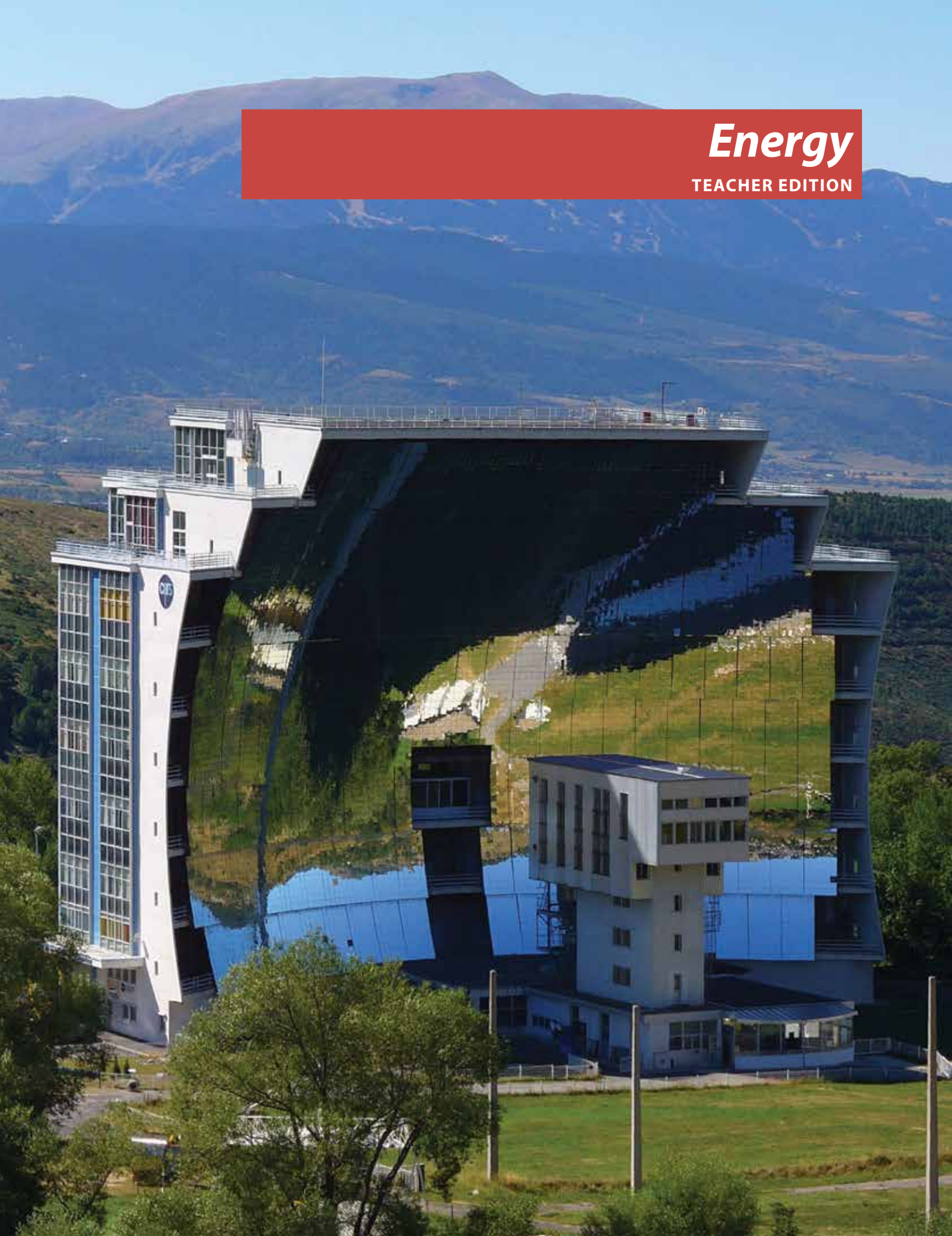


# *Energy*

TEACHER EDITION



# 1

## Home Energy Use

INVESTIGATION

1–2 CLASS SESSIONS

### ACTIVITY OVERVIEW

#### NGSS CONNECTIONS

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Students begin exploring concepts about energy transfer by analyzing qualitative data on energy use in two hypothetical homes in different environments. They consider how certain features of a home may cause the homeowner to use more or less energy. This introduces them to the idea of energy efficiency. They begin tracking their understanding about energy transfer and developing a plan to increase home energy efficiency. They will finalize and present that plan in the final activity in this unit.

