Energenius® Out-of-School Time Program

Energy and You!

Activities on Understanding Energy Use and Energy Efficiency

PG&E®

Introduction

Energy and You is an activity guide for children and youth in out-of-school time (OST) programs. It is designed to engage children and youth to think about how they use energy, how energy is measured, paid for, and ways to save energy.

As children and youth participate in activities about their own daily use of electricity and natural gas at school and at home, they will also identify simple energy-saving actions. They will understand how these actions can help reduce the impacts of energy use and production on the environment, and also practice influencing others to take energy-saving actions.

Guide to Activities

The three lesson plans in Energy and You can be used as a stand-alone unit or as part of a larger study of energy and the environment. The activities are designed to be completed in 3-6 sessions. Each activity provides an overview, preparation, materials, vocabulary and objectives.

This activity guide also offer activities for children and youth to take home to their parents, guardians, and other caretakers.

Training

This after school activity guide is provided as a resource for OST programs and is offered along with training for OST staff to implement these activities.

The Energenius Out-of-School Time Program activity guides and training were developed by the California School-Age Consortium with funding from Pacific Gas and Electric Company.

Contents

Activity 1:
Energy in our Lives

Activity Overview:
This activity asks children and youth to think about how they use energy at home and at school. It also provides an opportunity for children and youth to learn about energy efficiency, and practice energy-saving actions in their everyday lives.

This activity is intended to help children and youth make the connections between their everyday actions and use of energy. In later activities, children and youth will learn about the environmental impacts of energy use and energy conservation, so it's important for them to understand their role in using energy.

Objective(s):
- Children and youth will be able to identify ways they use energy at school and at home.
- Children and youth will be able to define the unit of measurement for electricity.
- Children and youth will discover the amount of energy used by common classroom and household items that use electricity.

Preparation:
- Read the entire activity thoroughly, making adjustments as necessary for the age(s) of the children and youth, group size, and session time.
- Make copies of the **My Energy Use Handout**, (page five) for each child or youth.
- Prepare four chart papers with the following headings: Before School, At School, After School Program, Evenings and Weekends. Draw two columns with the headings: Ways We Use Energy, and Energy-Saving Ideas. Post around the room.

Materials:
- Chart paper
- Markers, colored pencils, or crayons
- Optional: stickers, colored paper, other decorative materials
- **My Energy Use Handout** (page five)
- Home Energy Information Packets

Vocabulary:
Energy – The ability to do work. Energy can make things move, stretch, and grow. In these activities, the word energy usually refers to electricity and natural gas that "works" for us at home and at school.

Electricity – A type of energy used to power appliances and equipment. Also called electrical energy.

Energy Efficiency – The use of energy without waste. Energy efficiency refers to work done using the smallest amount of energy needed.

Energy in Our Lives: Introduction

1. Explain that in this activity we're going to explore energy in our lives.
2. Introduce the lesson by asking children and youth to think about the electricity they use every day.
3. Distribute markers to each student and separate them into small groups.
4. Point to the chart papers labeled Before School, At School, After School Program, and Evenings and/or Weekends that are hung around the room. Ask students to rotate to each poster and write down the ways they use energy during the different parts of their day. If they have trouble thinking of the ways they use energy, have them start by looking around the room they're in to identify how energy is being used.
5. Once at their starting chart paper, give the group two minutes to write the ways they use electricity during that time period.
6. After time is up, signal to children and youth to rotate to the next chart paper. Continue this process until everyone has visited all four chart papers.
7. Instruct the group to walk around, read the responses from everyone and come back together for a discussion.
8. Discuss using these questions. Do you see any patterns in the responses? What part of your day do you use the most energy? The least? What items do use you use most?
9. Explain that the electricity needed to power the things they use every day is generated from natural resources, and costs money. Children and youth will learn more about how energy is measured and paid for in a later activity.

Modification Tip:
To modify this activity for younger children and youth (K-2nd Grade), have them draw the ways they use energy individually or in pairs. Post the drawings on the wall and lead the discussion in the instructions above.

This activity can also be modified for younger children and youth or for limited time by leading a discussion about energy use instead of having the children and youth rotate around the room and chart their answers.

Be aware that for some programs, this activity may highlight economic differences between children and youth. If you think this is an issue for your group, the activity can be modified by having them focus only on how they use energy at school. They can discuss use of energy in the classroom, the library, computer room, OST program spaces and other school buildings.

