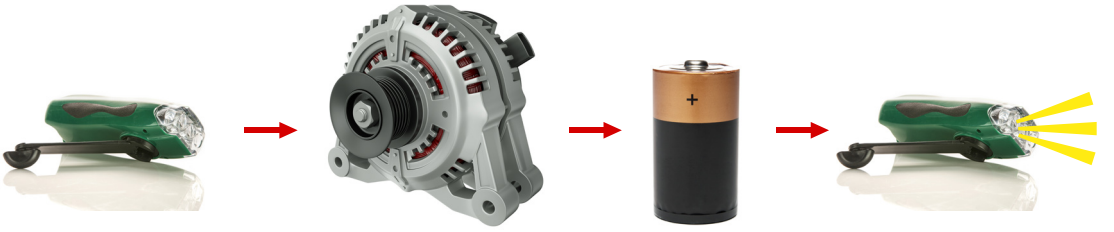
Capturing Human Energy

Chapter 1: Hand-Crank Flashlight

Have you ever used a hand-crank flashlight? You turn a crank on the outside of the flashlight and the crank turns a generator inside the flashlight. A generator is a machine that stores energy by charging a battery. When the generator turns, it converts kinetic energy to electrical energy and then stores it in a battery as potential energy. The potential energy stored in the battery can be used right away or saved for later. The energy that powers the light comes from the battery—but before that, it came from you. When you use a hand-crank flashlight, you are using your body's energy to power a light!

Hand-crank flashlights are powered by energy from the human body, so they never need new batteries.

How a Hand-Crank Flashlight Works



Turning the crank... ...turns the generator... ...which charges the battery... ...and powers the light.

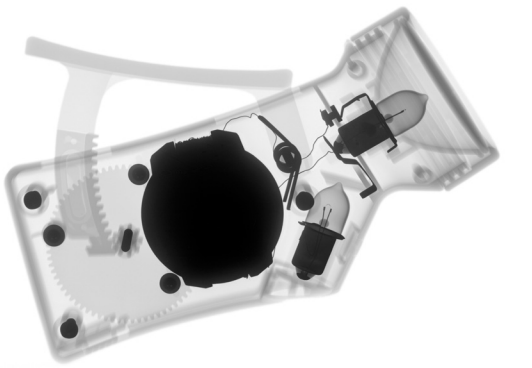
= energy transfer

When you turn the crank on a hand-crank flashlight, kinetic energy from your body turns the generator inside the flashlight. That kinetic energy is converted into potential energy and stored in the battery, which can then make the light bulb work.

The disadvantage of a hand-crank flashlight is that you have to turn the crank in order to charge the battery. The longer you plan to use the flashlight, the more energy you need to store and the more cranking you have to do.

However, turning a crank isn't the only way to store energy in a generator. There are lots of other ways to release kinetic energy: bouncing, stretching, compressing, and other forms of motion all involve kinetic energy, which means they can be used to turn a generator and store electrical energy in a battery. Now imagine if those motions allowed you to charge that battery just by doing everyday activities—things you have to do anyway, like walking.

Some people have invented devices that do just that: convert kinetic energy from everyday activities into electrical energy, storing the energy in batteries as potential energy that can be used to power flashlights, cell phones, and other devices. Students, business people, engineers, and even hobbyists have come up with ideas for inventions like this. You can read one or more of the chapters that follow to find out about a few of them.



Squeeze-lever flashlights are similar to hand-crank flashlights: both convert kinetic energy from the motion of the human hand. To make a squeeze-lever flashlight work, you squeeze the handle.

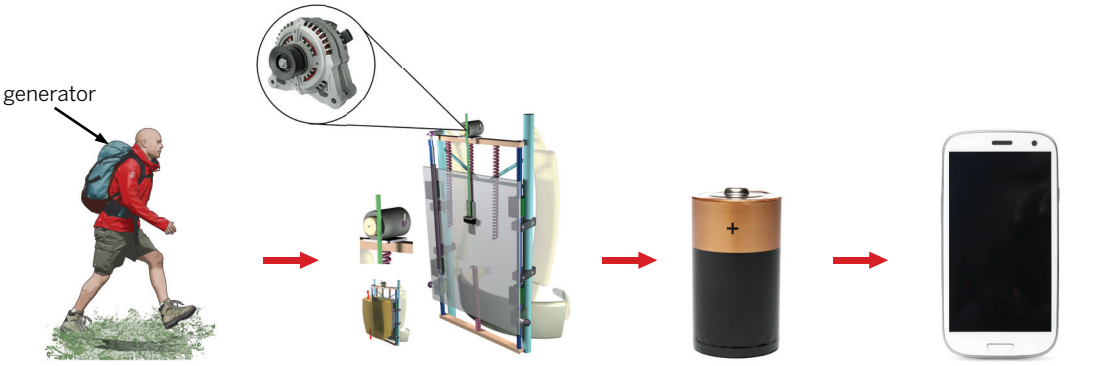
Chapter 2: Energy-Capturing Backpack

When you wear a backpack, the backpack moves up and down a bit as you walk. Like all motion, this up-and-down movement is a form of kinetic energy. An energy-capturing backpack uses that kinetic energy to charge a battery.