Prepare to teach the unit by reviewing the unit overview and assessment chart for a summary of the NGSS taught and assessed in this activity and how the standards are woven together throughout the unit. Decide in advance which assessments you plan to emphasize. Also review the NGSS pathways on the SEPUP website, and the phenomena and storyline documents found Teacher Resources IV, “Unit Specific Resources.”

#### NGSS CORRELATIONS

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##### Performance Expectations

*Working towards MS-PS3-3:* Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

*Working towards MS-PS3-4:* Plan an investigation to determine the relationship among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

##### Disciplinary Core Ideas

*MS-PS3.A Definitions of Energy:* Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.

*MS-PS3.B Conservation of Energy:*

The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.

Energy is spontaneously transferred out of hotter regions or objects and into colder ones.

**Science and Engineering Practices**

*Analyzing and Interpreting Data:* Analyze and interpret data to provide evidence for phenomena.

**Crosscutting Concepts**

*Cause and Effect:* Cause and effect relationships may be used to predict phenomena in natural or designed systems.

*Energy and Matter:* The transfer of energy can be tracked as energy flows through a design or natural system.

**Common Core State Standards—ELA/Literacy**

*WHST.6-8.9:* Draw evidence from informational texts to support analysis, reflection, and research.

**WHAT STUDENTS DO**

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Students brainstorm the uses of energy in the home and become aware of everyday energy consumption. They compare the features of two homes and suggest which one consumes less energy. Students then develop an operational definition of energy efficiency.

**MATERIALS AND ADVANCE PREPARATION**

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**■ For the teacher**

- 1 Scoring Guide: EVIDENCE AND TRADE-OFFS (E&T)

**■ For each student**

- 1 Student Sheet 1.1, “Anticipation Guide: Ideas About Energy”
- 1 Student Sheet 1.2, “Developing a Home Energy Efficiency Plan”
- 1 Scoring Guide: EVIDENCE AND TRADE-OFFS (E&T) (optional)

## TEACHING SUMMARY

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### GET STARTED

1. Students share their current understanding about energy.
  - a. Elicit students' initial ideas about energy by asking, "What is energy?" and "What are some examples of energy?"
  - b. (LITERACY) Before beginning this activity, have students complete the "Before" column on Student Sheet 1.1, "Anticipation Guide: Ideas About Energy."
  - c. (LITERACY) If you have not done so in previous units, introduce the use of a science notebook.

### DO THE ACTIVITY

2. Students consider household energy use.
  - a. Have students read the activity's introductory scenario about energy use in the home, and ask, "What features of your own home affect how much energy your home uses?"
  - b. Direct student groups to Procedure Step 1 to identify features that use *the most* energy in their homes.
  - c. Let students know that they will now examine energy use in two homes, one in Texas and the other in New York, in Procedure Steps 2–4.

### BUILD UNDERSTANDING

3. Students develop an initial understanding of energy efficiency.
  - a. When students complete Procedure Step 4, direct them to Analysis items 1–4.
  - b. Have a class discussion about Analysis item 2 on the concept of energy efficiency.
4. If you have not previously done so, introduce the concept of trade-offs.
  - a. Introduce the idea that decisions about solutions to scientific and engineering problems often involve trade-offs.
  - b. Provide an example of trade-offs.
  - c. Develop some examples of trade-offs in students' lives.
  - d. (E&T QUICK CHECK) Direct students to Analysis item 5, and introduce them to the concept of trade-offs when making a home more energy efficient.
  - e. If you have not previously done so, introduce the SEPUP Assessment System.
  - f. Provide an overview of the Scoring Guides.
  - g. Explain the expectations for student growth over time.



5. Students begin developing a home energy efficiency plan.
  - a. Explain to students that throughout this unit, they will deepen their understanding of energy in order to develop an energy efficiency plan to recommend to people in their own communities.
  - b. Distribute Student Sheet 1.2, “Developing a Home Energy Efficiency Plan.”

## TEACHING STEPS

### GET STARTED

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1. Students share their current understanding about energy.
  - a. Elicit students’ initial ideas about energy by asking, “What is energy?” and “What are some examples of energy?”

Use this question to prompt a discussion that encourages students to express what they know about the topic of energy. For examples of energy, they may respond with food, fuel, and sunlight.

