

LESSON 1

Background Information: What is Energy?

The United States uses a lot of **energy**—over two million dollars worth of energy per minute, 24 hours a day, 365 days a year. With just less than 4.5 percent of the world's population, we consume about 18.6 percent of the world's energy resources.

All of us use energy every day—for getting from one place to another, cooking, heating and cooling rooms, making products, lighting, heating water, and entertainment.

We use a lot of energy to make our lives comfortable, productive, and enjoyable. Most of that energy is from nonrenewable energy sources. It is important that we use our energy resources wisely.

Energy Efficiency and Conservation

The choices we make about how we use energy have environmental and economic impacts. There are many things we can do to use less energy and use it more wisely. These actions include both energy conservation and energy efficiency.

Energy conservation is any action or behavior that results in using less energy. Drying clothes outside on sunny days is an example of energy conservation.

Energy efficiency focuses on technologies that use less energy to perform the same tasks or the same amount of work. Buying a dryer that uses less energy is an example of energy efficiency.

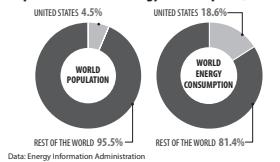
Who Uses Energy?

The U.S. Department of Energy uses categories to classify energy users—residential, commercial, industrial, and transportation. These categories are called the sectors of the economy.

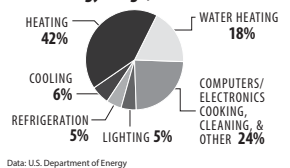
Residential and commercial energy use are lumped together because homes and businesses use energy in the same ways. The residential/commercial sector of the economy consumed just over 40 percent of the total energy supply in 2014, more energy than either of the other sectors. The residential sector consumed 21.9 percent and the commercial sector consumed 18.5 percent. Schools are included in the commercial sector of the economy.

The residential sector includes houses, apartments, and other places where people live. The commercial sector includes schools, businesses, and hospitals. The residential and commercial sectors are put together because they use energy for similar tasks—for heating, air conditioning, water heating, lighting, and operating appliances.

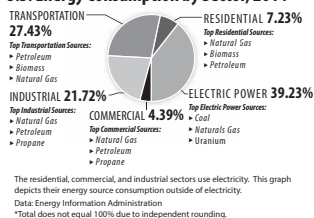
Population Versus Energy Consumption, 2014



Home Energy Usage, 2014



U.S. Energy Consumption by Sector, 2014



Energy at Home

4

LESSON 1: BACKGROUND INFORMATION

What Is Energy?

Energy makes change; it does things for us. It moves cars along the road and boats over the water. It bakes a cake in the oven and keeps ice frozen in the freezer. It plays our favorite songs and lights our homes. Energy makes our bodies grow and allows our minds to think. Scientists define energy as the ability to do work.

Forms of Energy

All forms of energy fall under two categories:



POTENTIAL

Stored energy and the energy of position (gravitational).



KINETIC

The motion of waves, electrons, atoms, molecules, and substances.

CHEMICAL ENERGY is the energy stored in the bonds between atoms in molecules. Gasoline and a piece of pizza are examples.

NUCLEAR ENERGY is the energy stored in the nucleus or center of an atom – the energy that holds the nucleus together. The energy in the nucleus of a plutonium atom is an example.

ELASTIC ENERGY is energy stored in objects by the application of force. Compressed springs and stretched rubber bands are examples.

GRAVITATIONAL POTENTIAL ENERGY is the energy of place or position. A child at the top of a slide is an example.

RADIANT ENERGY is electromagnetic energy that travels in transverse waves. Light and x-rays are examples.

THERMAL ENERGY or heat is the internal energy in substances – the vibration or movement of atoms and molecules in substances. The heat from a fire is an example.

MECHANICAL ENERGY is the movement of a substance from one place to another. Wind and moving water are examples.

SOUND ENERGY is the movement of energy through substances in longitudinal waves. Echoes and music are examples.

ELECTRICAL ENERGY is the movement of electrons. Lightning and electricity are examples.

