



Understanding Forms and Sources of Energy

Key Concept

Students learn the difference between forms and sources of energy and that energy is useful to us because of its ability to change form.

Time Required

150 minutes

Grades

6-8, 9-12

Next Generation Science Standards

Disciplinary Core Ideas

- [MS-PS3.A](#) | [HS-PS3.A](#)
Definitions of Energy
- [MS-PS3.B](#) | [HS-PS3.B](#)
Conservation of Energy and Energy Transfer
- [MS-ESS3.D](#)
Global Climate Change
- [HS-PS2.A](#)
Forces and Motion
- [HS-PS2.B](#)
Types of Interactions

Cross Cutting Concepts

- Developing and Using Models

Science and Engineering Practices

- Systems and System Models

BACKGROUND

You need to understand the differences between forms and sources energy to talk about and make informed decisions about energy choices.

Forms of energy are terms scientists use to classify the main types of energy—kinetic and potential. Radiant (light), thermal (heat), and mechanical (motion) energy are examples of forms of energy.

Sources of energy are resources that supply the energy needed to heat our homes, run our appliances, and move our automobiles. Petroleum, coal, and wind are examples of natural energy sources.

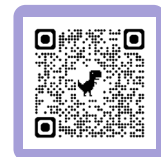
OBJECTIVES

At the end of the lesson, students will:

- describe and differentiate the main forms and sources of energy by giving examples
- explain what an energy transformation is and diagram the transformations that take place in an energy system, highlighting waste heat at each step
- state the major sources of energy and identify them as either renewable or nonrenewable
- identify the form of energy stored or delivered in each of the major energy sources

ADDITIONAL RESOURCES

Additional resources for this lesson can be found at kidwind.org/ww/formssources.



MATERIALS (PER GROUP OF 4 STUDENTS)

- Lamp
- 40-watt incandescent light bulb
- Battery-operated flashlight
- Hand-generator flashlight
- Student reading passages and student worksheets

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GETTING READY

- Make copies of the [Student Sheets](#)
- Review the Student Reading Passages and the [“Sources of Energy”](#)
- Review slides
- Try out the Light Bulb Energy Transformation demonstration

PART 1: FORMS OF ENERGY (30 MINUTES)

Step 1: Introduce the concept—forms of energy

Tell students that scientists classify **energy** into categories called **forms of energy**. Ask students if they can name some of the forms of energy that they’ve already learned about in school. Write all of their ideas on the board without comment. Students will probably include some energy sources (solar, wind, etc.) in their answers. If students do list some **sources of energy**, note these for use in Part 3 in this lesson. Next, tell students to read Passage 1: Forms of Energy. After they complete the Reading Passage, ask students to identify additional examples of each form. Have the class try to categorize the list on the board based upon the forms of energy in the table in the Reading Passage. Suggested categories include Forms of Energy, Examples of Forms of Energy (visible light, food, etc.), and Other (sources of energy, **energy carriers**, etc.). Tell students to complete the Part 1 questions on Student Worksheet 2.

PART 2: ENERGY TRANSFER, ENERGY TRANSFORMATION DIAGRAMS, AND WASTE HEAT (60 MINUTES)

Step 1: Light bulb energy transformation demonstration

Tell students that energy’s ability to change form is what makes it useful and that when energy changes from one form to another, it is called an **energy transformation**. Ask students to provide examples of energy changing from one form to another. Ask students to think back on the readings from the previous day.

Set up lamps and light bulbs, one for each group of about 4 students. Have them observe the light bulb turned off.

****Caution**** When bulbs are turned on, do not let students touch the bulb as it may result in serious burns.

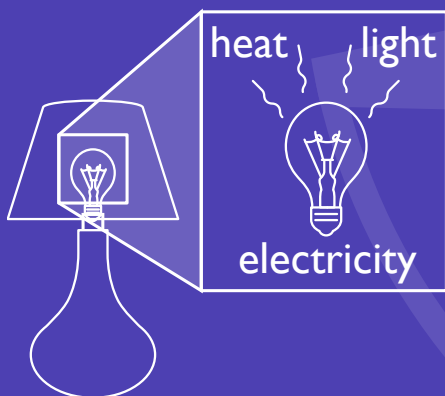
Have students turn the bulb on and identify all of the parts that have changes occurring. Where can they identify energy moving? What evidence do they have?

Ask students why this demonstration is an example of an energy transformation.

