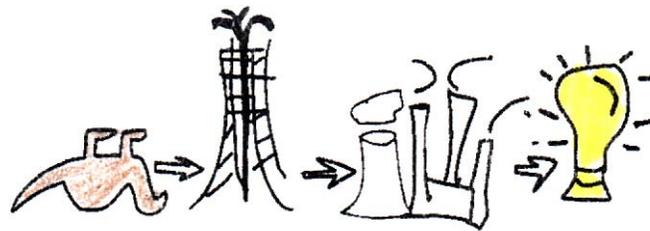


# Using a Really Big Power Plant

## Fossil Fuel Problems

In order to run our televisions, computers, VCR's, and other appliances, not to mention lights, we rely on power plants to supply our needed electricity. Many of these power plants burn **fossil fuels** as the energy source. Fossil fuels have the word fossil in their name because they are formed from the remains of animals and plants that lived millions of years ago.



In removing these fossil fuels from Earth, we create pollution. We can destroy the beauty of the land. We also create pollution when we burn these fuels to make energy. The gases that are emitted can cause global warming. They are called **greenhouse gases**. The other problem with fossil fuels is that because they are made from fossilized animals and plants, there is just a limited supply of them. In fact, fossil fuels are called **nonrenewable resources** because once they are all used, they are gone forever. Take a look at this chart that shows how long officials from the United States Department of Energy estimate that fossil fuels will last at the current production levels.

Fossil Fuel	How Long It Will Last
Oil	2096
Natural Gas	2165
Coal	2217

**Particulates** like tiny pieces of metal, **soot**, and dust are also emitted into the air when fossil fuels are burned. These particulates can cause health problems like making **asthma** worse. S. David Freeman is a man who learned about this when he was just a boy.

## S. David Freeman Cares About the Environment

When Mr. Freeman was a boy in Chattanooga, Tennessee he had the job of **stoking** the coal furnace at his house. On Sunday, David wore a white shirt. This shirt would turn gray because of the soot that was emitted from the furnace.



His family lived near a railroad track. The passing trains also emitted a lot of soot. David had asthma and his family had to move away to a more rural area because the soot seemed to make his asthma worse.

When David grew up, he worked in the White House Science Office for United States President Lyndon Johnson. He remembers that two New Hampshire women did some research and found that a new power plant did not need to be built in their area. They thought there was already enough power where they lived. This helped Mr. Freeman realize that Americans might be using too much energy. He wanted to look at better ways of using energy. In the 1970's he wrote a book called **Time to Choose** about using energy more efficiently. President Carter read the book and felt that the ideas were very

important. He asked Mr. Freeman to run the Tennessee Valley Authority (TVA) in 1977. The TVA is the biggest public power plant in the United States. Since he left the TVA in 1984, Mr. Freeman has helped many **utilities** change from using fossil fuels to other forms of energy.

## A Form of Energy

If fossil fuels cause problems, then what can be used for power instead? The Sacramento Municipal Utility District (SMUD) faced this question. S. David Freeman was general manager of the SMUD. He provided the leadership to help look at other ways to get power. He looked at ways to get away from always using fossil fuels, at ways to conserve energy, and at using electric cars at the SMUD. One of the important energy sources that Mr. Freeman and the employees of the Sacramento Municipal Utility District used were **photovoltaic** cells.



What are photovoltaic cells? Looking at word parts can often help us to understand big words. Photovoltaic is a big word, but if you break it down into parts, it's actually easy to understand. The word **photo** means light and the word part **voltaic** sounds like volt.

As you might suspect, voltaic has to do with electricity. Now you can see that photovoltaic involves turning sunlight into electricity. This is a form of **solar energy**.

## How Do Photovoltaics Work?

Photovoltaics were developed by Bell Laboratories in 1954. Like many other inventions, they were first used by **NASA** for space travel. In fact, we can think of the sun as a big power

plant in space. Light from the sun can be changed into electricity. Sunlight is made up of particles of solar energy called photons. When these photons come in contact with a photovoltaic cell one of three things can happen.

- Photons can be reflected off the photovoltaic cell.
- Photons can pass right through the photovoltaic cell.
- Photons can be absorbed by the photovoltaic cell.

When the sun's photons are absorbed by the photovoltaic cell, they can be **converted** into electricity.

There are many good things about photovoltaic cells. They have no moving parts, so they do not break. They are made of silicon which is produced from sand. They are thin and can be put on awnings or rooftops. The energy made by the photovoltaic cell and the sun can be stored for later use. Sunlight isn't about to run out the way fossil fuels will run out. The best thing, as you might have guessed, is that photovoltaics produce no pollution!

## **The Sacramento Municipal Utility Uses Photovoltaic Cells**

In 1984, there was a large nuclear power plant that served most of the electrical needs of Sacramento. There was a big problem with this nuclear power plant, though. It only worked about 40% of the time. So the people of Sacramento voted to close it down. Now the Sacramento Municipal Utility had to come up with other ways to get power to its customers. One of the things they did was to build two big photovoltaic power plants. They built these solar plants right around the closed nuclear power plant. There were 20 acres of solar panels that made enough power for 660 homes. Now, that's not a lot of houses, but it was a start!

Then they built a new photovoltaic solar station. This was called the Hedge Solar Station and was the most inexpensive public solar station built at that time.

S. David Freeman and the Sacramento Municipal Utility didn't stop there. They decided to put photovoltaic systems on customers' rooftops. This was a Photovoltaic Pioneer Program! About 400 homes and 2 dozen businesses signed up for this program. They found that an energy efficient home can make enough electricity from its rooftop to meet all of its power needs!

## **The Sacramento Municipal Utility is a Model For Other Communities**

On June 26, 1997 President Bill Clinton announced a Million Solar Roofs Initiative in the United States to encourage people to put photovoltaic systems on their rooftops. Japan helps people with the cost of buying and putting photovoltaic systems on their homes. In fact, more than 6,800 rooftop solar energy systems were put on Japanese homes in 1998. Switzerland, Germany, Italy, Norway, and the Netherlands all have solar rooftop programs too.

In developing countries, photovoltaic cells are very convenient and economical to use. Many of these countries do not have electric power lines already built. When they decide to use electricity, they can set up photovoltaic cells. In fact, seventeen United States students recently traveled to Africa to help bring electricity to schools and a health clinic. They installed solar panels on these buildings.

Now local people can study and visit the clinic after dark.



You can look around you and see if photovoltaic cells are used in your community! Look closely because this idea is not just for rooftops. You might be using a photovoltaic cell when you do your math lesson or when you are riding home from school.

## **You're an Expert!**

Pretend you are a teacher explaining greenhouse gases to your class. What would you say? Use the information in this article and other reference materials to make an outline of your explanation. Then instruct someone about greenhouse gases.

1. Imagine that you are a doctor who treats asthma patients. A television station is coming to interview you about things that can make asthma worse. What would you say? Write or tape your short "speech."
2. Make a list of at least 5 reasons why people should use solar energy.
3. Imagine that you are the advertising director for the Sacramento Municipal Utility District. Design a brochure that would encourage people to put photovoltaic systems on their roofs. Be sure to use the information from the article and look for additional information to help you produce a colorful, informative brochure.

## **Taking Action...**

Together with a classmate, make a list of the solar energy systems that you find in your town. You might take pictures or draw sketches of these systems. Use your information to write an article for your school newspaper or local paper about the good ways your town is helping the environment.