



# TEACHER GUIDE

## ENERGY TRANSFER GRADES 3-5

### COMMON MISCONCEPTIONS

- **Energy is matter.** Students may think that matter (things like coal, wood, etc.) are energy. Energy is stored in coal and wood.
- **Objects must be in contact with one another in order for energy to be transferred from one to another.** Energy, like light and sound, can move through the air.
- **Hot objects only feel hot.**  
A warm object transfers its heat energy to cooler objects resulting in a temperature change in both.
- **Only hot or warm objects transfer energy.**  
Moving objects can transfer energy regardless of their temperature.
- **The motion energy of an object does not depend on its speed.**  
The motion energy of an object increases as the speed increases.
- **Energy is associated mainly with humans, not inanimate objects. Objects have motion energy only when they are moved by a person.**  
Inanimate objects have energy if they are moving. For example, water flowing in a stream due to gravity has energy.
- **An object has energy within it that is used up as the object moves.**  
Energy is transferred between objects and as heat and light but is not used up.

### WHAT IS ENERGY?

At this level, energy can be defined as the ability to get things done. Students should understand that energy is not “stuff”—it cannot be held in their hand nor does it have any weight. In later grades students will explore energy and energy transfer in more depth and quantitatively.

## ENERGY VS. ELECTRICITY

When we talk about energy, we often talk about motion energy, sound energy, heat energy, or electrical energy. However, these are not all different types of energy—these words define where the energy is and how it is moving from place to place. When a lamp is plugged into an outlet the energy that flows through the electrical wires to the light bulb, where it is transformed into light, is all the same energy, but we might say that it is electrical energy transformed into light energy.

## GENERATORS

A generator is a simple machine that converts, or transforms, motion energy into electrical energy. The word “generator” can be misleading since energy is being transformed, not generated or created. Inside Dr. Jeff’s bicycle generator, the wheel is spinning because of the motion energy from Dr. Jeff’s mom pedaling. The generator doesn’t generate the electricity that powers Bert, it converts the motion energy to electrical energy.

## “PRODUCING ENERGY”

The law of conservation of energy says that energy can neither be created nor destroyed, yet in everyday language we often discuss “producing” and “using” energy. The everyday phrase is not scientifically correct. We are actually moving (transferring) energy from place to place, or converting it from one form to another. Choose your words carefully when working with students and discussing energy to avoid student misconceptions.

## CIRCUITS

In some states, circuits are touched upon at this grade level. Circuits fill the electronics we use on a daily basis. The basics of a circuit are simple: a wire runs from a source of electricity to an appliance (for example a light bulb). Another wire runs from the bulb back to the source of electricity. This creates a **closed** loop which needs to be maintained in order for electricity to flow. Switches on circuits are placed to open and close this loop turning off or on the device respectively. A simple diagram with a battery and light bulb can easily demonstrate this concept.

## HEAT TRANSFER

Hot objects contain thermal energy. The particles that make up heated objects are moving around more quickly. When a cooler object touches a hotter object this thermal energy is transferred from the hot object to the cool one. We call this conduction and it results in a temperature change in both objects. The temperature of the cool object rises and the temperature of the hot object falls. This is why a hot cup of tea feels hot when held with our cooler hands - the thermal energy is transferring from the hot cup into your cooler hands. Heat energy is always transferred FROM the hot object TO the colder object. Differentiating between conduction, convection and radiation is often done in middle school.