Answer: The electrical energy going into the bulb is changed into radiant (visible light) and thermal (heat) energy. If students are not able to identify the thermal energy, have some of them come up and put their hand near the bulb. You can also set up a thermometer near the bulb, using a stand, to record the temperature increase.

Explain how an incandescent light bulb produces radiant energy (light). Inside the light bulb, there is a thin metal

➤ LIGHT BULB DEMONSTRATION



Tell students that all of the thermal energy generated was “lost” because it cannot be captured to do useful work and that the “lost” energy is called waste heat.

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wire called a filament that glows when electricity flows through it.

The electricity flowing through the filament creates a great deal of friction. Eventually the friction causes the filament to become so hot that it glows “white” hot, producing visible light.

Ask students to use their Forms of Energy sheet to identify the energy transformations that take place in a light bulb. Tell students that an energy transformation diagram is a short-hand way of expressing the energy transformations that take place in an energy system. On the board, write the following energy transformation diagram that outlines the energy transformations that take place in an incandescent light bulb.

Electrical Energy $\xrightarrow{\quad}$ Thermal Energy
 $\xrightarrow{\quad}$ Radiant Energy

(Note: all arrows in energy transformation chains should point to the right)

Step 2: Waste heat and the laws of thermodynamics

Explain to students that each time an energy transformation takes place, some of the original form of energy is changed into **waste heat**. Remind students about how much heat the incandescent light bulb produced. Tell students that all of the thermal energy generated was “lost” because it cannot be captured to do useful work and that the “lost” energy is called waste heat. Waste heat occurs during any energy transformation because of the First and Second Laws of Thermodynamics. You may want to discuss these concepts with your students if you have not done so already.

Ask students to read Passage 2: The Laws of Thermodynamics. They should also take a look at Passage 3: Energy Losses.

Tell students that the waste heat generated is generated each time an energy transformation takes place. The waste heat can be shown in an energy transformation diagram by writing or drawing waste heat ($\lessapprox \lessapprox \lessapprox$) above each arrow. Add the waste heat marks to your diagram, which should now look like:

Electrical Energy $\xrightarrow{\lessapprox \lessapprox \lessapprox}$ Thermal Energy $\xrightarrow{\lessapprox \lessapprox \lessapprox}$

Radiant Energy

Step 3: Battery-operated and hand-generator flashlight demonstration

Bring in a battery-operated flashlight with an incandescent bulb rather than light-emitting diodes (LEDs). Turn it on and show it to the students. Students can answer the following questions verbally or by asking them to draw their own energy diagram of the light system. Tell students to look at their Forms of Energy sheet and ask them what form of energy a battery-operated flashlight produces.

Answer: radiant energy

Ask students what form of energy produced the radiant energy.

Answer: Thermal energy. If students don't identify this transformation and say electrical or chemical energy, tell them that another energy transformation takes place between these two steps. Refer them back to the incandescent light bulb transformation outlined in Step 1. What did they experience when they put a hand near the bulb?

Ask students what form of energy produced thermal energy.

Answer:

Electrical Energy

Ask students what is inside the flashlight that produces the electrical energy.

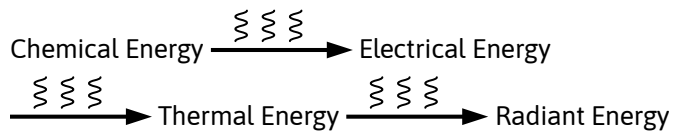
Answer: Batteries

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Tell students to look at the Forms of Energy sheet and ask them which form is stored in a battery.

Answer: Chemical Energy

Write the following the following energy transformation diagram on the board.



Note: Students may not be able to feel the thermal energy produced by the small light bulb in a flashlight, but if it is an incandescent bulb and not a LED, it is generating some thermal energy that students could feel if they could touch the bulb.

Show students the hand-generator flashlight. Depending on the kind you have, your explanation may be different. Tell them that this flashlight does not use batteries to produce radiant energy and that there is a small generator inside the flashlight that is operated by pumping the handle. Explain that this is the same type of generator that produces electricity in power plants (only it is much, much smaller). Point out the magnet and coils of wire inside. Show them that the handle is connected to a gear and when it is pumped, the circular magnet spins inside two coils of wire. The spinning magnet inside the coils of wire generates an electric current. Tell students that they're going to trace the energy flow in this flashlight all the way back to the original source (the Sun). As students trace the energy transformations back to the Sun, write each answer on the board until you have

a complete energy transformation diagram. Note: it may be easier for students to start with the radiant energy produced by the flashlight and work backwards.