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5

LESSON 1: BACKGROUND INFORMATION

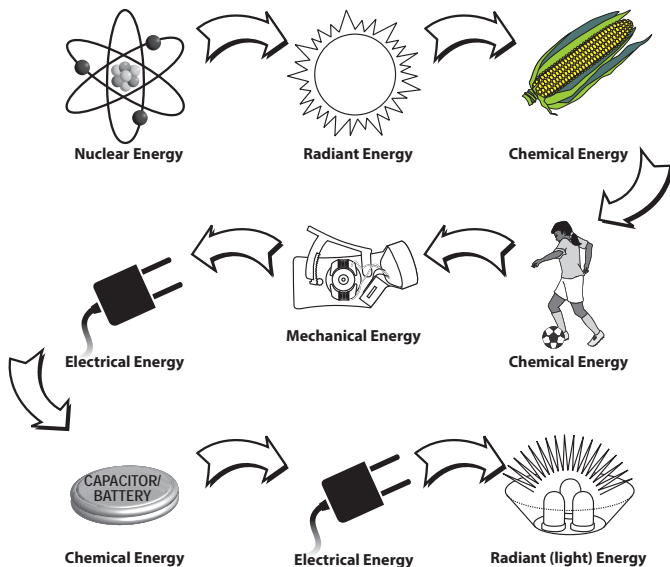
Energy Transformations

Conservation of Energy

Your parents may tell you to conserve energy. "Turn off the lights," they say. To scientists, **energy conservation** is not just about turning off the lights. The **Law of Conservation of Energy** says that energy is neither created nor destroyed. When we use energy, it doesn't disappear. We change one form of energy into another form.

A car engine burns gasoline, converting the chemical energy in gasoline into motion energy. Solar cells change radiant energy into electrical energy. Energy changes form, but the total amount of energy in the universe stays the same.

Energy Transformations for a Hand Generated Flashlight



Energy at Home

6

LESSON 1: BACKGROUND INFORMATION

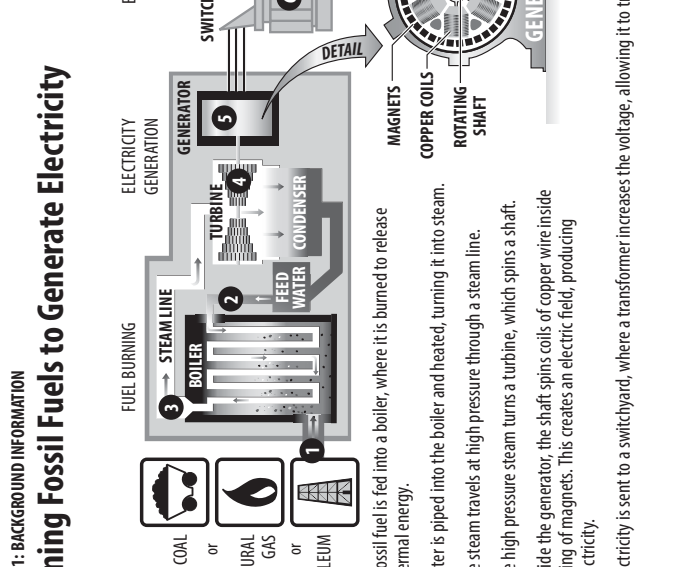
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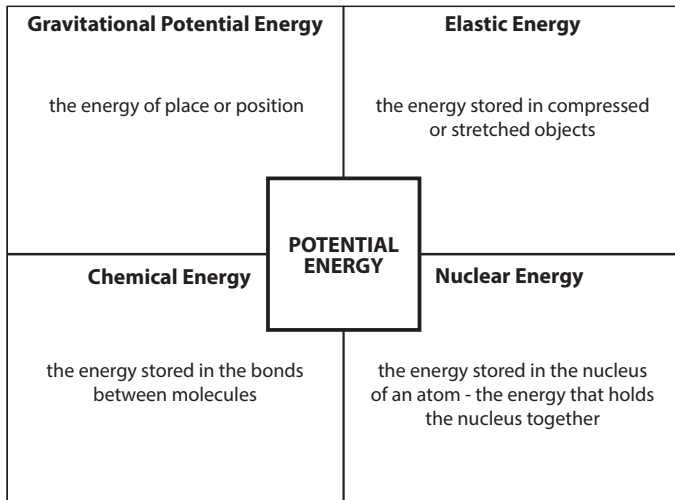
Energy at Home