Since it is quite challenging to closely define energy (even for professional scientists and engineers), do not try to create a formal definition of energy at this time. In fact, referring to the definition of energy in this first activity, out of context, may not be enlightening for students.

Be aware that many misconceptions are likely to surface from students during this discussion (see Background Information). It is not necessary to dispel them at this time since many of them will be addressed in the unit. Focus instead on drawing out students’ ideas around which they can develop accurate concepts as they progress through the unit.

- b. (LITERACY) Before beginning this activity, have students complete the “Before” column on Student Sheet 1.1, “Anticipation Guide: Ideas About Energy.”

This Anticipation Guide provides a preview of important concepts in the unit. It gives students an opportunity to explore their initial ideas, and revisit and modify them when they have finished the unit.

You might read the statements aloud and clarify any questions students have about their meaning. Be sure they understand that they should complete only the “Before” column at this time because they will have a chance to revisit these statements during the unit to see whether their ideas have changed or remained the same. They will fill in the “After” column as the unit unfolds, just as the relevant information for that statement is presented to see whether their ideas have changed or remained the same. For a sample of what a completed Anticipation Guide

for this unit might look like, see Sample Student Response to Student Sheet 1.1 at the end of this activity. For more information on Anticipation Guides, see the Literacy section of Teacher Resources II, “Diverse Learners.”

- c. (LITERACY) If you have not done so in previous units, introduce the use of a science notebook.

Explain your expectations for the type and organization of students’ notebooks. Keeping a science notebook helps students to track data; record predictions, hypotheses, and questions as they investigate; process ideas; build scientific writing skills; and write lab reports. Keeping a Science Notebook in Appendix E of the Student Book provides suggested guidelines. For more information about science notebooks, see the Literacy section of Teacher Resources II, “Diverse Learners.”

## DO THE ACTIVITY

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2. Students consider household energy use.

- a. Have students read the activity’s introductory scenario about energy use in the home, and ask, “What features of your own home affect how much energy your home uses?”

Accept all reasonable responses, and list them on the board or chart paper to refer to later in the activity. Keep this discussion brief as the purpose is to raise awareness about energy use in the home. Students may respond that energy is used to heat the house, to cook food, or to run devices (e.g., TVs and radios) and appliances (e.g., dishwasher or stove).

As noted above, defining energy—although a familiar idea—is difficult. It is an abstract concept that is only observed when transformed or transferred. The energy referred to in this activity is that of energy use in the home. Students’ everyday experiences with energy types (e.g., electricity, sunlight, thermal energy) provide a context for developing a conceptual understanding of energy throughout the unit.

- b. Direct student groups to Procedure Step 1 to identify features that use *the most* energy in their homes.

Point out that home features that affect energy use can include devices (e.g., light bulbs, cell phones) and appliances (e.g., stoves and refrigerators). But they also include structural features (e.g., windows, doors, and walls). For example, gaps between a door frame and a door can cause heating costs to rise in a cold climate.

Identifying features that affect energy use may be difficult for students to do accurately, but the exercise makes students aware that all energy uses are not quantitatively equal and that a number of features contribute to overall energy use. Consider having each group share out what they think are the top two or three energy uses in their homes. If a group's top choices were already mentioned by another group, have them share other items from their list.

- c. Let students know that they will now examine energy use in two homes, one in Texas and the other in New York, in Procedure Steps 2–4.

Have a brief class discussion about where the two homes are located and how the climates differ between Texas and New York.

You may want to tell students that home energy use accounts for about 22% of overall energy consumption in the United States. (The other major energy uses in the United States are for transportation, manufacturing, and business.) If students have difficulty connecting the home features to energy use, you may want to review each feature as they undertake Procedure Step 4. In addition to discussing how each feature is related to energy consumption, you may want to work with students to determine which of the two homes is likely to use less energy for each feature. An exact determination is not possible, as energy use depends not just on the devices and appliances in the home, but also on other factors (e.g., how frequently they are used).

### BUILD UNDERSTANDING

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3. Students develop an initial understanding of energy efficiency.
  - a. When students complete Procedure Step 4, direct them to Analysis items 1–4.

Decide whether you want students to write answers to any of the items in their science notebooks, discuss in their groups, or both. At this point, students may not have any basis to judge whether oil or gas is more efficient for heating a home. Explain to students that they should note these kinds of questions in their science notebooks. Explain that they will be learning much more about energy use and energy efficiency throughout the unit, so they can revisit these questions later.