What form of energy is produced in a hand-generator flashlight?

Answer: Radiant Energy

What form of energy produced the radiant energy?

Answer: Thermal Energy

What form of energy produced thermal energy in a light bulb?

Answer: Electrical Energy

What form of energy produced the electrical energy?

Answer: Mechanical Energy (pumping the handle)

What form of energy gives someone the ability to pump the handle?

Answer: Chemical Energy (food)

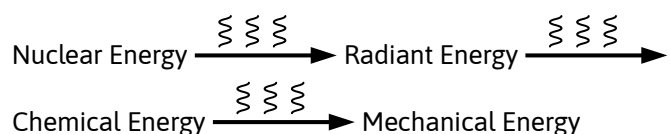
What form of energy powers the food chain?

Answer: Radiant Energy (light powers the photosynthetic process in green plants)

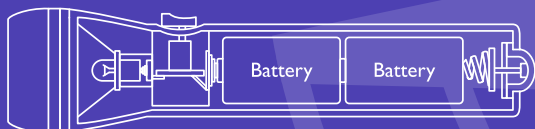
What form of energy produced the radiant energy plants need to make their own food?

Answer: Nuclear Energy (fusion in the Sun)

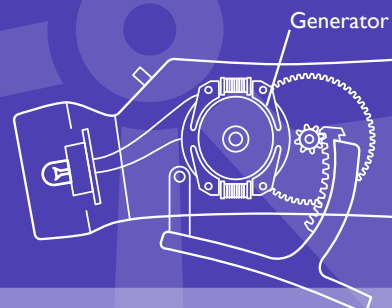
The energy transformation chain would look like this:



FLASHLIGHT

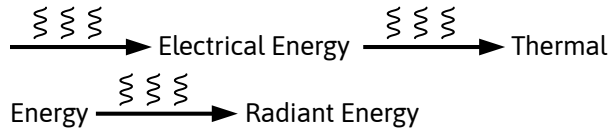


Two flashlights use different sources of energy to light a bulb in different ways. One uses the stored energy in a battery to generate light. The other uses the mechanical energy of your hand to generate light.



Some hand powered flashlights have a capacitor that stores short bursts of energy. If your flashlight has a switch it has this type of storage and you may need to add another step on your energy diagram.

Understanding Forms and Sources of Energy



Almost all energy transformations can be traced back to the fusion process in the Sun. Note: this is an important concept and should be covered again in the next section when reviewing sources of energy. All but one of the major energy sources we rely on (geothermal) can be traced back to the Sun as the original source (ex. all fossil fuels are believed to be the result of the compression and pressure on the remains of prehistoric plants and animals, wind is the result of uneven heating of the Earth's surface, hydropower is the result of the hydrologic cycle powered by the Sun, etc.)

Additional Practice

There are many other examples you can use with students on the Example Energy Transformation Diagrams Student Sheet. After you have completed some transformations, select a few from the sheet and write them on the board. The students can then attempt to complete these on their worksheet (Worksheet 2, question 3). If students have not already answered Worksheet 2, questions 1 & 2, ask them to complete them.

PART 3: SOURCES OF ENERGY (30 MINUTES)

Step 1: Introduce the concept of sources of energy

Introduce the idea that there are nine resources called primary sources of energy, so called because they exist in nature and do not come from a refining or generating process. You can begin the conversation by asking students where the energy comes from to meet their everyday needs. Students may offer examples that include primary and secondary sources and it will be important to help them understand the difference.

As an example, coal is a primary source of energy because we can dig it out of the ground and burn it. Gasoline is not a primary source of energy because it needs to be refined from petroleum; current electricity is not a primary source of energy because it must be generated using one of the primary sources such as coal, wind, or natural gas.

Students can further classify these sources into **nonrenewable** (coal, petroleum, natural gas, and uranium) and **renewable** (wind, solar, geothermal, hydropower, and biomass). The main difference between these two sources is that renewable sources can be replenished in our lifetime and nonrenewable cannot.

Ask students to complete [Worksheet 1](#) and answer the questions in Part 3 on their [Student Worksheet 2](#).

READING PASSAGE 3

The diagram in Reading Passage 3 is designed to help you and your students understand how the electricity generated by the wind would make it to a lamp in your house. It also discusses losses at each transformation step.