One way that an energy-capturing backpack can work is by hanging the heavy part of the backpack from springs, allowing it to bounce up and down as you walk. The bouncing turns the wheel of a generator. When the generator turns, it converts kinetic energy to electrical energy and then stores it in a battery as potential energy. The potential energy stored in the battery can be used to power a cell phone or other electrical device.

Walking produces an up-and-down motion that hikers can use to power small devices like cell phones.

How an Energy-Capturing Backpack Works



When you use an energy-capturing backpack, the motion of walking powers a generator that charges a battery. You can use the energy in that battery to charge small devices.

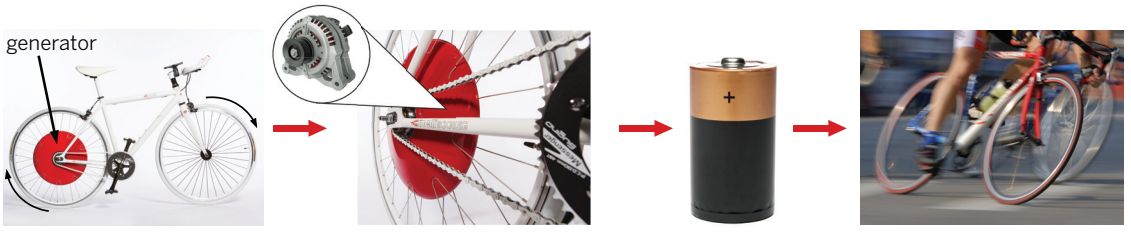
Chapter 3: Energy-Capturing Bike

A spinning bicycle wheel has lots of kinetic energy. The kinetic energy provided by the rider's pedaling makes bicycles a good way to capture energy from the human body. When you use the brakes on an energy-capturing bicycle to slow down, the kinetic energy of the spinning wheel is converted to electrical energy and stored in a battery as potential energy. That potential energy could be used to power all kinds of electrical devices. Some energy-capturing bicycles use the potential energy stored in the battery to run a motor that helps turn the wheel and gives the rider an extra boost. This can be a big help when riding up steep hills! Using a motor might sound like getting a free ride from the energy stored in your bicycle. However, if you trace it back, that energy first came from you, the rider.

The Copenhagen Wheel fits into a bicycle wheel and stores some of the rider's energy for later use.

It was your kinetic energy that was transferred to the bicycle wheel, then transferred to the generator and converted into electrical energy, then stored as potential energy in the battery, then used to power the motor that gave you a boost when you needed it most.

How an Energy-Capturing Bicycle Works



The spinning wheel...

...makes the generator in the wheel move...

...which charges the battery...

...which can power a motor that helps turn the wheel when the rider wants an extra boost.

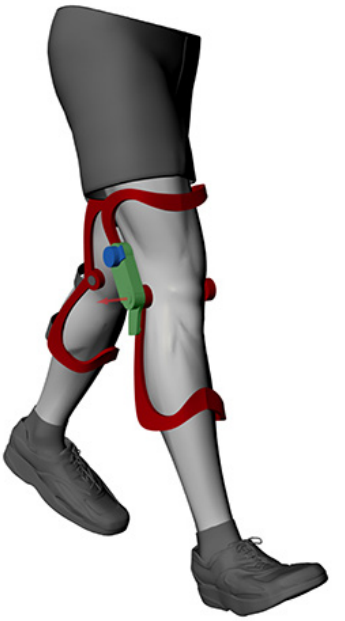
= energy transfer

On a bike with the Copenhagen Wheel, kinetic energy from the rider turns a generator that charges a battery, which can help power the bike when the rider needs some extra help.

Chapter 4: Energy-Capturing Knee Brace

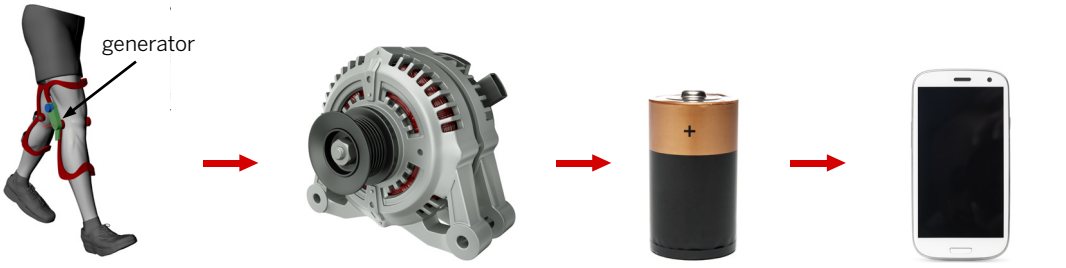
An energy-capturing knee brace uses the kinetic energy of your moving leg to charge a battery. The knee brace has a generator inside it. You bend your knee with each step, and as you straighten it again, the movement makes the generator spin. The kinetic energy in the spinning generator is converted to electrical energy, then stored in a battery as potential energy. You can use that potential energy to power a cell phone or other device.