- b. Have a class discussion about Analysis item 2 on the concept of energy efficiency.

Have students share their examples as a way for them to become more familiar with this concept.

4. If you have not previously done so, introduce the concept of trade-offs.
- a. Introduce the idea that decisions about solutions to scientific and engineering problems often involve trade-offs.

This unit includes issues that relate to science and/or engineering and that may lead to decisions about the best solutions or designs for solving problems. One goal of this curriculum is to teach students that

- decisions about possible solutions often involve trade-offs.
- identifying trade-offs involves analyzing evidence.

Explain to students that in this unit, they will make several decisions about energy use and efficiency. In this activity, students begin to consider the trade-offs in these decisions. In a decision involving trade-offs, something positive (or desirable) is given up to gain another positive (or desirable) outcome. Since many decisions involve trade-offs, students should understand that a perfect choice is often not possible. It is possible, however, to recognize and analyze the trade-offs associated with each decision.

- b. Provide an example of trade-offs.

For example, when asked, “Paper or plastic?” at a store checkout counter, most shoppers make the choice quickly. But there are several trade-offs attached to choosing paper or plastic. A shopper who chooses paper over plastic may do so to avoid generating plastic waste. In requesting the paper bag, though, they are contributing to other environmental problems, such as increased water and energy use, and the higher amounts of solid waste and carbon dioxide emissions associated with making paper bags. Neither choice is ideal, and both choices have a downside. Identifying the trade-offs helps clarify the reasoning that is being applied to make a decision.

- c. Develop some examples of trade-offs in students’ lives.

To further explore trade-offs, brainstorm with the class a list of decisions they make every day that involve trade-offs. Choose one, and talk through the associated trade-offs of deciding one way or another. This practice will familiarize students with ways of identifying and considering trade-offs in this and subsequent activities.

- d. (E&T QUICK CHECK) Direct students to Analysis item 5, and introduce them to the concept of trade-offs when making a home more energy efficient.

As defined in the Student Book, a trade-off is a desirable outcome given up to gain another desirable outcome. Help students understand this idea by using a concrete situation related to the comparison of Homes



A and B. For example, ask students about the home feature of windows: “What is the trade-off involved in using single-pane instead of double-pane windows?” Students are likely to respond that the single pane is less expensive than double pane. The trade-off for having a window that costs less initially is that it doesn’t help as much to keep the house cool or warm and results in higher energy bills in the long run.

- e. If you have not previously done so, introduce the SEPUP Assessment System.

Explain that Analysis item 5 is the first assessment in this unit; use it as an example to introduce the SEPUP Assessment System to your students. See Teacher Resources III, “Assessment,” to be sure you are familiar with the overall system.

- f. Provide an overview of the Scoring Guides.

Distribute the EVIDENCE AND TRADE-OFFS (E&T) Scoring Guide, and use it to model how the system works. Point out the levels in the first column of the Scoring Guide. Tell students that these levels are the same for all Scoring Guides and range from 0 to 4. Then review the descriptions of each level. For example, a Level-4 response is complete and correct in all Scoring Guides. Point out that the scores (0–4) are based on the quality of student responses and do not correspond to letter grades. Allow students to refer to the Scoring Guide as they prepare their answers. Be sure that they understand that the Scoring Guides do not include the specific content students must provide in their responses; rather, they explain the overall expectations for responses at various levels of performance on the task. For more information about the Scoring Guides and how you and students can use the system to improve their work, see Teacher Resources III, “Assessment.”

- g. Explain the expectations for student growth over time.

Let students know that they will not be formally assessed on their responses at this time. Rather, this item is a Quick Check, which is an opportunity for you to gauge students’ abilities to identify evidence and trade-offs. See Teacher Resources III, “Assessment,” for more information on Quick Checks.

Explain to students that they aren’t expected to always produce complete and correct work on their first attempts. Instead, they should work toward developing consistent Level-3 and Level-4 answers as they become more proficient with the concepts (both disciplinary core ideas and crosscutting concepts) and science and engineering practices being

assessed. It is not necessary (or even expected) that an “A” student will always write Level-4 responses, especially at the beginning of the course or when they are introduced to a new Scoring Guide. For a sample Level-4 response to Analysis item 5, see Sample Responses to Analysis, below. Point out that scientists and engineers often do not have the perfect ideas the first time. Often their ideas are modified when more data and testing of results are obtained.