Understanding Forms and Sources of Energy

VOCABULARY

energy – The ability to do work or to cause a change.

energy carrier – A secondary energy source that is an efficient and safe way to move energy from one place to another. Energy carriers do not exist in nature but must be refined or generated from a primary source of energy. Gasoline and electricity are examples of energy carriers.

energy transformation – Energy being changed from one form to another. An example is radiant energy from the Sun being transformed into chemical energy of sugar during the process of photosynthesis.

energy transformation diagram – A short-hand method of listing the energy transformations that take place in an energy system.

entropy – The scientific principle that eventually all energy, as it used, becomes so diffused or scattered (random) that it loses its ability to do useful work.

forms of energy – Scientific classification of the different types of energy.

natural resource – Energy resources that can be found within the environment such as wind, petroleum, and uranium.

nonrenewable energy – Energy sources that have a fixed amount of supply on the earth, because they take a long time to form. Petroleum and natural gas are examples.

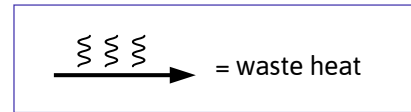
renewable energy – Energy that can be replenished within our lifetime such as energy from the Sun and wind.

sources of energy – Resources found in nature that can be obtained to provide heat, light, and power such as natural gas, coal, wind, and solar energy.

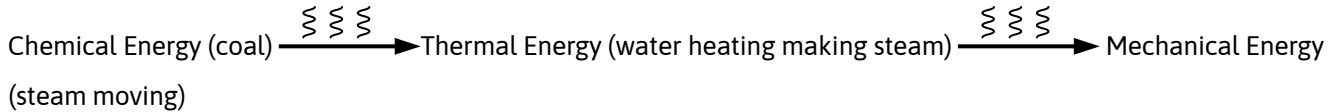
thermodynamics – The study of the transformation of energy into work and its relationship to variables such as temperature, volume and pressure.

waste heat – energy that is transformed to heat and “lost” from the resulting form as energy is transformed from one form to another.

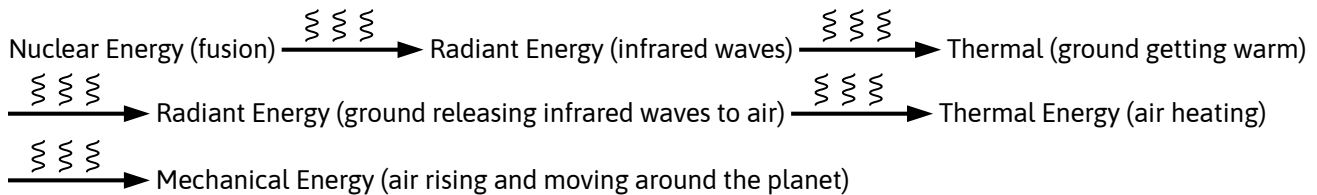
EXAMPLE ENERGY TRANSFORMATION DIAGRAMS



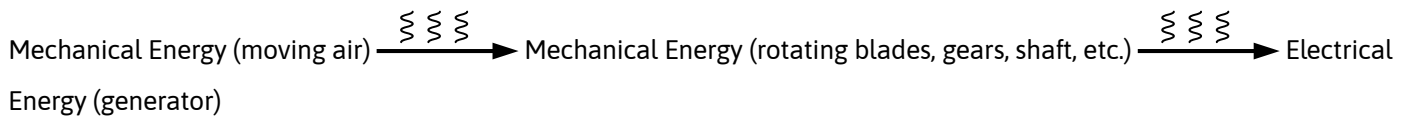
Fuel in a power plant creating moving steam



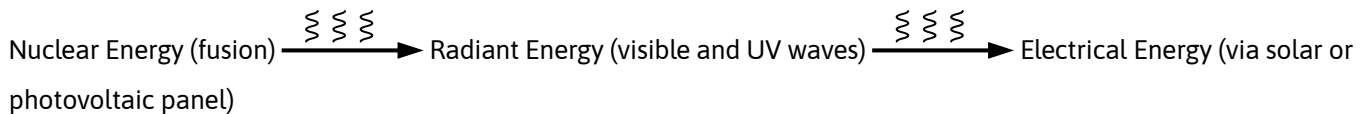
Sun heating the ground then heating the air, making wind



