please show respect to the performers, like me, and to the rest of the audience. If you do that, I promise, we'll do our best to give you a great show. Hey, we may even pick you to be one of the volunteers!

Thanks a lot and enjoy the show!

Vocabulary List for *The Energy Detective*

The following words are listed in the order in which they are used in
The Energy Detective.

Carbon footprint: a measurement of how much carbon gas a person, place, or thing releases into the atmosphere.

Sustainable: something that will last a long time and be available when you need it.

Kinetic Energy: motion energy.

Generator: a device that changes kinetic energy into electrical energy.

Perpetrator: the person responsible for doing something; the bad guy!

Turbine: a machine that uses blades to change kinetic energy into mechanical energy.

Alternative energy: an energy source other than fossil fuels or nuclear energy.

Renewable resources: things that regenerate and can used again, i.e. the sun or trees.

Synthetic trees: devices that use filters to pull carbon gases out of the air.

Sequestration: to safely store out of sight.

Decapitate: to cut off the head.

Nucleus (nuclei): the center, or core, of an atom (nuclei is plural for nucleus).

Potential energy: stored energy, energy waiting to happen.

Fission: splitting apart the nucleus of an atom.

Radiation: the dangerous energy waves and particles released during nuclear fission.

Trident: a three pronged spear.

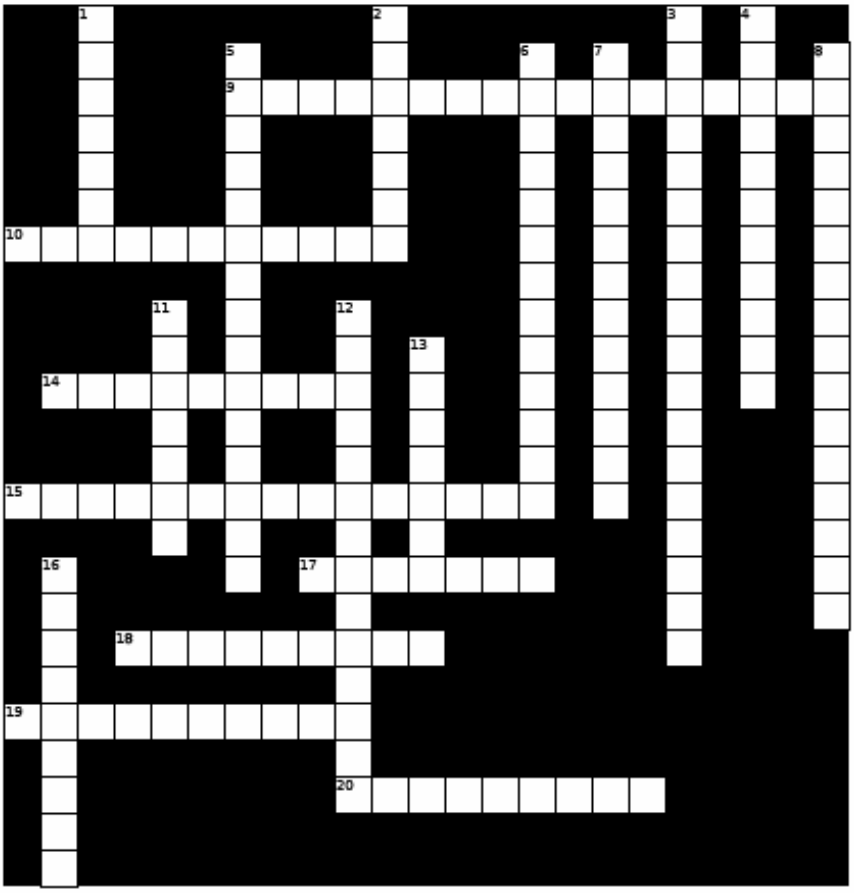
Perpetual: something that goes on forever.

Pelamis: named after a sea snake, this electric generator rides on top off the waves.

Hydroelectricity: electricity that is generated by moving water.

Solar cell: a silicon chip that generates electricity directly from the sun.