5. Students begin developing a home energy efficiency plan.
  - a. Explain to students that throughout this unit, they will deepen their understanding of energy in order to develop an energy efficiency plan to recommend to people in their own communities.

What becomes apparent to students through this activity is how much more there is to know about how energy in a home works. They may have questions about the purpose of insulation or how warm air travels through the house. Encourage students to record their questions in their science notebooks, where they can refer to them later. Let students know that in upcoming activities, they will find answers to many of their questions.

- b. Distribute Student Sheet 1.2, “Developing a Home Energy Efficiency Plan.”

Explain to students that they will use this sheet to record their understanding of how each of the features on the list affects energy use and, therefore, energy efficiency. At this point, students will fill in their initial ideas and may leave much of the sheet blank. For example, they may not have any basis to judge the energy demands of heating compared with cooling. Explain to students that they should note these kinds of questions on the bottom of the Student Sheet to revisit later. As they learn about energy transfer and energy transformation throughout the unit, they will add to their explanations on this Student Sheet.

Note that there are additional blank rows for students to add home features that affect energy use. Let them know that this information will all come together in the final activity of this unit, “Improving Home Energy Efficiency.” Determine if you will fill out one row with students as an example, or if you will do this at the end of one of the next two activities.

There are specific Analysis items that instruct students to revisit this Student Sheet at the end of the following activities: “Conservation of Energy,” “Energy Transfer Challenge,” and “Conduction, Convection, and Radiation,” and the final activity, “Improving Home Energy Efficiency.” See Sample Student Response to Student Sheet 1.2 at the end of this activity.

## SAMPLE RESPONSES TO ANALYSIS

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1. How do the climates, or average weather conditions, in the two home locations influence the energy use in the homes?

*Texas is a much warmer climate than New York. Because of this, New York homes are likely to use much more energy for heating, whereas Texans use more energy for cooling. Another example is demonstrated in the model homes from this activity. The amount of sunlight exposure is much less in New York than Texas, so it may be unnecessary to use reflective films on the windows.*

2. **Energy efficiency** means using less energy to provide the same amount of useful energy. For example, a light bulb that uses less energy than another to provide the same amount of light is more energy efficient. Based on your experience in this activity, give two examples of changes that could make a home more energy efficient.

*An example might be the insulation of Homes A and B, where Home B uses more insulation that allows less hot air to seep out of the house. This should result in a more efficient use of energy in the home than having less insulation. Another example might be getting a water heater that has more insulation so that the water stays hot instead of some of that heat escaping into the room, or getting a hot water heater that only heats water when it is needed.*

3. If the people who live in Homes A and B have similar lifestyles, which home do you think uses less energy in a year? Use your analysis and interpretation of the data in the table to support your choice.

Students' responses may vary since information is limited in the activity. One sample response is shown here:

*Home B uses less energy overall because it has equal or better features in every category. Specifically, Home B uses more-efficient energy sources, such as natural gas instead of oil or electricity, and it holds energy within the house through insulation, windows, and shrubbery. It also has more efficient appliances and lights.*

4. What could be done to reduce the energy needs of

- a. Home A?

*Home A could improve its insulation, add double- (or triple-) pane windows, increase its use of high-efficiency appliances and lights, and plant vegetation nearby.*

- b. Home B?

*Home B could improve its efficiency by changing the remaining single-pane windows to double- (or triple-) pane and changing the remaining incandescent lights to fluorescents. Adding reflective window film may or may not be useful in the climate.*

5. (E&T QUICK CHECK) What are the trade-offs in making a home more energy efficient? A **trade-off** is a desirable outcome given up to gain another desirable outcome.

**SAMPLE LEVEL-4 RESPONSE**

*The trade-off to making a home more energy efficient is that it can cost money to do this. I may have a stove that isn't energy efficient so it costs more to run, but I would have to spend money to buy a new stove. That would mean spending money right now, although it could save me money in the long run. Or, I could plant a tree to shade my house, but when the tree gets large, it may drop a lot of leaves that I would have to rake in the fall. So I would have to do more work, but it would save money.*

6. **Reflection:** What steps have you and your family taken to reduce energy use in your home?