8

LESSON 1

Forms of Energy

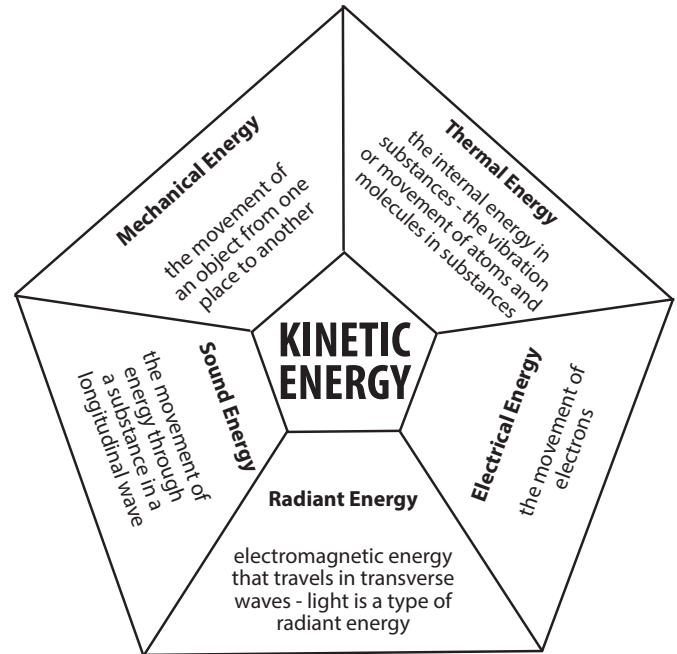
Energy can be stored. Stored energy is called potential energy.



LESSON 1

Forms of Energy

Energy can be in motion. Motion energy is called kinetic energy.



LESSON 1

Energy Transformation - Toys

Energy cannot be created or destroyed. It can only change from one for to another.

Using the Transformation Cards, show how energy has been transformed by each of the toys. Look at the Toaster example below.

M Mechanical	R Radiant	C Chemical	N Nuclear	E Electrical	T Thermal	+ Plus	→ Transforms to
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Toaster

M	+	E	→	T	+	R
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Dynamo Flashlight

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Glow Stick

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Solar Toy

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Toy Vehicle

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LESSON 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.

- 1 Using the information from the *Forms of Energy* charts and the graphic below, determine how energy is stored or delivered in each of the sources of energy. Remember, if the source of energy must be burned, the energy is stored as chemical energy.

NONRENEWABLE

Petroleum _____
 Natural Gas _____
 Coal _____
 Uranium _____
 Propane _____

RENEWABLE

Biomass _____
 Hydropower _____
 Wind _____
 Solar _____
 Geothermal _____

- 2 Look at the U.S. Energy Consumption 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 provided by each form of energy?

Mechanical _____
 Chemical _____
 Radiant _____
 Thermal _____
 Nuclear _____






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

U.S. Energy Consumption by Source, 2014

NONRENEWABLE

	PETROLEUM 34.9% Uses: transportation, manufacturing
	NATURAL GAS 27.5% Uses: heating, manufacturing, electricity
	COAL 18.0% Uses: electricity, manufacturing
	URANIUM 8.3% Uses: electricity
	PROPANE 1.6% Uses: heating, manufacturing

RENEWABLE

	BIOMASS 4.8% Uses: heating, electricity, transportation
	HYDROPOWER 2.5% Uses: electricity
	WIND 1.7% Uses: electricity
	SOLAR 0.4% Uses: heating, electricity
	GEOTHERMAL 0.2% Uses: heating, electricity

*Total does not add to 100% due to independent rounding.
 Data: Energy Information Administration

The Energy I Used Today

Circle the things you used or did in the left column. For each item circled, write the number of Energy Bucks (in parenthesis) in the Energy Bucks column. Add them together to find your Total Energy Bucks Used. List the transformation of energy in column two. The first example has been completed for you.

What device woke me up this morning?	ENERGY BUCKS	TRANSFORMATION
Alarm Clock/Radio/Cell phone (2 bucks)	2	E → S

What devices were used to make my breakfast?