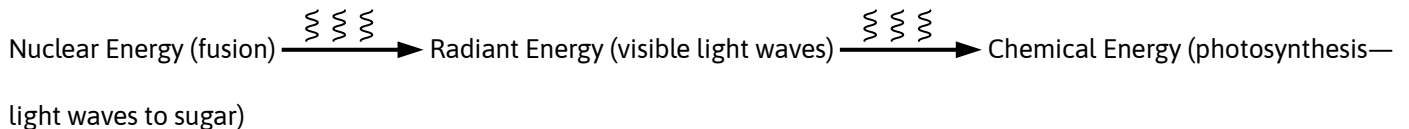
Wind to electricity in a wind turbine



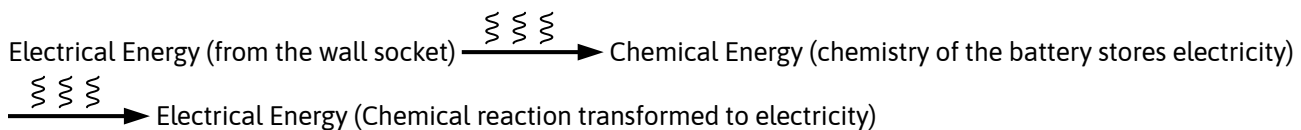
Sun to electricity (photovoltaic)



Sun to plants growing



Rechargeable battery being charged and then running a portable game system



There are many, many more. Once you get the hang of it, you can envision the energy transfers taking place all around you. See if your students can come up with some of their own.

READING PASSAGE 1: FORMS OF ENERGY



It is important to understand energy because it drives our world and all that is in it. Energy is in everything. We use energy for everything we do, from making a jump shot to baking cookies to sending astronauts into space. To use energy without understanding it is to run the risk of wasting it.

Energy is the ability to do work. For scientists, work involves change (a melting ice cube) or movement (a speeding car). Scientists classify energy in a physical sense as:

- Potential (stored) energy
- Kinetic (moving or working) energy

The different forms of potential and kinetic energy are listed in the table below.

Table 1. Forms of energy (Table courtesy of The NEED Project www.need.org)

| POTENTIAL ENERGY | KINETIC ENERGY |
|--|---|
|  <p>Stored Energy or Energy of Position</p> |  <p>Energy of Motion</p> |
| Chemical – Energy stored in chemical bonds such as coal, natural gas, and petroleum. | Radiant – Energy that travels in electromagnetic waves such as x-rays, UV waves, visible light waves, radio waves, and infrared (heat) waves. |
| Nuclear – Energy in the nucleus of an atom. It is extracted through fission (splitting atoms) or through fusion (fusing atoms). | Mechanical – Movement of any object with mass from one place to another. Wind is a movement of air molecules. |
| Stored Mechanical – Energy in a mechanical item such as a spring that is compressed or a rubber band that has been stretched. | Electrical – Movement of electrons such as in lightening or electrons in electrical wires. |
| Gravitational Energy – Things that have mass and have height above the surface of the Earth have stored energy due to gravity. Water above a dam or a rock held above your head has stored gravitational energy. | Thermal – Internal energy of vibrating molecules. Temperature is a measure of this internal energy. The faster molecules within a substance vibrate, the higher the temperature |
| | Sound – Movement of energy by vibrating particles. |

READING PASSAGE 2: LAWS OF THERMODYNAMICS

Energy is the ability to perform work, and it is around us all the time in many forms. Work is a force that can cause an object to move. Work done by animals and machines requires a quantity of energy. For an animal or machine to do something that requires energy, the energy must be changed from one form to another during the process of work.

The First Law of Thermodynamics, loosely interpreted, states that energy can neither be created nor destroyed; it changes from one form to another. During a transformation, some of the available energy is used to cause work to happen, and in the process the energy changes to a different form.

At first glance, this seems like a wonderful arrangement. If energy can't be destroyed, can we continue to use it over and over again?

The answer is "no" because of the Second Law of Thermodynamics which states that heat always flows spontaneously from hotter to colder regions of matter. When this spontaneous process happens, energy loses its ability to do work even if it is not destroyed..



A child on a swing provides an example of this principle. Mechanical energy in the child's body is used to set the swing in motion. When no more energy is put into the swing by pushing or pumping, it will gradually stop. It would seem that all of the energy was gone. If you had a very sensitive thermometer, however, you could measure that some of the mechanical energy had changed (transformed) to a low heat. It would show an increase in the temperature of the swing and the swing supports and in the air around the swing.

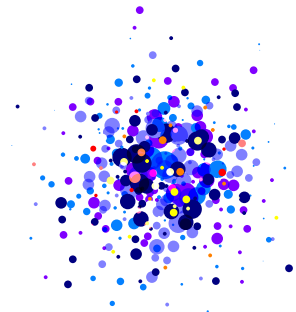
The heat is not sufficient to be useful, however. It is passed off to cooler surroundings. In such cases the energy is said to be degraded (weakened) to a point where we are not able to use it.