Activity 1A:
Energy in Our Lives: Being Energy Efficient

1. Ask children and youth the following:
   a. Do you know what the word efficient means?

      Energy efficiency – the use of energy without waste. Energy efficiency refers to work done using the smallest amount of energy needed.

   b. How do you try to be efficient in your life? If children and youth have trouble answering this question, have them think about doing homework or chores.
2. Explain that soccer or basketball players are efficient when they don't waste steps. An efficient car travels more miles on a gallon than an inefficient car. People can be energy efficient when they use only as much electricity or natural gas as needed to do a certain task. Being energy efficient means not wasting energy.
3. Divide the group so there is an even number of children and youth back at the posters.
4. Tell the groups that now they will brainstorm ways to be energy efficient before school, at school, in the after school program, and evenings and/or weekends. Have children and youth write their suggestions in the column labeled Energy-Saving Ideas.
5. After about ten minutes, have children and youth rotate around the room to look at the work of others.

Debrief Questions

- What did you notice about the Energy-Saving Ideas from all of the groups?
- Which of the ideas seem easy to you? Which ones might be more difficult?
- Why do you think it's important to be energy efficient?

Remind children and youth that saving energy saves natural resources and money and is good for the environment!

Modification Tip:
To modify this activity for younger children and youth (K-2nd Grade), lead a brainstorm with the whole group, rather than having teams work independently.

Activity 1B:
Energy in Our Lives: Energy Conservation Slogans

1. Tell children and youth that they have the ability to make a difference when it comes to saving energy. Small changes can add up to big energy savings over time, and they can also help others to remember to be energy efficient too!
2. Have children and youth return to their groups from the last activity.
3. Explain that they will be creating an energy-saving slogan to help themselves and others remember to be energy efficient.
4. Ask children and youth if they can think of a slogan from a brand or product. Examples could include a phrase or rhyme from a cereal or toy commercial.
5. Have children and youth spend five-ten minutes brainstorming slogans for the energy saving tips that they came up with for the last activity. If they can easily think of one have them continue brainstorm others and pick the best one at the end.
6. Distribute a piece of chart or butcher paper to each group and have them pick one of their slogans to create a sign. Have them create and decorate their slogan sign using colored markers, pencils, crayons, stickers, colored paper, etc.
7. When groups have created their slogan signs, have them presented to the larger group.
8. Post the signs around the program space.

Take Home Activity

1. Provide children and youth with the **My Energy Use Handout** and review the instructions.
2. Explain that they'll use this to find ways to save energy at home.
3. Hand out the home energy information packets. Tell children and youth that the packet contains information that can help their families save energy and money; ask them to review the Home Energy Information Packets with their family.

My Energy Use

If we want to be more energy efficient, we should know how and when we use energy at home. Use the log below to write down for a few days when and how you use energy (electricity or natural gas). Then write down ways that you can save energy at home.

When I used electricity:	What electricity was used:	How long I used electricity:
Example: before school	Example: I turned the light on in the kitchen	Example: 30 minutes

Energy-Saving Opportunities:

1. Example: Open the blinds instead of turning on the lights during the day
2. _____
3. _____
4. _____
5. _____

NOTES:

Activity 2:
Measuring Energy

Activity Overview:
In this activity, children and youth explore an energy bill and identify the biggest uses of energy in the average home. In order to read the energy bill, children and youth will also be introduced to the way electricity and natural gas are measured. They also learn tips that can help save their households money and conserve energy.

Children and youth are able to make the connection between their energy use and the effects on their family more concrete in this activity. The take home activity has them exploring their own household energy use to measure their effect on reducing energy use at home.

Objective(s):
- Children and youth will be able to explain how energy is measured.
- Children and youth will be able to read an energy bill.
- Children and youth will be able to identify what energy uses make up their bill each month.
- Children and youth will be able to list ways to reduce their energy use.

Preparation:
- Read through the entire activity thoroughly, making adjustments as necessary for the age(s) of the children and youth, group size, and session time.
- Make copies of Sample Energy Bill, Energy Extras – Part 1, and Family Energy Talk Handouts, one for each child and youth.

Materials:
- **Sample Energy Bill Handout** (page 11)
- **Energy Extras** – **Part 1 Handout** (page 15)
- **Family Energy Talk Handout** (page 16)
- **Home Energy Information Packets**

Vocabulary:
Natural Gas – An air-like substance found in the Earth that can be burned for heat or fuel.

Electricity – A type of energy used to power appliances and equipment. Also called electrical energy.

Watt – A measure of power.

Kilowatt – A unit of electrical power that equals 1,000 watts.