The knee brace spins the generator when you're straightening your knee instead of when you're bending it. That's because your muscles don't have to work as hard to straighten your knee as they do to bend it. This makes the knee brace easier to use—you don't have to work very hard to spin the generator.



An energy-capturing knee brace harvests energy with the bending and straightening of the leg.

How an Energy-Capturing Knee Brace Works



Taking a step...

...makes the generator in the knee brace move...

...which charges the battery...

...which can power a cell phone or other equipment.

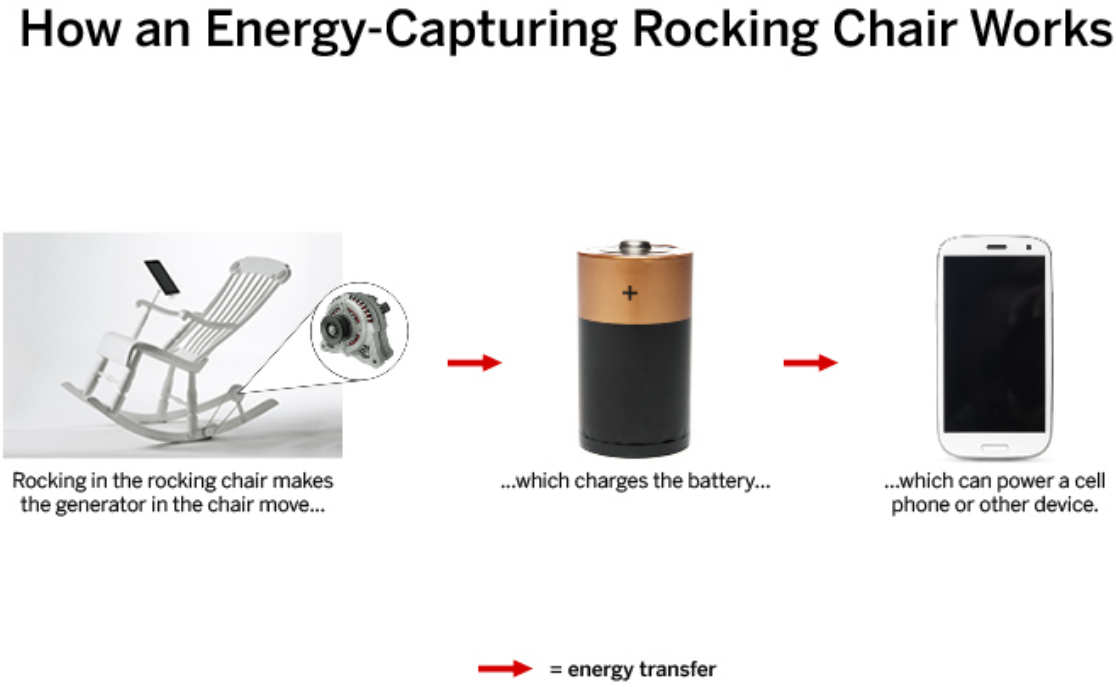
= energy transfer

When you use an energy-capturing knee brace, the motion of your steps turns a generator in the knee brace. That energy is converted to potential energy and transferred to a battery. The energy in the battery can be used to power a small device, like a cell phone.

Chapter 5: Energy-Capturing Rocking Chair

Most chairs can't convert energy from the body into electrical energy. However, an energy-capturing rocking chair can! Energy-capturing rocking chairs use the motion of rocking to power electronic devices—a lamp attached to the chair or a charger for phones and other electronic devices. The process begins with the kinetic energy your body uses to rock the chair, usually by pushing your foot against the floor. That kinetic energy makes the chair rock back and forth and spins a generator built into the rockers (the parts of the chair that rest on the floor). The kinetic energy in the spinning generator is converted into potential energy and stored in a battery built into the body of the chair. The energy can be used right away to power the lamp or the device charger, or it can be stored for later. When using stored energy to power the lamp or the device charger, you don't need to rock to keep them working.

An energy-capturing rocking chair uses the motion of rocking to power electronic devices.



When you rock an energy-capturing rocking chair, kinetic energy is transferred to a generator on the back of the chair. The generator transfers energy to a battery. Energy from the battery can be used to power electrical devices.