The child on the swing can demonstrate what entropy means. The swing slowed down and came to a stop. The energy was not all gone, but it was so scattered that it could do no more work. The principle of entropy is this: eventually all energy, as it is used, becomes so random that it loses its ability to do work. Each time an energy transformation takes place, some of the original energy is "lost" to waste heat.

Another example of the principle of entropy was shown during the incandescent light bulb demonstration. The purpose of a light bulb is to produce light (radiant energy); however, all of the electrical energy entering the bulb was not transformed into radiant energy. Most of the electrical energy was transformed to heat (thermal energy).

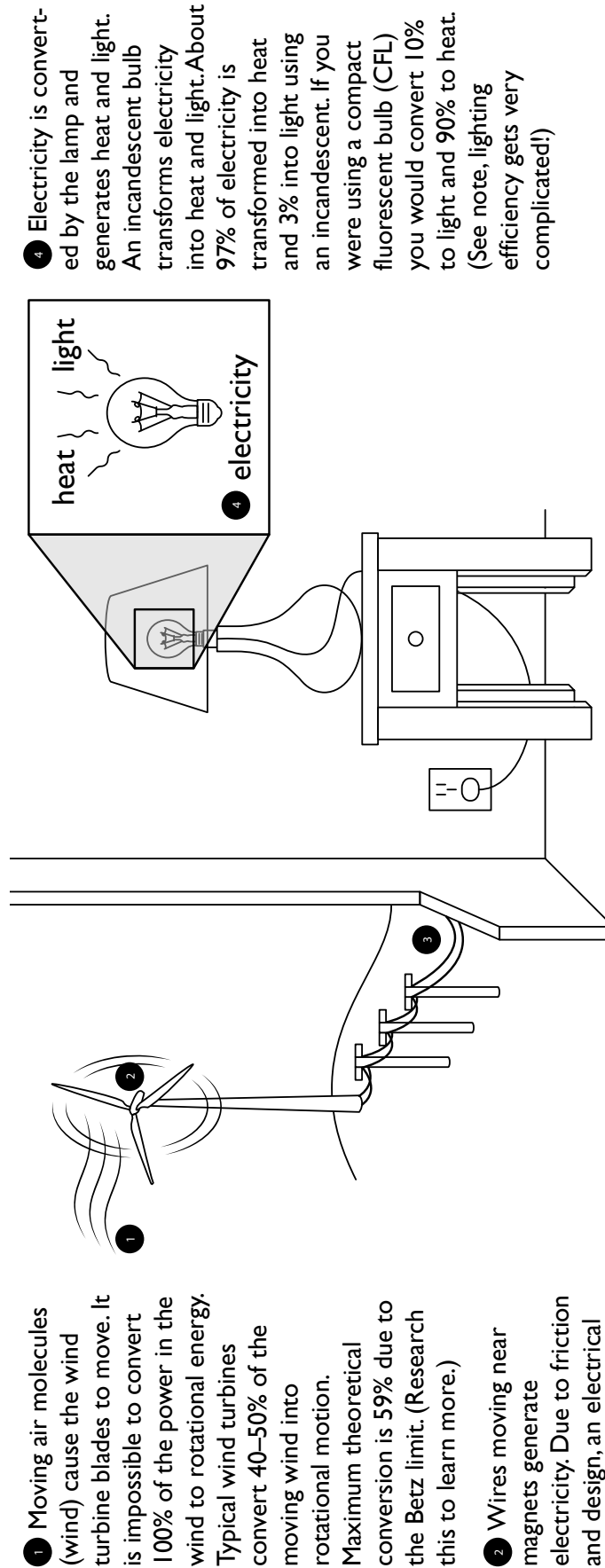
This is experienced this when when people put their hands near a light bulb. The thermal energy generated during this energy transformation cannot be used as it dissipates (is randomly scattered) into the air. It is "lost" because it was not captured and consequently, was not able to perform any useful work. This "lost" thermal energy is also called waste heat. Waste heat is produced every time an energy transformation takes place.

Your body is capable of transforming energy from one form to another. For example, if you eat a hamburger and then exercise (lift weights or participate in an aerobics class), all the movement (mechanical energy) that it takes to exercise requires your body to transform the chemical energy in the hamburger into the mechanical energy to make your muscles move. However, all of the chemical energy in the hamburger is not transformed to mechanical energy. Some of the chemical energy is transformed to thermal energy (waste heat).