Microwave (2 bucks)	_____	_____
Stove/Oven (5 bucks)	_____	_____
Toaster Oven/Toaster (3 bucks)	_____	_____
Refrigerator (3 bucks)	_____	_____

What devices did I use as I got ready for school this morning?

Air Conditioning/Heating (10 bucks)	_____	_____
Radio/CD Player/MP3 Player/iPod (2 bucks)	_____	_____
Gaming System (3 bucks)	_____	_____
TV/DVD Player (3 bucks)	_____	_____
Shower/Bath (3 bucks)	_____	_____
Hair Dryer (3 bucks)	_____	_____
Curling Iron/Curlers/Flat Iron (3 bucks)	_____	_____
Telephone/Cell Phone (2 bucks)	_____	_____
Computer (3 bucks)	_____	_____
iPad/Tablet (2 bucks)	_____	_____

What rooms had lights turned on this morning?

Bedroom (2 bucks)	_____	_____
Bathroom (2 bucks)	_____	_____
Kitchen (2 bucks)	_____	_____
Family Room (2 bucks)	_____	_____
Other (2 bucks)	_____	_____



Home Activity

HOUSEHOLD RATING GUIDE

How to Rate Your Family's Energy Use

How much energy does your family use every month? Are your family members aware of the energy they use? Do they know about ways to save energy at home by changing their actions and taking simple steps to make the house more energy efficient?

This guide can help your family save energy in five energy areas:

- Living Efficiently
- Home Heating and Cooling
- Water Heating
- Household Appliances and Electronics
- Lighting

Start by finding your family's Household Energy Conservation Rating. First, read the statements in each energy section carefully. Decide how much or how little your family's energy use fits the statements and then rate your family's energy use by choosing a number from 0 to 5 for each statement in the first five categories.

For example, if your family never makes an effort to save energy in a category, choose 0. But if your family always makes an effort, choose 5. (If some members of your household are more energy conscious than others, choose the number you feel represents the average for your family.)

Please be honest with your responses. Do not be embarrassed if you give your family low ratings; most American households would receive ratings of 0, 1, or 2. The important thing is to honestly evaluate your current energy consumption and work to reduce it.

Living Efficiently

1. We have had an energy audit of our house.
Your local utility will send someone to your house to perform an audit and show you where your house is wasting energy and what you can do to correct it.

Yes No

2. We have eliminated drafts around windows and doors with caulking and weatherstripping.
Proper caulking and weatherstripping can cut fuel costs by up to 10 percent.

Yes No

3. We have the proper amount of insulation in the attic and walls.
If you need to add insulation, the cost will be returned to you in lower utility bills.

Yes No

4. We have insulated our hot water tank and piping.
A well-insulated tank can save \$10-20 in energy costs over a 12-month period.

Yes No

5. We have low-flow shower heads.
These easy-to-install devices save energy and provide adequate shower pressure.

Yes No

6. When buying new appliances, we compare EnergyGuide labels and buy energy efficient models.
The most energy efficient new appliances cost a little more, but save money and energy over their operating life.

Yes No

7. When purchasing vehicles, fuel mileage is one of our most important considerations.
A fuel efficient vehicle can save thousands of dollars in fuel costs over the life of the vehicle.

Yes No

Lesson 1 – What is Energy?

ASSESSMENT

1. The energy in petroleum, natural gas, coal and biomass is stored as _____?
- a. thermal energy b. chemical energy c. kinetic energy d. sound energy

2. The energy source that provides most of our transportation needs is _____?
- a. wind b. petroleum c. propane d. coal

3. Which energy source is a type of mechanical energy?
- a. uranium b. geothermal c. solar d. hydropower

4. Which conservation behavior would save the most energy in your home?
- a. turn off an LED light b. open the window instead of turning on the air conditioning c. driving to school d. turn off the TV for one hour

5. What is the most energy efficient way to dry your hair? Explain.

6. You ate a banana for breakfast. List the transformation steps involved in giving you energy for your morning at school.

7. Appliances are one of the "Top Five" energy users in your home. Describe two ways you can conserve energy with the appliances you use most at home.