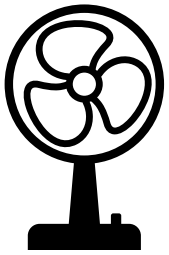
Kilowatt-hour (kWh) – The measure of electric power used over time. It is equivalent to 1,000 watt-hours.

Therm – A measurement of usage of natural gas. A therm is the energy equivalent of burning 100 cubic feet of natural gas.

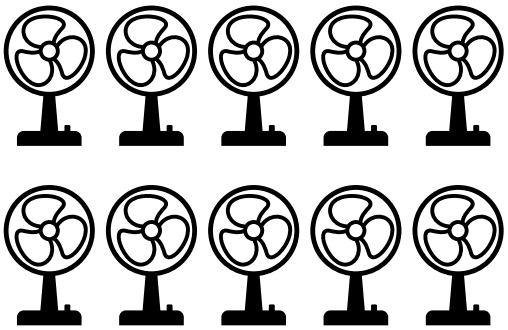
Propane – A nonrenewable energy sources that is produced as a by-product from natural gas processing and oil refining.

Measuring Energy: Introduction

1. Ask children and youth if they know how electricity is measured.
2. Explain that energy is measured by the amount of work it does. An electric meter measures the amount of energy used. If your school, for example, keeps electric lights on 24 hours a day, electricity is "working" around the clock by lighting the school. The use of energy is measured in watts and kilowatt-hours. It takes 1,000 watts used for one hour to make one kilowatt-hour or kWh.
3. Share the following definitions:
    a. Watt – A unit of measure of electric power.
    b. Kilowatt – A unit of measurement of electric power that equals 1,000 watts.
    c. Kilowatt-hour (kWh) – A unit of measurement of electricity used which translates to one kilowatt used for one hour.
4. Share the following to help children and youth visualize kilowatt-hours:
    a. Ask for a volunteer to stand up and tell the class to imagine that this person represents a small table fan. You can have them rotate their hands around to make a circular movement. Let's imagine that this fan uses 100 watts of electricity to run.
    b. Now have nine other volunteers stand up and rotate their hands. If all 10 of the fans running in the room right now are turned on for an hour, the amount of electricity used would be equal to one kilowatt –hour.
    c. Write the following on the board: 100 watts x 10 fans x one hour = 1,000 watt-hours or one kilowatt-hour.
    d. Reiterate that a kilowatt-hour (kWh) is the measurement of electricity use over the course of an hour.
5. Explain that it's important for us to know how electricity is measured so we can understand how we pay for electricity, and ways to save it!



If one fan uses 100 watts of electricity...



...and ten fans were running for one hour, it would equal 1000 watt hours or one-kilowatt-hour.

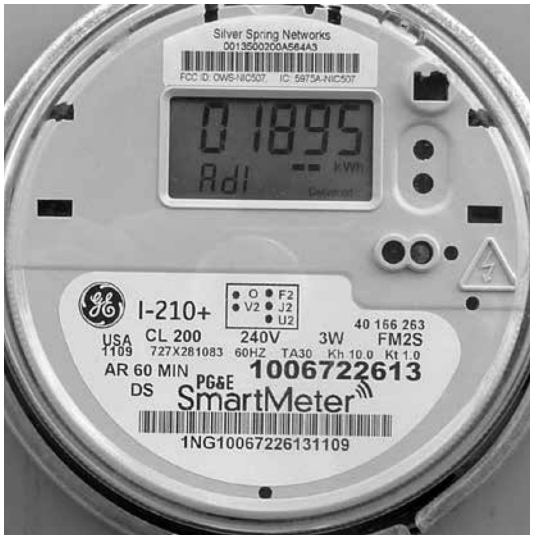
If one-kilowatt-hour cost $.10 then ten fans running for one hour would cost _____.

Modification Tip:
To modify this activity for younger children and youth (K-2nd Grade), create premade signs with an image of a fan to help them visualize the appliances. If children and youth are having a hard time understanding how energy is measured, talk about how other things are measured – inches and feet, pounds, minutes and hours, etc. You can bring in a hairdryer and turn it on to show the work it does (produces heat, blows air). Energy is unique in that it is measured by the work it does!