Crossword Puzzle for *The Energy Detective*



Across

9 Energy source other than fossil fuels or nuclear energy. (2 words)
10 Something that will last a long time and be available when you need it.
14 Energy waves released during nuclear fission.
15 Stored energy. (2 words)
17 Splitting apart the nucleus of an atom.
18 Device that changes kinetic energy into electrical energy.
19 Cut off the head.
20 A chip that generates electricity directly from the sun. (2 words)

Down

1 Electric generator that rides on top off waves.
2 Machine that uses blades to change kinetic energy into mechanical energy.
3 i.e. the sun or trees. (2 words)
4 The bad guy.
5 Measurement of how much carbon gas is released into the atmosphere. (2 words)
6 Motion energy. (2 words)
7 Store out of sight.
8 Electricity generated by moving water.
11 Three pronged spear.
12 Devices that pull carbon gases out of the air. (2 words)
13 Center of an atom.
16 Something that goes on forever.

Use the clues to solve this ***Energy Detective*** vocabulary word crossword puzzle.

Word Find for ***The Energy Detective***

R O L H C N G N G I N H R I U L N
E C H Y O O E F A O I A A T H R Y
N E E D K I N E T I C E N E R G Y
E O P R Y R E L P N I T A N T R R
W R O O B H R A D I A T I O N C Y
A L T E R N A T I V E E N E R G Y
B C E L N Y T C I C L R O F N S M
L L N E E Y O O R N S Y M R N A G
E E T C I T R T P I U I R R A A T
R P I T T C S E N N S C S R N O C
E C A R B O N F O O T P R I N T T
S C L I M A T E C H A N G E N D G
O N E C C S F O S S I L F U E L S
U L N I F I S S I O N A A N A A T
R A E T T R T S O L A R C E L L F
C S R Y A E E T U R B I N E I E E
E E G E L E O D R C L C F R E R L
S D Y N E F F I C I E N C Y N R E

alternative energy
carbon footprint
climate change
efficiency
fission
fossil fuels
generator
hydroelectricity
kinetic energy
potential energy
radiation
renewable resources
solar cell
sustainable
turbine

Use your detective skills to find all of these words that are used in ***The Energy Detective.***

The words may be across or down.

Word Find for ***The Energy Detective***

(Challenging)

N O N L B L I I H R WE Y M S N Y T C
G L O B A L WA R M I N G T T R N T B
O E T Y E E G N N E N S R R G K I E I
O T O N I N U U I U D Y E E I U R N Y
T T N O E A A A S E Y E N N E T A T E
S Y N T H E T I C T R E E S F L I N F
L G L I B K L O E O R T E R F C C I F
E R E G A R E P M A I H V M I C S R U
U E N N U N I T T C S N I R C S Y P R
F N F H Y D R O E L E C T R I C I T Y
L E E E I I R N I P C C A O E C T O M
I L A I D A E I T C E M N O N I U O M
S A I E L R N U C L E A R R C I R F I
S I N O G L N S E U E O E I Y Y B N J
O T S Y I E L B A N I A T S U S I O S
F N A T U R A L G A S R L L N A N B I
S E C R U O S E R E L B A WE N E R A
T T N B T S S T E E N O I T A I D A R
Y O I T T E G N A H C E T A M I L C T
U P N A N T A U A E N D H T C L G S T

alternative energy
climate change
electricity
generator
Hi Amperage
kinetic energy
nuclear
radiation
Sunny
trident

Atom
coal
fission
global warming
hydroelectricity
natural gas
oil
renewable resources
sustainable
turbine

carbon footprint
efficiency
fossil fuels
Gus T
Jimmy Ruff
Neptune
potential energy
solar
synthetic trees
wind

Use your detective skills to find all of these words that are used in ***The Energy Detective.***

<u>The words may be horizontal, vertical, diagonal, and even backwards!</u>

The Case of the Kilowatt Caper

The sign on the door says *No Case Too Big – No Case Too Small*.

You can find that door down a long, narrow hallway, three flights up, in a dusty old building tucked away on a side street in Nashville, Tennessee.

If you open that door, you'll find me, Jimmy Ruff, Private Detective.