READING PASSAGE 3: UNDERSTANDING LOSSES

As you can see from this image, to light a bulb in your house using wind power takes many steps.



READING PASSAGE 3 APPLICATIONS

Start with 100 units of energy.

- Wind to generator: lose 50 units of energy in transformation. 50 units remain.
- Generator to electricity: lose 5 units of energy in conversion. 45 units remain.
- Electricity moving down the wires: lose 3 units in transfer. 42 units remain.
- Electricity converted into light: lose 40 units to heat. 2 units are used to light bulb.

In this example if we started with 100 units of power in the wind. We end up with 2 units of power transformed into light.

How do fossil fuels compare to wind in terms of energy transformation? A typical coal fired plant will convert 35–40% of the energy in the coal to usable thermal energy to heat water. Natural gas plants perform a bit better converting 50–60% of the fuel into usable thermal energy. After that each of these plants will face the same power line and other losses.

Important note on lighting:

Light is measured in “lumens,” which correspond to the amount of light produced per watt. For a source of light to be 100 percent efficient, it would need to emit 680 lumens per watt! The luminous efficiency of fluorescent lighting is between 9–11% for most CFLs, while conventional incandescent bulbs stand between 2–3 percent. The luminous efficiency of halogen lamps is between the previous two at 3.5 percent efficiency, while newly developed LEDs are between 8–15%.

Luminous efficiency is one way to determine which bulb to choose. Another element to look at is the watts it takes to produce the same amount of light. For example: It takes an incandescent bulb 60 watts to produce the same amount of light that would take a CFL bulb only 15 watts to produce. An LED could produce the same light with 8 watts.

WORKSHEET 1: FORMS AND SOURCES OF ENERGY

In the United States, we use a variety of resources to meet our energy needs. Use the information below to analyze how each energy source is stored and delivered.

- Using the table below, determine how energy is stored or delivered in each of the sources of energy. If the source of energy must be burned, the energy is stored as chemical energy.

Nonrenewable

Petroleum _____

Coal _____

Natural Gas _____

Uranium _____

Renewable

Biomass _____

Hydropower _____

Wind _____

Geothermal _____

Solar _____

- Look at the U.S. Energy Production by Source graphic below and calculate the percentage of the nation's energy use that each form of energy provides.

What percentage of the nation's energy is generated by each form of energy?

Chemical _____ Nuclear _____

Motion _____ Radiant _____

What percentage of the nation's energy is generated by renewables? _____

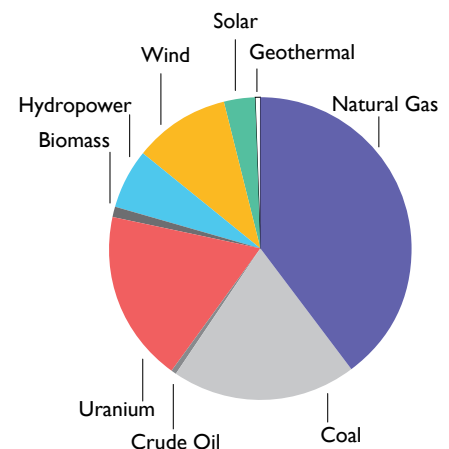
What percentage of the nation's energy is generated by nonrenewables? _____

This worksheet appears courtesy of The NEED Project

U.S. Energy Production by Source, 2022¹

| ENERGY SOURCE | % | USES |
|---------------------|--------------|-------------------------------------|
| Natural Gas | 39.8% | heating, manufacturing, electricity |
| Coal | 19.5% | electricity, manufacturing |
| Crude Oil | 0.6% | transportation, manufacturing |
| Uranium | 18.2% | electricity |
| NONRENEWABLE | 88.7% | |

| ENERGY SOURCE | % | USES |
|------------------|--------------|--------------------------------------|
| Biomass | 1.3% | heating, electricity, transportation |
| Hydropower | 6.2% | electricity |
| Wind | 10.2% | electricity |
| Solar | 3.4% | heating, electricity |
| Geothermal | 0.4% | heating, cooling, electricity |
| RENEWABLE | 21.5% | |



U.S. Energy Information Administration. (2022). What Is U.S. Electricity Generation by Energy Source? U.S. Energy Information Administration.

WORKSHEET 1: FORMS AND SOURCES OF ENERGY

In the United States, we use a variety of resources to meet our energy needs. Use the information below to analyze how each energy source is stored and delivered.