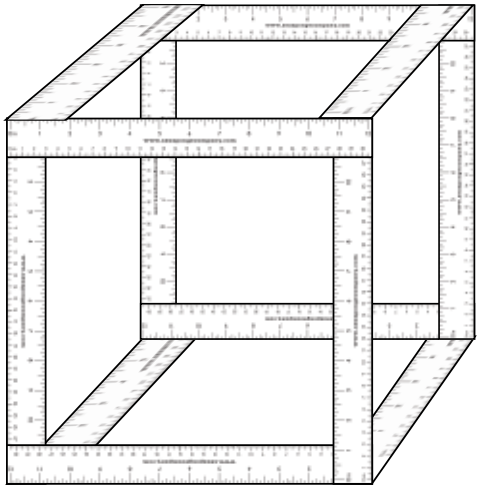
For older children and youth (6th – 8th Grade), you can extend the activity by having children and youth do more calculations for more fans or longer amounts of time.

Activity 2A:
Measuring Energy: Reading an Energy Bill

1. Ask children and youth if they've ever looked at their energy bill at home. Explain that some families pay for their energy as part of a rent payment and do not receive an energy bill.
2. Tell children and youth that in order for us to be able to do our everyday tasks such as turning on the lights or taking a shower, we need energy. Now we're going to learn about how we pay for energy, and ways to be energy efficient to reduce our energy costs.
3. Explain that most homes use natural gas, propane, and/or electricity for its energy. These include:
    a. Natural gas helps to heat our homes and is the fuel used in gas stoves and ovens. In order for natural gas to get to our homes, it has to be extracted from the earth, processed to remove contaminants, and delivered through pipelines.
    b. Electricity comes from a variety of sources, and powers anything that needs to be plugged in like a cell phone charger or television. In order for electricity to get to our homes, it needs to be generated, transmitted, and distributed over power lines.
    c. Propane – A nonrenewable energy sources that is produced as a by-product from natural gas processing and oil refining.
    d. Some homes use just electricity. Propane is most often used in rural areas.
4. Pass out the Sample Energy Bill to children and youth.
5. Have them take two-three minutes to read the bill, and circle words they don't know and underline what key words they understand.
6. Ask children and youth to share words they circled and underlined. Chart the words and review:
    a. A watt is a measure of power.
    b. A kilowatt is a unit of electrical power that equals 1,000 watts.
    c. A kilowatt-hour (kWh) is the measure of electric power used over time. It is equivalent to 1,000 watt-hours.
    d. A therm is a measurement of usage of natural gas. A therm is the energy equivalent of burning 100 cubic feet of natural gas.



(To understand what a cubic foot is, give six children or youth two rulers each. Ask them to arrange the rulers into the shape of a cube. This can also be done ahead of time using dowels, paper, or other materials.)



7. Walk through the different parts of the bill to make sure children and youth understand what is on it.
    e. Prior meter reading – this measurement shows the amount of kilowatt-hours or therms recorded on the customer's meters at the beginning of the 30-day billing period.
    f. Current meter reading – this measurements shows the meter reading at the end of the billing period.
    g. The difference between the prior meter reading and the current meter reading indicates the amount of kilowatt-hours or therms used over the month. The number of kilowatt-hours or therms multiplied by the rate determines the amount of money owed on the bill.
    h. Baseline usage – this is an amount of kilowatt-hours or therms allocated to customers at the lowest rate.
    i. Once users go over the baseline allocation, they are charged at a higher rate.
    j. Explain that energy users are charged multiple rates to encourage households to use less energy.
8. Ask children and youth if they can identify the following:
    k. The total energy bill ($204.31)
    l. The number of therms used this billing cycle (100)
    m. The number of kWh used this billing cycle (400)
9. Explain that there are supports available for households that have trouble paying their energy bill, one of those supports is the California Alternate Rates for Energy Program or CARE program.

Modification Tip:
Modify and extend this activity for older children and youth by having them answer the following:

- What would this customer pay for electricity and natural gas for a year?
- What factors that could change the amount of the annual utility bill?

Together with their parents or guardians, older children and youth can also visit **www.pge.com** to view their household PG&E bills.

Energy Bill

Electricity and Natural Gas Bill

Valley Electricity AND Gas Company

For service at:
Hunter C. Hayes
44 Lowe St.
Golden Valley, CA 90000

Electric Account # 445 777 1110 E	
Prior Meter Reading	44061
Current Meter Reading	44461
Difference	400

Baseline usage 250 kWh @ $0.10	
101–150 percent of baseline 120 kWh @ $0.15	
151–200 percent of baseline 25 kWh @ $0.20	$48.75
Taxes (6 percent)	2.92
Total charges	$51.67

Natural Gas Account # 445 777 1110 G	
Prior Meter Reading	6406
Current Meter Reading	6506
Difference	100

Baseline usage 20 therms @ $1.20	
Over baseline 80 therms @ $1.50	$144.00
Taxes (6 percent)	8.64
Total charges	$152.64

Total amount due: $204.31

This is a fictitious bill and utility company–for activity use only.