The sign on the door means what it says. I've cracked cases for some of the largest corporations in Tennessee. I've also helped little Izzy Noblin find her missing goldfish…or at least what was left of Goldie after the cat was finished with her. I'm not going to tell you where I found the remains.

So, I wasn't surprised then when the door crashed open and a kid rushed in like his hair was on fire. Actually, his hair did look like it was on fire. It was bright red with orange spikes shooting out in every direction.

"You gotta help me!" he cried. "You're my last hope!"

"Don't worry, kid," I reassured him. "I'll track down the stylist responsible for destroying your hair. She'll do hard time for a crime like that."

"It's not my hair," he spluttered, "it's this!" He shovel passed a crumpled wad of paper in my direction.

I took the wad and uncrumpled it on my desk. "Mr. Reznick's Kilowatt Caper," I read. "This looks like some kind of homework assignment."

"This isn't regular homework, it's another one of Reznick's impossible special projects! First he made us write a 40 page paper comparing the cost of groceries between 'Bargain Mart' and the 'La Dee Dah High End Food Emporium.' Next he made us spend three months filling out tax forms using the wages from the imaginary careers he gave us. I was a 'Whack-A- Mole' repairman. And now, this!"

"It's the old 'math is part of everyday life' trick," I said. "Let's take a look at what he's up to this time."

The assignment looked like your typical worksheet. It started out with some simple definitions, followed by a series of word problems.

"OK," I said to the kid, "let's start at the top. It says here that electricity is often measured in *watts*."

"What's a watt?" he whined.

"A watt is what you get when you multiply the amps times the volts, " I explained.

The kid gave me one of those deer in the headlights kind of stares.

"OK, OK," I said, "I don't think you have to worry about the amps and volts. A watt is simply a way to measure how much electricity is being used at any given time. Just like you might tell how fast an Aaron Rogers pass is by measuring it in miles per hour."

"Why didn't old Reznick say that in the first place?" the kid grumped.

I didn't point out to him that the teacher had basically said the same thing on the top of the sheet. I did point out that Reznick said a *kilowatt* is equal to one thousand watts, and that a *kilowatt hour* was the total number of kilowatts that were used in one hour.

"Now remember this," I said to the kid, "for the problems on the worksheet the electricity costs 10 cents per kilowatt hour. That's important."

"10 cents per kilowatt hour …10 cents per kilowatt hour," the kid repeated. "Got it."

The kid leaned over the desk and we read the first problem together: A washing machine uses 500 watts of power. If you wash clothes for one hour each day, how much will it cost to wash clothes for one week?

"Who washes clothes everyday?" the kid asked. "If my Ma doesn't catch me, I wear the same clothes every day!"

"Yeah, I can tell," I said, putting some distance between myself and the smelly youth. "Let's see if I can talk you through the problem."

"The first thing we have to do is find out how many kilowatts are being used. To do that we divide the number of watts, 500, by the number 1000."

The kid did some quick figuring in his head. "500 watts divided by 1000…that equals .5 kilowatts," he said smiling. Maybe this kid wasn't so bad after all.

"You got it, kid. Now to figure out the kilowatt hours, you multiply the total number of hours times the number of kilowatts."

"OK," he said, "I can do that. I multiply the kilowatts, .5, times the hours. That would be .5 kilowatts times one hour."

"Slow down," I cautioned, "look again at how many hours we're talking about here."

He gave me a withering look. "It says right here one hour each day." He jabbed his finger at the worksheet. "Are you blind or something?!"

"One hour each day," I said, ignoring his rudeness, "but for how many days?"

He took another look at the problem, then grinned sheepishly. "One hour each day for an entire week. That would be seven days. I knew that. I was just testing you."

"Of course you were. Now do the math," I instructed.

"One hour a day for seven days," he said, "that's seven hours. We multiply seven hours by .5 kilowatts and we end up with 3.5 kilowatt hours."

"You're in the home stretch," I said. "Now how much does 3.5 kilowatt hours of electricity cost?"

"Well, one kilowatt hour costs 10 cents, so, if I multiply 3.5 times .10 that will tell me the total cost." This time he jotted down the numbers and worked the problem out on the back of the worksheet. "35 cents!" he proclaimed triumphantly. "The electricity would cost 35 cents!"

