The Energy Story

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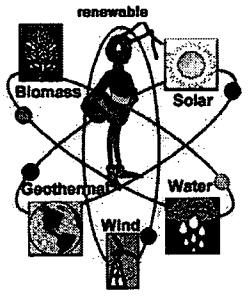
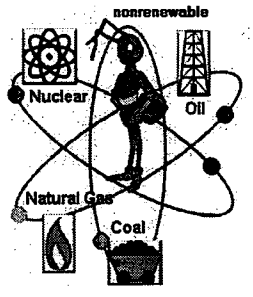
Energy is the ability to do work. *Energy can only be changed into another sort of energy. It cannot be created nor can it be destroyed. Without energy, nothing can move or change or even exist. Indeed, everything that ever happens from the blink of an eyelid to the creation of a galaxy depends on energy.*

Energy comes in different forms- **heat** (thermal),**light** (radiant), **mechanical, electrical, chemical,** and **nuclear** energy. There are two types of energy: **stored**(potential) energy and **working** (kinetic) energy(depending on whether the energy is moving or stored).

Energy sources: All forms of energy are stored in different ways, in the energy sources that we use every day. These sources are divided into two groups -- **renewable***(an energy source that we can use over and over again)* and **nonrenewable***(an energy source that we are using up and cannot recreate in a short period of time).*

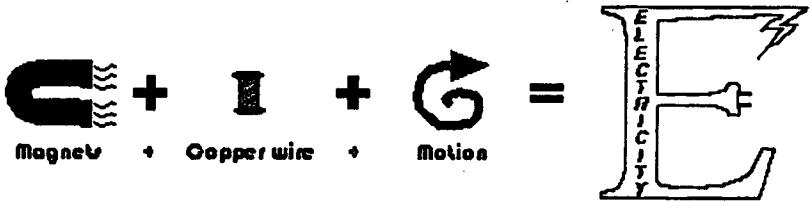




ELECTRICITY

Electricity is a basic part of nature and it is one of our most widely used forms of energy. We get electricity, which is a **secondary energy source**, from the conversion of other sources of energy, like coal, natural gas, oil, nuclear power and other natural sources, which are called **primary sources**. *Electricity is a controllable and convenient form of energy used in the applications of heat, light and power.*

How is electricity generated? An electric generator is a device for converting mechanical energy into electrical energy. The process is based on the relationship between magnetism and electricity.



The electricity produced is the same, regardless of source. Different fuels just provide energy to do the same basic thing; turning the copper armature inside the generator and generating an electric current.

How are turbines used to generate electricity? A turbine converts the kinetic energy of a moving fluid (liquid or gas) to mechanical energy. The turbine has many blades that look like the blades of a fan. When the liquid/gas hits the blades, they spin a shaft that is attached to the bottom of the blades. The shaft that comes out of the turbine is connected to the generator makes it turning. As the magnet inside the generator turns, an electric current is produced in the wire.

How is a transformer used? To solve the problem of sending electricity over long distances, George Westinghouse developed a device called a transformer. The transformer allowed electricity to be efficiently transmitted over long distances.

GEOTHERMAL ENERGY

Geothermal Energy has been around for as long as the world existed. "Geo" means earth, and "thermal" means heat. So, geothermal means earth-heat. Earth's energy can be converted into heat and electricity. The three technology categories are geothermal heat pumps, direct-use applications, and power plants. Even if there is no commercial applications of this technology at present time, one day we might also be able to recover heat directly from the magma. We're standing on a resource that could easily supply the energy needs of the entire world for centuries.

FOSSIL FUELS

Plants store energy from the sun as they grow. Fruits, vegetables, and wood from trees, for example, all contain stored solar energy. We call it biomass energy, from "bio" for "life" or "living." These kinds of energy are also renewable, but of course it takes longer to grow a plant or a tree than it does to get heat directly from sunlight. When energy is stored in a material, we call that material **fuel**. Food and wood are biomass fuels. When you have become old, old biomass that has become concentrated, you have what we call "fossil fuel." There are three major forms of fossil fuels: coal, oil and natural gas. All three were formed many hundreds millions of years ago before the time of the dinosaurs -hence the name fossil fuels.