NOTES:

Activity 2B:
Measuring Energy: Energy Face Off

1. Divide children and youth into two groups.
2. Explain that the money spent on energy use goes to seven main categories – Appliances, Cooling, Electronics, Room Heating, Lighting, Water Heating, and Other. We're going to play a game to see if you can put these in order of energy cost.
3. Flip a coin to see who will start. The starting team then gets ten seconds to guess which energy use category is the highest on the list.

    - **Room Heating – furnace, radiator, floor heater (29%)**
    - **Cooling – air conditioner (17%)**
    - **Water heating– for baths, washing dishes, clothes, etc. (14%)**
    - **Appliances – refrigerator, dishwasher, clothes washer and dryer, etc. (13%)**
    - **Lighting – lamps, overhead lights (12%)**
    - **Electronics – televisions, computers, cell phones, etc. (4%)**
    - **Other (11%)**

4. Alternate teams until all seven categories are revealed.

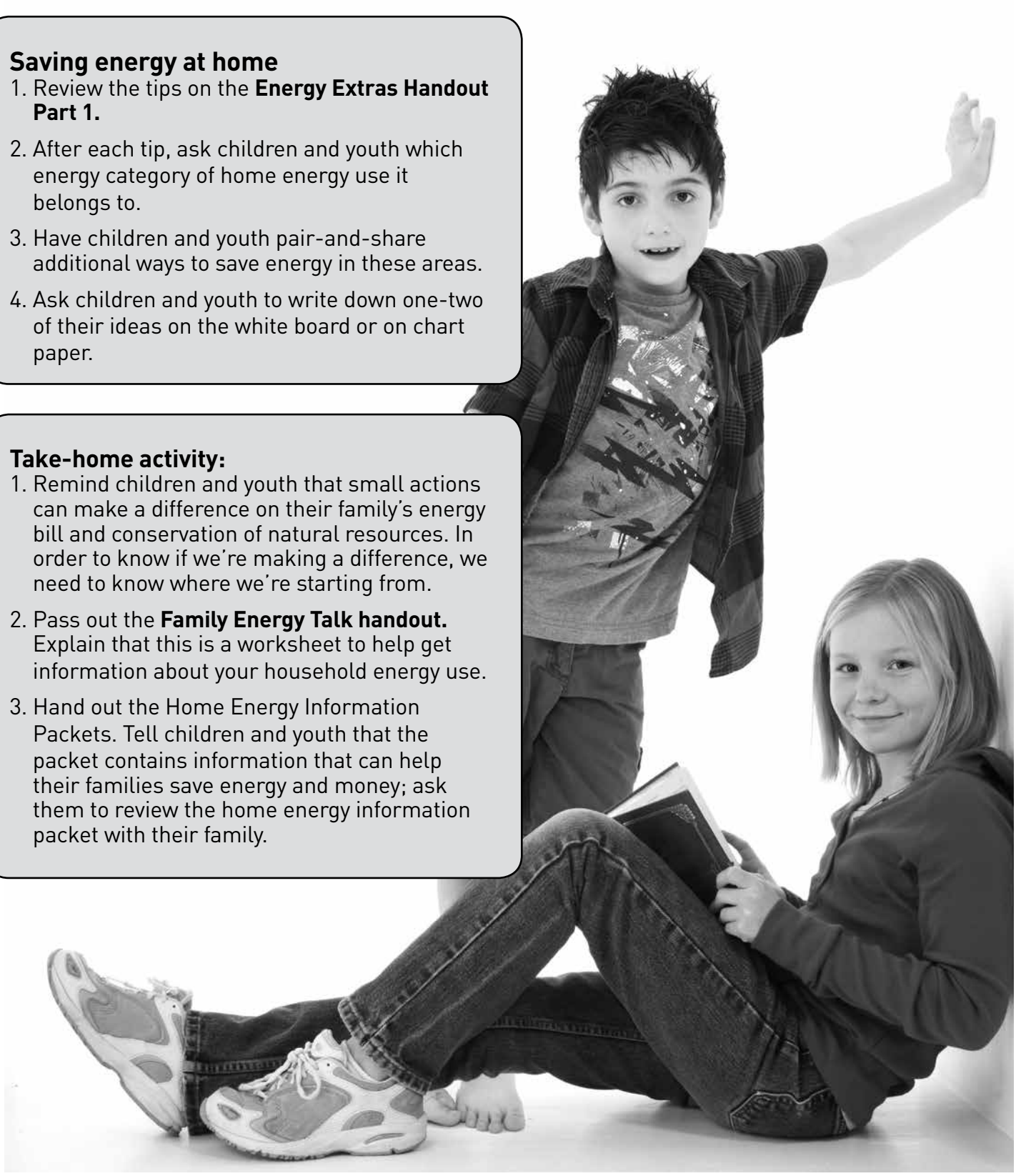
Debrief questions:
a. What surprised you about these categories?
b. What did you know already?
c. Why did you guess what you guessed?
d. How does this information help you think about saving energy?