"That's it, hot shot! Now see if you can solve the rest of 'Mr. Reznick's Kilowatt Caper'."

How about you? Can you solve the rest of "Mr. Reznick's Kilowatt Caper?" Be sure to read the problems carefully to find all of the clues. It's fine to use a calculator or scratch paper if you want; some of the problems are pretty tricky. And watch out for Problem 4 – part of that problem will have to be solved backwards!

Good luck!

Mr. Reznick's Kilowatt Caper

Electrical Energy is often measured in watts (W).

A kilowatt (kW) is equal to 1000 watts.

A kilowatt hour (kWh) is the total number of kilowatts used in one hour:
kWh = kW x time in hours.

For the following problems assume that electricity costs $ .10 per kWh.

Example: A washing machine uses 500 watts of power. If you wash clothes for one hour each day, how much will it cost to wash clothes for one week?

Solution: 500 W/1000 = .5 kW .5kW x 7 hours = 3.5 kWh 3.5 kWh x $ .10 = $ .35

Answer: $ 0.35 per week

Problem 1: For three days before Thanksgiving, Grandma spent 5 hours a day using her oven to bake all kinds of delicious food and treats. Her oven uses 10,000 watts. How much did the electricity cost for cooking Thanksgiving dinner?

Solution: _____

Problem 2: The Bat Cave uses one hundred 60 watt light bulbs. It is pretty dark in there, so the lights are on every day for 10 hours a day. How much money would Batman save in a year if he replaced all the light bulbs with 20 watt compact florescent bulbs.

Solution: _____

Problem 3: The PS2 uses 30 watts. The XBox 360 uses 165 watts. If you played each game system for 100 hours, how much more would the electricity cost to play the XBox 360?

Solution: _____

Problem 4: Jenna's Dad told her that she could spend the same amount money for the electricity to watch TV as she could for buying a Coke. If a Coke costs $ .50, and if Jenna's TV uses 100 watts of power, how many hours can Jenna watch TV?

Solution: _____

The Real Energy Detective

Slowly the mini-video cam snaked its way down the metal ductwork. As Detective Pat Garrett continued to feed the cable down the shaft, he kept his eyes on the hand-held monitor.

Slowly…slowly…there! Just as Garrett suspected; the culprit lay at the junction of two of the metal panels.

Pat Garrett isn't an FBI agent. He isn't a law enforcement officer of any kind. And the culprit in our ductwork scenario isn't a bank robber or an escaped convict. The culprit is a split seam allowing conditioned air to escape from the house. Pat Garrett is a home energy audit specialist for Duck River Electric Membership Corporation. Pat is a real energy detective.

Like many of the electric cooperatives across Tennessee, Duck River Electric Membership Corporation provides its customers with free home energy audits. During a home energy audit, the specialist comes out to your home and hunts for clues of energy waste and inefficiency. In the Duck River service area of south central Tennessee, Pat is the man to see.

For over five years, Pat has been helping his customers save energy and money. "Most people think I am just going to give them some brochures or pamphlets about energy efficiency," Pat says. But after he spends over two hours covering the entire house from attic to crawl space, "the customers are really impressed with how much we do."

Pat actually starts his investigation of each target home before he ever leaves his office. He begins by researching the age and construction type of the house. This information will help him know what problems to expect when he is in the field.

When he arrives at a house, Pat begins with a complete surveillance of the house's exterior. As he circles the home, Pat charts all of the house's windows and doors. He also looks for clues of energy waste, such as broken windows, peeling weather stripping and loose caulking, and signs of moisture that could create wet and inefficient insulation. He also inspects any exterior heating and cooling units, and checks out the electric meter.

Once inside, he will examine the attic and make sure there is a sufficient amount of insulation. He'll get out his smoke pen to track air flow to be sure the warm air in winter, or cool air in summer, are not escaping through any cracks. He may use his mini-video cam to take a closer look at the ductwork if he suspects there may be leaks.