Students' responses may vary depending on their experiences. One sample response is shown here:

*At my house, we have replaced our clothes dryer and a large freezer with ones that were listed as being energy efficient. We try to turn lights off when we're not in a room. My mom always makes sure we close the refrigerator door. In the summer when it's hot out, we keep our blinds and curtains closed to keep out as much heat as possible so our air conditioner doesn't have to work as hard to keep the house cool.*

**REVISIT THE GUIDING QUESTION**

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What does it take to reduce energy use in a home?

To reduce energy use in a home, we could do several things. We could use fewer appliances, use more energy-efficient appliances, better insulate our homes, or plant trees around our homes.

**ACTIVITY RESOURCES****KEY VOCABULARY**

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**energy efficiency**

**trade-off**

## BACKGROUND INFORMATION

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### MISCONCEPTIONS ABOUT ENERGY

Some of the common ideas that students have about energy are as follows:

- Energy is associated only with living objects. (These students may incorrectly believe that since inanimate objects don't live and move on their own, they aren't associated with energy.)
- Energy is the same thing as force and/or power. (Some of these students incorrectly use force and/or power and energy interchangeably.)
- Energy is a fuel. (These students see power plants, gasoline, and electricity as energy producers instead of energy transformers. These students tend to overlook the energy in living things.)
- Energy is a fluid, ingredient, or product. (These students may incorrectly think that energy is something that flows through things or something that is present when the right combination of ingredients is mixed.)



## STUDENT SHEET 1.1

### ANTICIPATION GUIDE: IDEAS ABOUT ENERGY

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Before starting the activity, mark whether you agree (+) or disagree (—) with each statement below.  
After completing the activity, mark whether you agree (+) or disagree (—) with each statement below.  
Under each statement, explain how the activity gave evidence to support or change your ideas.

BEFORE

AFTER

\_\_\_\_\_

\_\_\_\_\_

1. An object has energy even when it is not moving.

\_\_\_\_\_

\_\_\_\_\_

2. Only living things are associated with energy.

\_\_\_\_\_

\_\_\_\_\_

3. When energy is used, it is gone forever.

\_\_\_\_\_

\_\_\_\_\_

4. Electrical energy can be transformed into light, sound, or thermal energy.

\_\_\_\_\_

\_\_\_\_\_

5. Thermal energy and temperature are different.

\_\_\_\_\_

\_\_\_\_\_

6. Energy cannot be measured.

\_\_\_\_\_

\_\_\_\_\_

7. The water heater in a home uses more energy than the refrigerator.

\_\_\_\_\_

\_\_\_\_\_

8. All houses use the same amount of energy.

\_\_\_\_\_

\_\_\_\_\_

9. Purchasing more-efficient large appliances is the only way to improve the energy efficiency of a home.

## STUDENT SHEET 1.1

### ANTICIPATION GUIDE: IDEAS ABOUT ENERGY

Before starting the activity, mark whether you agree (+) or disagree (—) with each statement below.

After completing the activity, mark whether you agree (+) or disagree (—) with each statement below.

Under each statement, explain how the activity gave evidence to support or change your ideas.

BEFORE	AFTER	
_____	+ _____	<p><b>1. An object has energy even when it is not moving.</b>  <i>In Activities 2 and 3, I learned that objects have potential energy even when they are not moving.</i></p>
_____	— _____	<p><b>2. Only living things are associated with energy.</b>  <i>In Activity 2, the steel and aluminum rods had gravitational potential energy that was converted into kinetic energy when they fell. In Activity 3, I learned that roller coasters also have potential and kinetic energy. In Activity 4, the shot gained thermal energy when it was shaken.</i></p>
_____	— _____	<p><b>3. When energy is used, it is gone forever.</b>  <i>In Activity 5, I learned that energy cannot be created or destroyed. In Activity 6, I learned that energy can be transformed into different types.</i></p>
_____	+ _____	<p><b>4. Electrical energy can be transformed into light, sound, or thermal energy.</b>  <i>In Activity 6, I learned that energy can be transformed into different types. In Activity 14, we transformed electrical energy into light and thermal energy.</i></p>
_____	+ _____	<p><b>5. Thermal energy and temperature are different.</b>  <i>In Activity 7, I learned that thermal energy is related to the total internal energy of a substance due to the movement of those particles and that temperature is related to the average kinetic energy of the particles.</i></p>
_____	— _____	<p><b>6. Energy cannot be measured.</b>  <i>In Activity 14, we calculated the electrical energy supplied to the light bulbs and measured the thermal energy produced by the bulbs.</i></p>
_____	+ _____	<p><b>7. The water heater in a home uses more energy than the refrigerator.</b>  <i>I think this will depend on how much the water heater and the refrigerator are used, but I believe that the water heater will use a lot of energy because in Activity 8, I learned that water requires a lot of energy to heat up. In Activity 15, the Energy Efficiency Factor cards don't indicate anything that makes me change my mind.</i></p>
_____	— _____	<p><b>8. All houses use the same amount of energy.</b>  <i>In Activity 15, each of the Family Energy Profiles had a different annual energy cost. This makes sense because each house would have different appliances and could have different numbers of people and be in climates where heating and cooling needs would be different.</i></p>
_____	— _____	<p><b>9. Purchasing more-efficient large appliances is the only way to improve the energy efficiency of a home.</b>  <i>In Activity 15, I calculated the savings from a variety of energy improvements. Some of the improvements involved large appliances, but many did not.</i></p>