Saving energy at home

1. Review the tips on the **Energy Extras Handout Part 1.**
2. After each tip, ask children and youth which energy category of home energy use it belongs to.
3. Have children and youth pair-and-share additional ways to save energy in these areas.
4. Ask children and youth to write down one-two of their ideas on the white board or on chart paper.

Take-home activity:

1. Remind children and youth that small actions can make a difference on their family's energy bill and conservation of natural resources. In order to know if we're making a difference, we need to know where we're starting from.
2. Pass out the **Family Energy Talk handout.** Explain that this is a worksheet to help get information about your household energy use.
3. Hand out the Home Energy Information Packets. Tell children and youth that the packet contains information that can help their families save energy and money; ask them to review the home energy information packet with their family.



Energy Extras-Part 1

1 Flip that Light Switch!

When you leave a room always turn off lights that are not being used. By simply flipping a switch you will:

- Save money on your utility bill.
- Save energy by using less electricity.
- Reduce the amount of greenhouse gas emissions put into the atmosphere.

2 Let the Dishes Wait!

If you have a dishwasher, make it a house rule to run the dishwasher it a house rule to run the dishwasher only when it is fully loaded. Washing only full loads instead of partially full loads is the energy-efficient way to use the dishwasher. Run only full loads and you will:

- Save the electricity that powers the dishwasher.
- Save water.
- Save the energy used to heat the water.

Use the dishwasher's air-dry instead of the heat-dry setting. You will cut the dishwasher's energy use from 15 to 50 percent. If you wash dishes by hand in your house, turn off the faucet while scrubbing your dishes to save water and the energy to heat the water, or add a wash basin to your sink and use the same water to scrub dishes before you rinse

3 Heat Your Home Smartly!

Take control of the thermostat during the colder months. Use the recommended energy-efficient setting of 68 degrees Fahrenheit or lower during the day and, health permitting, 55 degrees Fahrenheit when going to bed or away for more than four hours.

- Save up to 10 to 20 percent of heating costs.
- Open drapes and shades on sunny days in the winter to help warm the rooms.

4 Use the Energy from the Sun!

Hang your washed clothes outside to dry in good weather. You will save energy and money and can make a difference for the environment. When you air-dry clothes outside for six months out of a year, you can:

- Save up to $70 a year if you use an electric dryer and $27 a year if you have a gas dryer.
- Save up to 478 kWh of electricity or 23 therms of natural gas in a year.
- Prevent up to 200 lbs. of greenhouse gas emissions (CO_2) from being released into the atmosphere.

Family Energy Talk

Use these questions to find out how much energy you household uses. Talk to an adult to help you find the following information and see if you're able to save energy and money over time.
Note: Many people pay for energy along with their rent, so your family may not be able to access the bills to answer these questions.

1. How often do we get billed for our electricity and natural gas?

2. How much electricity (in kilowatt hours or kWh) did we use on our last energy bill?

3. How much natural gas (in therms) did we use on our last energy bill?

4. When will our next bill come? Can we compare our energy use this month to next month?

5. Do you know that there are PG&E programs to help families save money on their utility bills?

☐ Yes ☐ No

Activity 3:
Saving Energy

Activity Overview:
In this activity, children and youth will learn about ways to conserve energy. They will then practice through a role-play activity convincing others to be green and conserve energy.

This activity should help children and youth connect the information about the energy they use, where it comes from, and how it can affect the world around them.

Objective(s):
- Children and youth will be able to make the connection between energy and the environment and being green.
- Children and youth will learn about energy saving practices and tips.
- Children and youth will practice convincing others to save energy.

Preparation:
- Read through the entire activity thoroughly, making adjustments as necessary for the age(s) of the children and youth, group size, and session time.
- Make copies of the **Superhero for the Environment,** (page 20) one for each child or youth.
- Make copies of the **Energy Extras-Part 2** (page 21) Handout, one for each child or youth.