Another special tool Pat has in his arsenal is a velometer. The velometer is a special device that measure how fast the air is flowing. "If the air is moving too fast," Pat explains, "the condenser coil on air conditioner can't do its job efficiently. That's a big waste of energy."

"If the air is moving too slowly," he adds, "the house isn't breathing properly. Without proper airflow, you wont have the desired temperature change across the evaporator. That will make the unit work harder." Again, a big waste of energy.

Real Energy Detective – Page 1

Of course, a home energy audit wouldn't be complete without a visit to the crawl space. Many people forget about insulating under their homes and a lot of energy escapes that way. It can be a dirty job, and a tight fit for the five foot, ten inch Garrett. Checking out the crawl space can also add an unexpected twist to the job. "I've seem some pretty big snakes down there," Pat laughs.

Even the smallest details don't escape Pat's investigation. He looks at air filters, hot water heaters, thermostats, refrigerators, and freezers. According to Pat, "A lot of people plug in an old freezer out on their porch, then don't fill it up. They waste a lot of money that way. A full freezer uses a lot less electricity than an empty one does."

After completing the investigation, Pat prepares a written report for the homeowner. In the report Pat details his findings and makes recommendations on how the owner can help improve their energy efficiency and cut down on energy waste.

As far as Pat is concerned, that is the best part of being an energy detective, helping the costumers and showing them that their energy cooperative really cares.

Energy Web Sites

Just like Private Detective Jimmy Ruff, you may want to begin your energy sleuthing on the Internet. These websites can help get you started learning more about different energy sources and energy efficiency. Some of the sites have some great games on them, too!

www.tvakids.com

www.touchstoneenergykids.com

www.eia.doe.gov/kids

www.energystar.gov (click the "Kids" link)

Your **teacher** can get in on the fun, too, by checking out these sites:

http://apps1.eere.energy.gov/education/lessonplans/

www.doe.gov/energysources/electricpower.htm

Always Practice Internet Safety!

Please get permission before surfing the web. All of the sites listed were up and running at the time this list was made. They all presented material in a way that was appropriate for students. But, we do not have control over these sites or over their content. If you discover that any of these sites are inappropriate in any way, please protect yourself and other students by exiting the site immediately and then reporting the site to a teacher or another adult.

The Energy Detective Goals & Standards

The curriculum based ***The Energy Detective*** performance, the **Energy Casebook** workshop, and ***The Energy Detective*** **Study Guide** are designed as valuable instructional tools. Listed below are the Tennessee Department of Education Goals and Standards that these presentations and material will help teachers address.

SCIENCE STANDARDS

Embedded Technology & Engineering

Conceptual Strand

Society benefits when engineers apply scientific discoveries to design materials and processes that develop into enabling technologies

GLE 0507.T/E.1 Describe how tools, technology, and inventions help to answer questions and solve problems.

GLE 0507.T/E.2 Recognize that new tools, technology, and inventions are always being developed.

GLE 0507.T/E.3 Identify appropriate materials, tools, and machines that can extend or enhance the ability to solve a specified problem.

GLE 0507.T/E.4 Recognize the connection between scientific advances, new knowledge, and the availability of new tools and technologies.

GLE 0607.T/E.1 GLE 0707.T/E.1 GLE 0807.T/E.1
Explore how technology responds to social, political, and economic needs.

GLE 0607.T/E.2 GLE 0707.T/E.2 GLE 0807.T/E.2
Know that the engineering design process involves an ongoing series of events that incorporate design constraints, model building, testing, evaluating, modifying, and retesting.

GLE 0607.T/E.3 GLE 0707.T/E.3 GLE 0807.T/E.3
Compare the intended benefits with the unintended consequences of a new technology.

Interdependence

Conceptual Strand 2

All life is interdependent and interacts with the environment.

GLE 0507.2.3 Establish the connections between human activities and natural disasters and their impact on the environment.

The Earth

Conceptual Strand 7

Major geologic events that occur over eons or brief moments in time continually shape and reshape the surface of the Earth, resulting in continuous global change.

GLE 0707.7.5 Differentiate between renewable and nonrenewable resources in terms of their use by man.

