**ENERGY CHANGES MAKE THINGS HAPPEN**

**For anything to happen there always has to be an energy conversion or change. An example of Some of the Energy Changes that have to happen in order for a person to Jump are given below:**

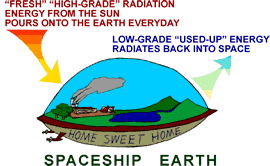
It always starts in the sun, where matter is **changed** into **electromagnetic energy** and zips out into space. The energy a person uses to jump always comes first from the sun.

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| A tiny bit of the sun's energy falls onto earth. On earth some of the oman about to eat a banana**solar energy** is changed by [photosynthesis](http://www.ftexploring.com/photosyn/photosynth.html) into **chemical energy** stored in the carbohydrate molecules in plant cells. |
| A human eats a plant. Or a human eats an animal that ate a plant. The **chemical energy** stored in the plant (or animal) cells is moved into the cells of the human's body. All of the body processes, like digestion, pumping blood, breathing, are powered by cells **converting the stored chemical energy into work and heat**, in a process called **respiration**. Respiration takes place in every cell in your body. |
| Inside the muscle cells of the human (or any animal), the **chemical energy is transformed (changed) into mechanical work and heat**. The muscle contracts, the legs push, and the body leaps into the air. Some of the **chemical energy has now been changed into the kinetic energy** of a body flying up into the air. The rest of the original chemical energy has been used to raise the temperature of your jumping body. If you keep jumping for long you'll get pretty hot. |

**Introduction to Energy Changes -  
Or The Changes that Make Things Change**  
 Energy is that "[certain something](http://www.ftexploring.com/energy/definition.html" \t "_blank)" inside stuff (or matter to be more precise) that makes everything happen. When something or somebody moves or jumps or falls or explodes or breathes or thinks or dances or does anything, it's because energy is being transformed.

Energy is [being transformed](http://www.ftexploring.com/energy/enrg-types.htm" \t "_blank) or changed from one type of energy to another, or, in the case of [heat flow](http://www.ftexploring.com/energy/heatflow.htm" \t "_blank), from one place to another place.  
  
     There are some things about the way energy always behaves that everybody (yes everybody) ought to know about. This is the section that will introduce you to the basics of energy behavior. You will discover here that you are very interested in energy.   
     "This is good stuff," you will say to yourself over and over, as you read through these pages.  
      "I never knew how much I loved thermodynamics," you will add as a happy afterthought.   
  
     We start with the stories of a dancin' fool, a cd player, a locomotive, and some of the interesting energy changes that make music, dancing, freight trains, and tree climbing monkeys, possible.             
    http://www.ftexploring.com/energy/transparent.gif **Whole Lot of Changes Goin' On and On and On...**   
 THERE **HAS TO BE AN ENERGY CHANGE TO MAKE THINGS HAPPEN!**     Put a cd in your portable player, put on the headphones and flip the switch.  
  
     **Chemical energy** that was "waiting around", doing nothing much but "sitting" in the battery being **potential**, suddenly starts turning into **electrical energy**. The new electrical energy, formerly known as chemical, zips through some wires to the electric motor that spins the disc. Now the energy that used to be electrical has become the **mechanical energy** of the spinning disc.  
  
     An electrical signal from sensors that "read" the spinning disc travels through a wire to the little speakers in the headphones. In the headphones, the electrical energy that carried the signal now becomes **sound energy** (sound waves).  
  
**Where the Voices Inside Your Head Come From**  
 Inside your head, sound energy in your ears is changed into electrical and chemical signals that travel to a part of your brain where those signals are turned into a sensation we call music.   
  
    Your brain sends electrical signals to muscles in your legs, arms, face, and other places. Inside the muscle cells chemical energy is stored in glucose molecules (see [Introduction to Photosynthesis](http://www.ftexploring.com/me/photosyn1.html)). The signals from your brain tell your muscles to contract. The muscles convert the stored chemical energy into mechanical work, and you start to move. (The process in plant and animal cells that converts glucose into work and heat is called respiration). The energy in the glucose came from a plant or animal you ate. By now, you should know from where the plant got the energy.   
  