## STUDENT SHEET 1.2

### DEVELOPING A HOME ENERGY EFFICIENCY PLAN

You will be using this Student Sheet to keep track of your understanding of how different features of your home affect energy use. Because you will eventually develop a plan to increase energy efficiency, be sure to note which features use a lot of energy.

Home feature	Use in home	Amount of energy used or saved 1: little 2: medium 3: a lot	How feature affects transfer or transformation of energy	How feature affects energy efficiency
Window type				
Window treatment				
Appliances				
Heating				
Cooling				
Lighting				
Insulation				
Trees and shrubs				

Idea Catcher: \_\_\_\_\_

(continue on reverse side if necessary)

## STUDENT SHEET 1.2

### DEVELOPING A HOME ENERGY EFFICIENCY PLAN

You will be using this Student Sheet to keep track of your understanding of how different features of your home affect energy use. Because you will eventually develop a plan to increase energy efficiency, be sure to note which features use a lot of energy.

Home feature	Use in home	Amount of energy used or saved 1: little 2: medium 3: a lot	How feature affects transfer or transformation of energy	How feature affects energy efficiency
Window type	To keep temperature in home consistent (cool in summer, warm in winter).	3: Homes have many windows, so this can add up to a lot of savings if all of them are double-pane.	The double panes slow down or prevent transfer of thermal energy from warm areas to cool areas.	Using double-pane windows uses less energy to keep the home at the desired temperature.
Window treatment	To keep sunlight out or to keep heat from escaping the home.	1: Helps a little when it is very hot outside, especially if all windows have the treatment.	The window treatments slow down or prevent transfer of thermal energy from warm areas to cool areas.	Using window treatments uses less energy to keep the home at the desired temperature.
Appliances	Used for various tasks, including washing and drying clothes, cooking.	2: Some appliances, like a dryer, use more energy than other appliances, like a television.	Appliances transform one kind of energy, like electricity, into another kind of energy, like thermal or sound.	Energy-efficient appliances transform more of the original type of energy into the desired type of energy.
Heating	Used to warm up the home in cold temperatures.	3: Uses a lot of energy during the winter.	Heating systems transform one kind of energy, like electricity, into thermal energy.	Using energy-efficient heating systems uses less energy to keep the home at the desired temperature.
Cooling	Used to warm up the home in cold temperatures.	3: Uses a lot of energy during the summer.	Cooling systems transform electricity to remove thermal energy from the home.	Using energy-efficient cooling systems uses less energy to keep the home at the desired temperature.
Lighting	Used to light rooms and work areas when it is dark and for safety.	2: Amount of energy used depends on how many and for how long the lights are on.	Light bulbs transform one type of energy, like electricity, into other types of energy, especially light energy.	Energy efficient light bulbs transform more of the original type of energy into light energy.
Insulation	Used to keep temperatures in the home consistent: cool in summer, warm in winter.	3: If we don't have insulation in our walls or ceiling, it will take more energy to keep the home warm in winter.	Insulation slows down or prevents the transfer of thermal energy from warm areas to cool areas.	Using more insulation uses less energy to keep the home at the desired temperature.
Trees and shrubs	Used to provide shade to prevent the sun from hitting the roof and walls directly.	1: Helps a little when there are leaves on the trees and shrubs.	Trees and shrubs slow down the transfer of thermal energy from warm areas to cool areas.	Planting trees and shrubs uses less energy to keep the home at the desired temperature.