Matter

Conceptual Strand 9

The composition and structure of matter is known, and it behaves according to principles that are generally understood.

GLE 0807.9.1 Understand that all matter is made up of atoms.

Energy

Conceptual Strand 10

Various forms of energy are constantly being transformed into other types without any net loss of energy from the system.

GLE 0607.10.1 Compare and contrast the three forms of potential energy.

GLE 0607.10.2 Analyze various types of energy transformations.

GLE 0607.10.3 Explain the principles underlying the Law of Conservation of Energy.

SOCIAL STUDIES STANDARDS

Culture

Content Standard: 1.0

Culture encompasses similarities and differences among people including their beliefs, knowledge, changes, values, and traditions. Students will explore these elements of society to develop an appreciation and respect for the variety of human cultures.

1.04 Describe the influence of science and technology on the development of culture through time.

1.06 Understand the influence of science and technology on the development of culture through time.

History

Content Standard: 5.0

History involves people, events, and issues. Students will evaluate evidence to develop comparative and casual analyses, and to interpret primary sources. They will construct sound historical arguments and perspectives on which informed decisions in contemporary life can be based.

5.5.14 Understand economic, social, and cultural developments in the contemporary United States.

- Describe global environmental issues.

Individuals, Groups, and Interactions

Content Standard: 6.0

Personal development and identity are shaped by factors including culture, groups, and institutions. Central to this development are exploration, identification, and analysis of how individuals and groups work independently and cooperatively

6.01 Recognize the impact of individual and group decisions.

THEATRE STANDARDS

Standard 6.0 Theatrical Presentation

Students will compare and incorporate art forms by analyzing methods of presentation and audience response for theatre, dramatic media (such as film, television, and electronic media), and other art forms.

6.1 Explore other art forms as they contrast and/or relate to theatre.

6.4 Understand the role of the audience and demonstrate appropriate audience etiquette.

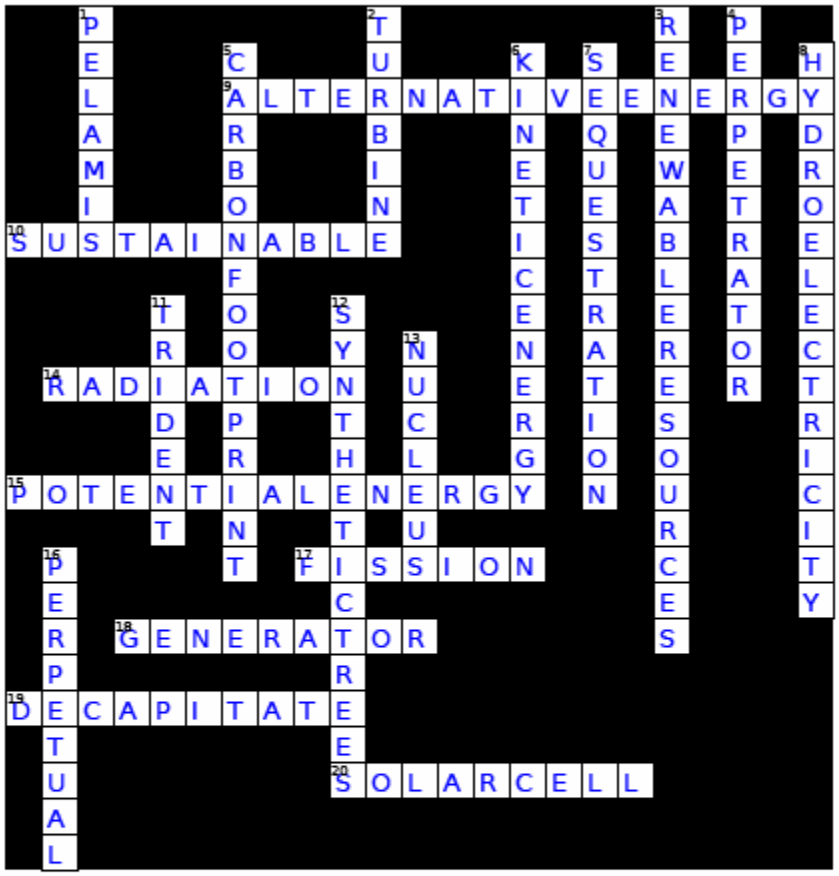
Standard 7.0 Scene Comprehension

Students will analyze, evaluate and construct meanings from improvised and scripted scenes and from theatre, film, television, and electronic media productions.