Materials:
- **Superhero for the Environment Handout** (page 20)
- **Energy Extras-Part 2** - Handouts (page 21)
- Butcher paper, markers, colored pencils, or crayons

Vocabulary:
Green – Green is a color. Green also means being concerned with protecting the environment.

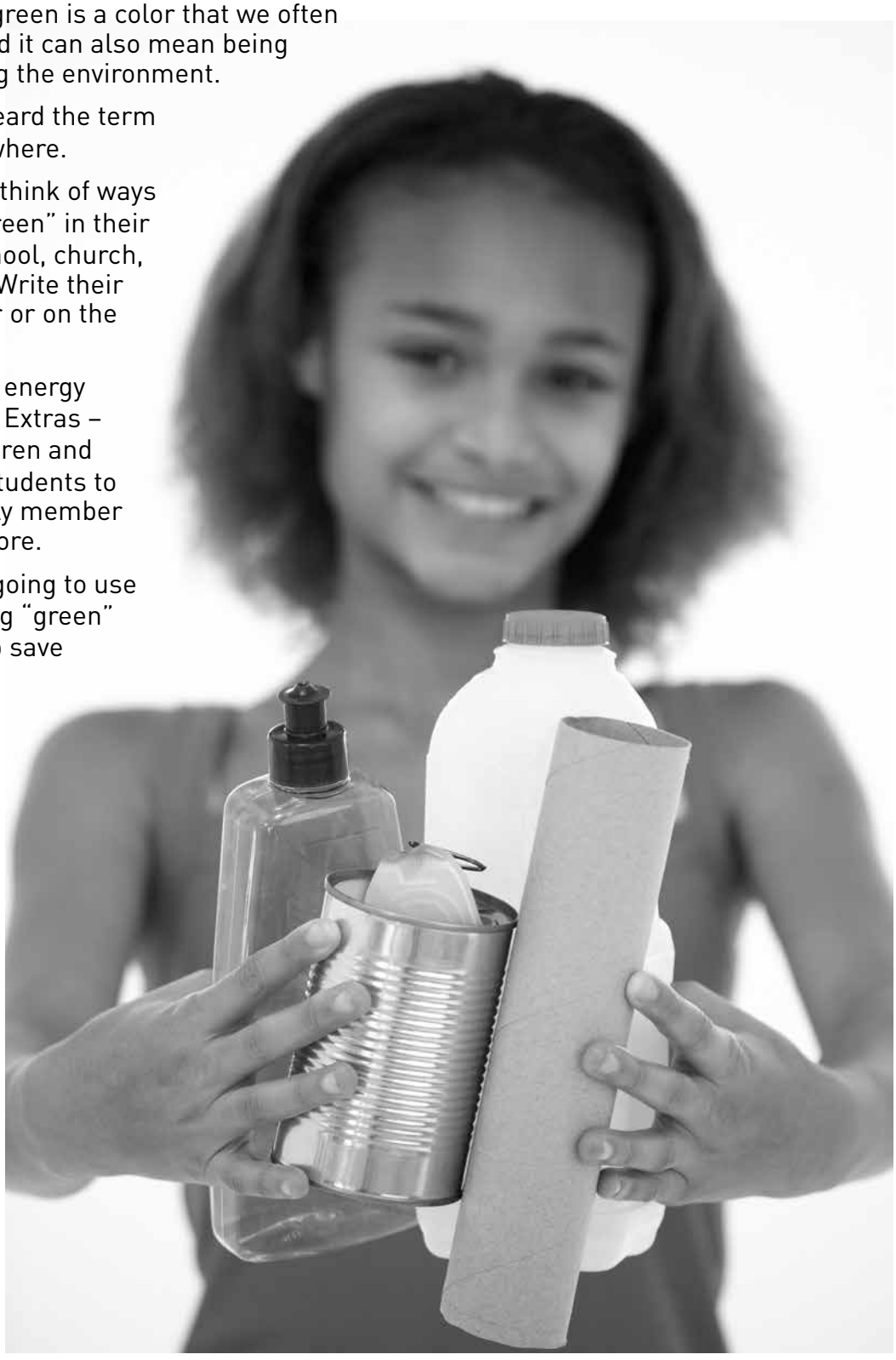
Environment – That which surrounds. The natural environment includes land, air, water, trees, and other things in nature.

Waste – Using more than one needs.