- Using the table below, determine how energy is stored or delivered in each of the sources of energy. If the source of energy must be burned, the energy is stored as chemical energy.

| Nonrenewable | Renewable |
|-----------------------------|----------------------------|
| Petroleum <u>Chemical</u> | Biomass <u>Chemical</u> |
| Coal <u>Chemical</u> | Hydropower <u>Motion</u> |
| Natural Gas <u>Chemical</u> | Wind <u>Motion</u> |
| Uranium <u>Nuclear</u> | Geothermal <u>Thermal</u> |
| | Solar <u>Solar Radiant</u> |

- Look at the U.S. Energy Production by Source graphic below and calculate the percentage of the nation's energy use that each form of energy provides.

What percentage of the nation's energy is generated by each form of energy?

Chemical 61.1% (petroleum, coal, natural gas, biomass) Nuclear 18.2% (uranium)
 Motion 3.4% (wind, hydro) Radiant 3.4% (solar)

What percentage of the nation's energy is generated by renewables? 21.7%

What percentage of the nation's energy is generated by nonrenewables? 78%

*Numbers do not add up to 100% due to other category factors. Also, remember that biomass is a renewable energy source.

WORKSHEET 2

Part 1: Types of energy

1. List nine forms of energy and provide examples of each of each.
2. Classify the forms of energy you have written down into the two main types of energy discussed in the reading passage. Provide a heading for each group.

Part 2: Energy transfer & energy transformation diagrams

For this part of the lesson, you will need Table 1: Forms of Energy from Reading Passage 1.

3. Write the energy transformation diagram that shows electricity to an incandescent light bulb. (Be sure to label waste heat lost in each transformation).
4. Write the energy transformation diagram that shows the energy in your hand to light produced by a hand-generator flashlight (be sure to label waste heat lost in each transformation).
5. Your teacher has written a few common energy transformations on the board. Complete energy transformation diagrams for at least three of them. If you have more time, you can do more!

Part 3: Sources of energy

1. Explain the difference between a form of energy and a source of energy.
2. List the nine major sources of energy that we rely on in the U.S.
3. List the sources of energy into two categories. Provide a heading for each group.

WORKSHEET 2

Part 1: Types of energy

1. List nine forms of energy and provide examples of each of each.

Possible answers include chemical (fossil fuels, biofuels, food); nuclear (fission in a nuclear power plant and fusion in the sun); stored mechanical (rubber band, spring) gravitational (holding a book above the ground, an apple on a tree branch); radiant (visible light, x-rays, radio waves); mechanical (car moving down a street, pumping the handle on a hand-generated flashlight); electrical (current moving through a wire); thermal (boiling water, electric blanket); sound (bell, radio, person talking).

2. Classify the forms of energy you have written down into the two main types of energy discussed in the reading passage. Provide a heading for each group.

Possible answers:

Kinetic: radiant, mechanical electrical, thermal, sound

Potential: chemical, nuclear, stored mechanical, gravitational

Part 2: Energy transfer & energy transformation diagrams

For this part of the lesson you will need your Forms of Energy Table in the reading passage.

1. Write the Energy Transformation Diagram that shows the energy transformations in an incandescent light bulb.

electrical $\xrightarrow{\text{~}} \text{thermal}$ $\xrightarrow{\text{~}} \text{radiant}$

2. Write the Energy Transformation Diagram that shows the energy transformations in a hand-generator flashlight.

mechanical $\xrightarrow{\text{~}} \text{electrical}$ $\xrightarrow{\text{~}} \text{thermal}$ $\xrightarrow{\text{~}} \text{radiant}$

3. Your teacher has written a few common energy transformations on the board. Complete Energy Transformation Diagrams for at least three of them. If you have more time, you can do more!

Various diagrams depending on the examples chosen.

Part 3: Sources of energy

1. Explain the difference between forms of energy and sources of energy.

Forms of energy are the types of energy, and sources of energy are the resources we use to supply our energy needs

2. List the nine major sources of energy that we rely on in the U.S.

petroleum, natural gas, coal, uranium, biomass, hydropower, wind, geothermal, solar

3. List the sources of energy into two categories. Provide a heading for each group.

Possible answers include:

Non-renewable: petroleum, natural gas, coal, uranium,

Renewable: biomass, hydropower, wind, geothermal, solar

REFERENCES

- 1 U.S. Energy Information Administration. (2022). *What Is U.S. Electricity Generation by Energy Source?* U.S. Energy Information Administration. www.eia.gov/tools/faqs/faq.php?id=427&t=3