7.1 Respond to selected theatrical experiences.

7.2 Examine creative drama and formal theatre, film and multimedia productions.

Key for *The Energy Detective* Crossword Puzzle



Across

9 Energy source other than fossil fuels or nuclear energy. (2 words)
10 Something that will last a long time and be available when you need it.
14 Energy waves released during nuclear fission.
15 Stored energy. (2 words)
17 Splitting apart the nucleus of an atom.
18 Device that changes kinetic energy into electrical energy.
19 Cut off the head.
20 A chip that generates electricity directly from the sun. (2 words)

Down

1 Electric generator that rides on top off waves.
2 Machine that uses blades to change kinetic energy into mechanical energy.
3 i.e. the sun or trees. (2 words)
4 The bad guy.
5 Measurement of how much carbon gas is released into the atmosphere. (2 words)
6 Motion energy. (2 words)
7 Store out of sight.
8 Electricity generated by moving water.
11 Three pronged spear.
12 Devices that pull carbon gases out of the air. (2 words)
13 Center of an atom.
16 Something that goes on forever.

Solutions for *The Energy Detective* Word Finds

Regular Word Find

alternative energy
carbon footprint
climate change
efficiency
fission
fossil fuels
generator
hydroelectricity
kinetic energy
potential energy
radiation
renewable resources
solar cell
sustainable
turbine

Solutions for *The Energy Detective* Word Finds

Challenging Word Find

alternative energy
climate change
electricity
generator
Hi Amperage
kinetic energy
nuclear
radiation
Sunny
trident

Atom
coal
fission
global warming
hydroelectricity
natural gas
oil
renewable resources
sustainable
turbine

carbon footprint
efficiency
fossil fuels
Gus T
Jimmy Ruff
Neptune
potential energy
solar
synthetic trees
wind

Mr. Reznick's Kilowatt Caper – Solutions

The students should start by reading *The Case of the Kilowatt Caper*. This story will introduce the concepts and outline an approach to solving the problems on the worksheet.

For younger students, you may want to solve the problems as a class instead of individually.

Problem 1: 10,000 watts/1000 = 10 kW
10 kW x 15 hours = 150 kWh
5 hours per day x 3 days = 15 hours
150 kWh x $.10 = $15.00

Answer: Grandma spent $15.00 for the electricity to cook Thanksgiving dinner.

Problem 2: Regular bulbs
60 W/1000 = .06 kW
.06 kW x 3,650 hours = 219 kWh
10 hours per day x 365 days = 3,650 hours
219 kWh x $.10 = $21.90/year each bulb
$21.90 x 100 bulbs = $2,190.00/year for 100 bulbs

CFL Bulbs
20 watts/1000 = .02 kW
.02 kW x 3,650 hours = 73 kWh
10 hours per day x 365 days = 3,650 hours
73 kWh x $.10 = $7.30/year each bulb
$7.30 x 100 bulbs = $730.00/year for 100 bulbs

$2,190.00 - $730.00 = $1,460.00

Answer: Batman would save $1,460.00 per year by using CFL bulbs.

Problem 3: PS2
30 watts /1000 = .03 kW
3 kWh x $.10 = $0.30
.03 kW x 100 hours = 3 kWh

Xbox 360
165 watts /1000 = .165 kW
16.5 kWh x $.10 = $1.65
.165 kW x 100 hours = 16.5 kWh

$1.65 - $0.30 = $1.35

Answer: It would cost an extra $1.35 to play the Xbox 360.

Problem 4: 100 watts/1000 = .1 kW to watch TV
Now work back from the cost of a can of Coke:
$.050/$0.10 (cost of electricity) = 5 kWh
5 kWh/.1 kW (energy for watching TV) = 50 hours

Answer: Jenna could watch TV for 50 hours.