Saving Energy: Introduction

Introduction

1. Ask children and youth if they know what it means to be "green." Explain that green is a color that we often associate with nature, and it can also mean being concerned with protecting the environment.
2. Ask everyone if they've heard the term "green" being used and where.
3. Ask the group if they can think of ways that they can be more "green" in their everyday lives (home, school, church, community center, etc.). Write their answers on a chart paper or on the white board.
4. Distribute and review the energy saving tips on the Energy Extras – Part 2 Handout with children and youth. For each tip, ask students to stand up if they or a family member had practiced that tip before.
5. Explain that today we're going to use what we know about being "green" and saving energy to help save Greentown!



Activity 3A:
Saving Energy: A Superhero for Greentown

1. Ask children and youth if they have a favorite superhero.
2. Ask one-two children or youth to share the name of their superhero and what their super powers are.
3. Today, we will be creating our own superheroes to help Greentown – a city that is not so green. Read the following description of Greentown to the group:

   Greentown does not live up to its name in the least. When it was founded, everyone in Greentown made sure to save energy and their energy bills were nice and low. They were concerned with the environment and made sure not to litter or waste energy. As more people moved to Greentown many didn't know how to save energy and their energy bills were very expensive! They would leave their windows and doors open with the air conditioner running on full blast in the summer, and would litter and not recycle anything.

4. Explain that Greentown needs a superhero who is committed to helping people save energy, clean up the environment and make Greentown green again!
5. Split everyone into groups of three. Explain that each member of the group will help contribute to creating their superhero.
6. Give the children and youth the Superhero for the Environment Handout. Tell them they have 15-20 minutes to figure out the following:
   a. Superhero Name:
   b. Super power:
   c. Super saying (a catchy phrase or rhyme that represents the superhero):
7. Once children and youth have their superhero information figured out, give each group a piece of butcher paper to draw their superhero.
8. Have each group share about their superhero.

Modification:
For children and youth in 6th-8th grades, extend the activity by having them create a full comic for their superhero. Remind them that an effective story will have a beginning, middle and end.

Debrief questions:
a. Do you think that your superhero's super powers are something anyone can do? Why?
b. How can you be a superhero for the environment every day?
c. Of all the tips we learned today, which ones are the easiest for you to do? Why?
d. Which energy saving tips will the hardest for you? Why?

Take-home activity:
1. Remind children and youth that small changes can make a difference!
2. Have them take out their Energy Extras-Part 2 Handouts to review.
3. Ask which tip they think would be best to try first at home. Share that saving energy is a group effort – so it will help to talk to their families about these tips!
4. Hand out the Home Energy Information Packets. Tell children and youth that the packet contains information that can help their families save energy and money; ask them to review the home energy information packet with their family.

Superhero for the Environment

Greentown does not live up to its name in the least. When it was founded, everyone in Greentown made sure to save energy and their energy bills were nice and low. They were concerned with the environment and made sure not to litter or waste energy. As more people moved to Greentown many didn't know how to save energy and their energy bills were very expensive! They would leave their windows and doors open with the air conditioner running on full blast in the summer, and would litter and not recycle anything.

Greentown needs a superhero who is committed to helping people save energy, clean up the environment and make Greentown green again!

Superhero name: _____

_____

_____

Super power(s): _____

_____

_____

Super saying: _____

_____

_____

Sketch your superhero for the environment on the paper provided.

Energy Extras–Part 2

5 Make a Lighting Change!

Replace energy-wasting incandescent light bulbs with compact fluorescent light bulbs (CFLs) or light-emitting diodes (LEDs). Energy-efficient bulbs last up to ten times longer and use 75 percent less energy. By replacing only four of your most used light bulbs with these bulbs you can:

- Save 500 to 900 kWh of electricity each year.
- Save $60-$100 on your electricity bill.
- Prevent the release of 600 to 900 lbs. of CO_2 (greenhouse gas emissions).

6 Beware of Vampire Energy Users!

Vampire energy is used by electronic equipment that is in stand by mode but not in use. These "vampires" can add almost 20 percent each month to the amount your family pays for energy.

7 Keep it Cool!

Setting your air conditioning (AC) thermostat five degrees higher will save up to 20 percent on cooling costs. Also keep windows and exterior doors closed when AC is in use.

8 Cold and Clean!

Wash clothes in cold water, when possible. About 90 percent of the energy used in a clothes washer goes toward heating the water. Even if you do your laundry at the laundromat, you can still use cold water to reduce your overall energy footprint.

NOTES:

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