HYDRO POWER

Hydro means water. Hydro-electric means making electricity from water power. Hydroelectric power uses the kinetic energy of moving water to make electricity. The principal advantages of using hydropower are its large renewable domestic resource base, the absence of polluting emissions during operation, its capability in some cases to respond quickly to utility load demands, and its very low operating costs. Disadvantages can include high initial capital cost and potential site-specific and cumulative environmental impacts.

NUCLEAR ENERGY

Another major form of energy is nuclear energy, the energy that is trapped inside each atom. One of the laws of the universe is that matter and energy can't be created nor destroyed. But they can be changed in form. Matter can be changed into energy. The famous scientist Albert Einstein created the mathematical formula that explains this.

It is: $\mathbf{E = mc^2}$, ***E****- energy,* ***m*** *-mass and c stands for the speed of light*

Nuclear fission means splitting an atom apart. Splitting an atom releases heat and light energy. In a nuclear power plant, an atomic chain reaction is controlled to produce

heat to boil water. That water boils water in pipes to make steam to turn a turbine and a generator to make electricity.

Nuclear fusion means combining atomic nuclei to make a larger nucleus. The sun uses nuclear fusion of hydrogen into helium to make light and heat energy. Scientists are trying to create nuclear fusion to make a cleaner source of power.

OCEAN ENERGY

Ocean energy draws on the energy of ocean waves, tides, or on the thermal energy (heat) stored in the ocean. Oceans cover more than 70% of Earth's surface, making them the world's largest solar collectors. The sun warms the surface water a lot more than the deep ocean water, and this temperature difference stores thermal energy. Thermal energy is used for many applications, including electricity generation. Right now, most ocean energy power plants are only experimental and are fairly small. The total power of waves breaking on the world's coastlines is estimated at 2 to 3 million megawatts. In favorable locations, wave energy density can average 65 megawatts per mile of coastline. But how can we get energy from the ocean? There are three basic ways to tap the ocean for its energy. We can use the ocean's waves, we can use the ocean's high and low tides, or we can use temperature differences in the water.

SOLAR ENERGY

Sunlight has always been a source of energy for plants, animals and humans. We use sunlight and heat from the sun to dry clothes outside. The sun's heat can be used to warm water flowing through pipes on a roof. Sunlight can also be focussed in a solar thermal system to heat water or other fluids to make steam. The steam can be used to turn turbines to make electricity. Sunlight can be used directly in solar cells or photovoltic cells to make electricity.

WIND ENERGY

Wind energy can be used to do work. Wind has been used for many years to drive boats and in windmills to grind grains or pump water. Wind turbines are

being used today to make electricity. Wind spins the large blades which turn generators inside the turbine to make electricity.

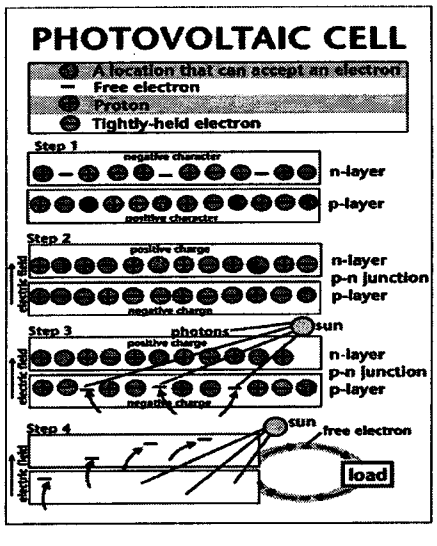
BIOMASS

Biomass is organic material which has stored sunlight in the form of chemical energy. Biomass fuels include wood, wood waste, straw, manure, sugar cane, and many other byproducts from a variety of agricultural processes. Using biomass does not add to global warming. Plants use and store carbon dioxide when they grow. This is then released when the plant material is burned. So using biomass closes this cycle of storing carbon dioxide.

Biomass can be recycled and made into other products such as paper and fertilizer. Because biomass is reused and recycled, less garbage is sent to the dump. Less land is needed for "landfills" to hold the garbage. And the use of biomass is environmentally friendly because the biomass is reduced, recycled and then reused. Today, many new ways of using are still being discovered. One way is to produce ethanol, an alcohol fuel for cars. Another way is to change biomass to combustible gases for electricity production.

