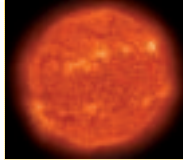


THE SUN PERMANENT POWER

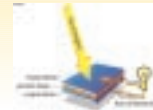


Electricity from Sunlight

Sunlight is the most important source of energy on planet Earth. Each day, the Earth receives hundreds of millions of watts of energy from the sun. Most of that energy is in the form of visible light. This is the form of energy that powers weather, climate, and all living systems on our planet. Sunlight can be converted into other useful forms such as heat and electricity.

Sunlight can be converted into useable amounts of

electricity with the help of special devices called photovoltaic (PV) cells. PV cells are most commonly made from silicon, the same material used to make computer chips. Silicon is one of the Earth's most common elements, and is a major component of sand and many kinds of rocks. A PV cell is built like a sandwich, with two layers of silicon separated by a thin "junction layer."



The make-up of a typical photovoltaic cell.

The upper surface of the cell is made of silicon that tends to release electrons when sunlight falls upon it. Since the electrons build up a small negative charge in this layer, it

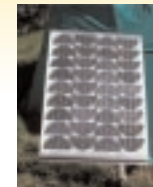
is called "n-type silicon." At the same time, sunlight triggers a faint positive charge in the lower layer, so it is called "p-type silicon." Because of the positive and negative charges, the cell operates like a tiny battery. Electricity will flow from the cell if the two layers are connected by a wire.

Single photovoltaic cells are often used to power small electronic devices, including many calculators and watches. These devices use extremely small amounts of electricity, amounts that are easily provided by single photovoltaic cells, eliminating the need for disposable batteries.



A single photovoltaic cell.

To produce electricity in larger amounts, photovoltaic cells must be connected together. Many individual PV cells may be glued to a sheet of glass or other stiff material and connected together with wires. Such an assembly is often called a photovoltaic (or solar) module, and can have a hundred cells or more. The combined current from all the cells that make up the module can be significant, enough to run a computer or television.



A typical photovoltaic module. This one is composed of 36 individual PV cells.

Storing Electricity

Photovoltaic modules make electricity in all kinds of conditions, from cloudy skies to full sunlight, in all seasons of the year. They are at their peak of efficiency in full, direct sunlight. However, electricity is often needed at times when there is little or no sunlight, such as at night. For this reason, solar panels are usually connected to rechargeable batteries, which collect and store electricity so that it can be used whenever it is needed.

The batteries used with photovoltaic modules must be able to withstand being drained of energy and then recharged again many times. They contain special parts and chemicals not found in disposable batteries. They are also usually larger and more expensive than their disposable cousins.



Rechargeable batteries designed for use with photovoltaic systems.

Besides solar modules and rechargeable batteries, modern photovoltaic systems are usually equipped with some kind of electronic charge controller. The main job of the charge controller is to feed electricity from the solar panel to the battery in the most efficient manner and to prevent the battery from being over-charged. The charge controller also protects the solar modules from electrical damage.



An electronic charge controller used to maintain the health of a rechargeable battery.

In many cases, people need the electricity stored in the rechargeable batteries to run normal household appliances. The problem is that most of those appliances require 110 volts of alternating current (110V AC), whereas the battery puts out only direct current (DC), usually at a much lower voltage. A device called a power inverter solves this problem by converting the battery's low-voltage direct current to 110 volts of alternating current. Modern charge controllers often come equipped with their own built-in power inverters.

Sustainable ENERGY

Can cars be powered by renewable energy?

Yes they can! They may not be powered directly by sunlight, as is the car in this construction plan, and the one in the photo below, but they can take advantage of other forms of renewable energy to provide their fuel.



Sunlight powers this lightweight single-occupant car. Source: University of Alberta Solar Vehicle Project.

Hydrogen

One of the most promising developments in transportation technology is the hydrogen fuel cell. A fuel cell is a device that combines pure hydrogen with oxygen from the atmosphere to produce electricity, without creating pollution. The electricity is used in powerful electric motors that drive the wheels of the car. A hydrogen-powered car is quiet to drive, and extremely clean in terms of pollutants.



Hydrogen fuel cells provide large amounts of electricity for powering vehicles, without creating pollution. Source: Daimler Chrysler.

Biodiesel

Diesel is a common transportation fuel made from petroleum, a non-renewable resource. "Biodiesel" is similar, but is made instead from oil-bearing grains such as canola. To make biodiesel, used vegetable oil from fast food restaurants is filtered, treated with chemicals, and separated. The clear, oily liquid smells a bit like French fries when it is burned in the car. If the crop is grown sustainably, the vegetable oil that is produced from it is a renewable resource.



These vehicles are powered by a fuel produced from vegetable oil. Source: www.musbioenergyfranchise.com.

Ride the Wind

In Calgary, Alberta, when you ride on the C-Train public transit system, you are literally "riding the wind." The electricity used by the City of Calgary to power the C-Train comes from wind turbines located south of the city. In other words, the operation of the C-Train system requires no coal, oil, or natural gas to push it along, just the energy of the wind.



Calgary's C-Train is powered by non-polluting wind energy. Image courtesy of the City of Calgary.

Making transportation more sustainable

Until we are using only renewable energy to power our vehicles, we are going to have to live with fossil fuels and their pollution. However, there are ways we can drastically reduce our need for fossil fuels in transportation. These include

- Making greater use of public transit and car-pooling
- Choosing to live closer to work and stores
- Using bicycles and other non-motorized forms of transportation when possible
- Planning and building communities that minimize roads and maximize green spaces, placing residences in close proximity to stores and places of work

It's About The
Solar Energy
HEAT-POWER-SUSTAINABLE