     You use a bunch of face muscles to smile. You move arm and leg muscles in a coordinated manner (some people move in a more coordinated manner than others). You strut and gyrate to the music. Some people call this dancing. You're busy thinking how cool you are while billions of cells in your body are busy converting chemical energy into work and heat.   
  
     You start to sing off key and too loudly because of the headphones. Singing requires using the diaphragm muscles below your stomach to force air through the larynx in your neck. Once again chemical energy in the muscles is changed into mechanical energy (and heat). Then the mechanical energy in the contracting muscles is changed into mechanical pressure and flow energy (kinetic) of the air being pushed out of your lungs.  
  
     The larynx changes the pressure and flow energy into sound energy which travels as sound waves through the air and bothers many of the easily annoyed people within earshot who don't seem to appreciate your awesome talent. The sound waves in their ears are also changed into electrical signals inside their brains, but somehow they aren't as happy about it as you are. So they don't use muscle cells to smile.

**Epilogue to the CD-Dancer Story:**

The **[First Law of Thermodynamics](http://www.ftexploring.com/energy/first-law.html" \t "_blank)** tells us that all of the previously potential energy that came out of the battery and out of the dancer's muscle cells doesn't go away to the mysterious dimension of nothingness.  It has to still be around somewhere. Where is that somewhere? It all ends up as a slight increase in the energy of air molecules.   
  
      Yes, it actually heats up the air a little bit.  A little bit warmed the battery then flowed into the air.  A little bit warmed the wires then flowed into the air.  The spinning cd and motor did work on some air molecules, causing them to zip around faster and transfer their newly increased kinetic energy to still more air molecules.  The cells in your body gave off heat, which flowed out of your body into the air.  Your dancing limbs also pushed billions of air molecules out of the way.  All of that heat and motion was eventually transferred to the air, slightly increasing the energy of billions of air molecules.  After that it was radiated out into space where it will help to warm up the universe an itsy-bitsy, teensy-weensy (yellow polka-dotted) little bit.  
  
     That's really what happens.  Energy comes from the sun, gets used awhile, and then gets sent back out into space.  At the end of its usefulness it is what mechanical engineers often call low-grade energy.  When energy becomes [low-grade](http://www.ftexploring.com/energy/2nd_Law.html" \t "_blank) it is no longer in a form that is very useful to life (except maybe to help keep things a little warmer).  Having worn out its welcome, the hapless energy radiates back out to the cold heat sink of outer space.  Luckily for us a new fresh dose of "high-grade" energy from the sun radiates into the earth everyday.   
  
      The **[Numero Uno Law of Thermodynamics](http://www.ftexploring.com/energy/first-law.html" \t "_blank)** says that, over a certain period of time, the energy that is radiated back into space plus the energy that stays behind on earth has to exactly equal the energy that comes in from the sun.  If the energy coming into the earth from the sun does not equal the energy radiated back out into space, then the earth's average temperature will change over time.   If more energy comes in than goes out, the earth's average temperature would start to go up, and would keep warming up until the energy in and out is again balanced.  If more energy goes out than comes in, then the earth's average temperature will get cooler.   
     This basic law of thermodynamics is why many scientists are worried about the "green house effect". They are concerned that increasing CO2 and other green house gasses will trap in more energy over time and raise the average temperature of the earth. Many scientists (but not all - we have to be fair) believe this is already happening.

**One More Time   
"There Has to be a Change or Transfer of Energy"**  
 We keep saying it. Nothing can happen in this wondrous world without energy.  Energy is that certain something inside "stuff" that makes things happen.

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| But it isn't just energy. Energy can sit around doing nothing for a long time, like in a battery or a tank of diesel fuel. Nothing will happen until that "waiting" **potential energy** gets changed into another form of energy. |  |  | atteries and flashlight |
| It's energy moving from one place to another place, or energy being changed from one type of energy into another type of energy that makes things happen. |  |  | A flashlight converts the chemical energy stored in batteries into light and heat. Most of the energy is converted to heat. Only a small percentage of the original energy in the battery is converted into light energy. |

*Source: http://www.ftexploring.com/energy/energy-1.htm#monkey*