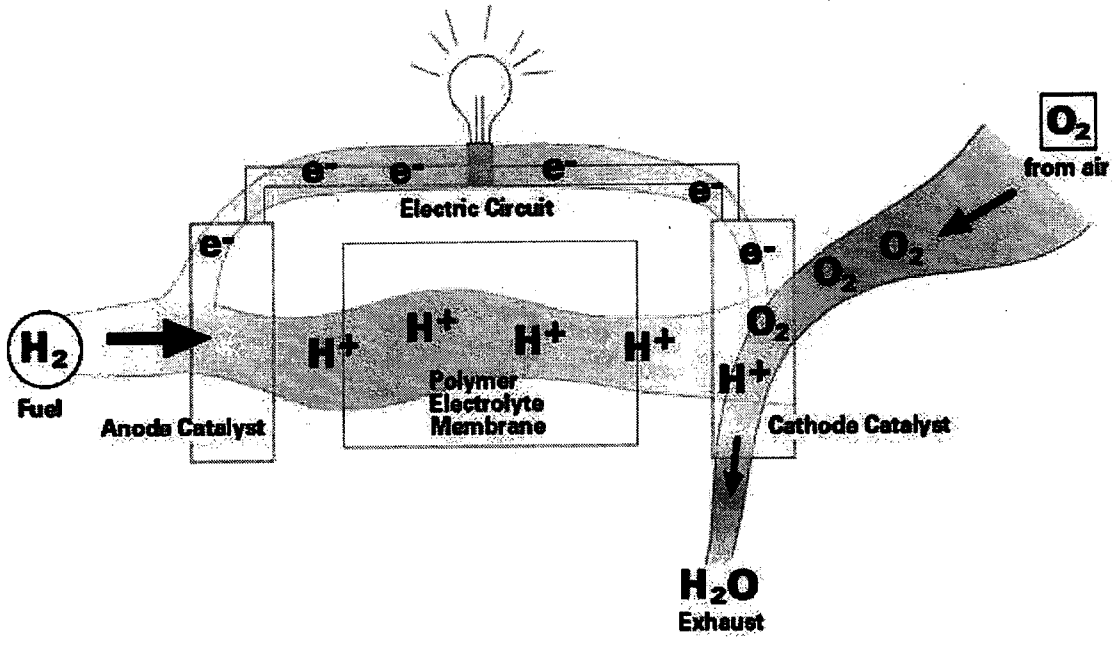
MEETING FUTURE ENERGY NEEDS

In the last few decades, scientists have been looking for ways to produce energy without adverse side-effects. Promising renewable energy sources are wind, direct solar and biomass and hydrogen.



A novel way of producing electricity is using water and solar energy is called **photoelectrochemical (PEC)** technology. This combines a photovoltaic cell, which produces electricity when exposed to sunlight, and an **electrolyser** to convert water directly to hydrogen and oxygen. Again, the technology is not yet perfected. One of the problems is to find a photovoltaic cell that isn't corroded by the electrolytes in solution but is still cheap enough to be competitive with alternative techniques and fuels.

Hydrogen's usefulness lies in its ability to store energy at high densities and to produce it on demand – much like petrol and natural gas do today. It can be used to generate electricity at times when primary energy sources (like wind, wave or solar) are producing insufficient power to meet demand. Conversely, such energy sources can be used to produce hydrogen when they are generating more electricity than is required by the grid. It can provide power for fuel cells that can be used much like batteries and recharged at will. Fuel cells are a promising technology for use as a source of heat and electricity for buildings, and as an electrical power source for electric vehicles. The promise of fuel cells for the on-site production of electricity is great. Many say fuel cells may do for the power industry what desktop computers have done for the computer business. Just as cellular phones and distribution.



SAVING ENERGY AND ENERGY CONSERVATION

Today the world faces an energy crisis. Ninety-five percent of the energy consumed in today's world comes from fossil fuels. But fossil fuels reserves are being used at a tremendous rate and new resources are not being discovered to keep pace. It is estimated that at current rates of use, our known reserves of petroleum will run out in thirty years and natural gas in twenty. Coal may last several hundred years more but there are serious environmental problems associated with increased use of coal. Even uranium for nuclear fission is in short supply. As a result, petroleum and natural gas have become much more expensive and people are recognizing the need to conserve, both to save money and to direct valuable resources to other needs.

To make sure we have plenty of energy in the future, it's up to all of us to use energy wisely. We must all conserve energy and use it efficiently. It also up to those of you who will want to create the new energy technologies of the future.

One of you might be another Albert Einstein and find a new source of energy. It's up to all of us. The future is ours but we need energy to get there.