Case 1:

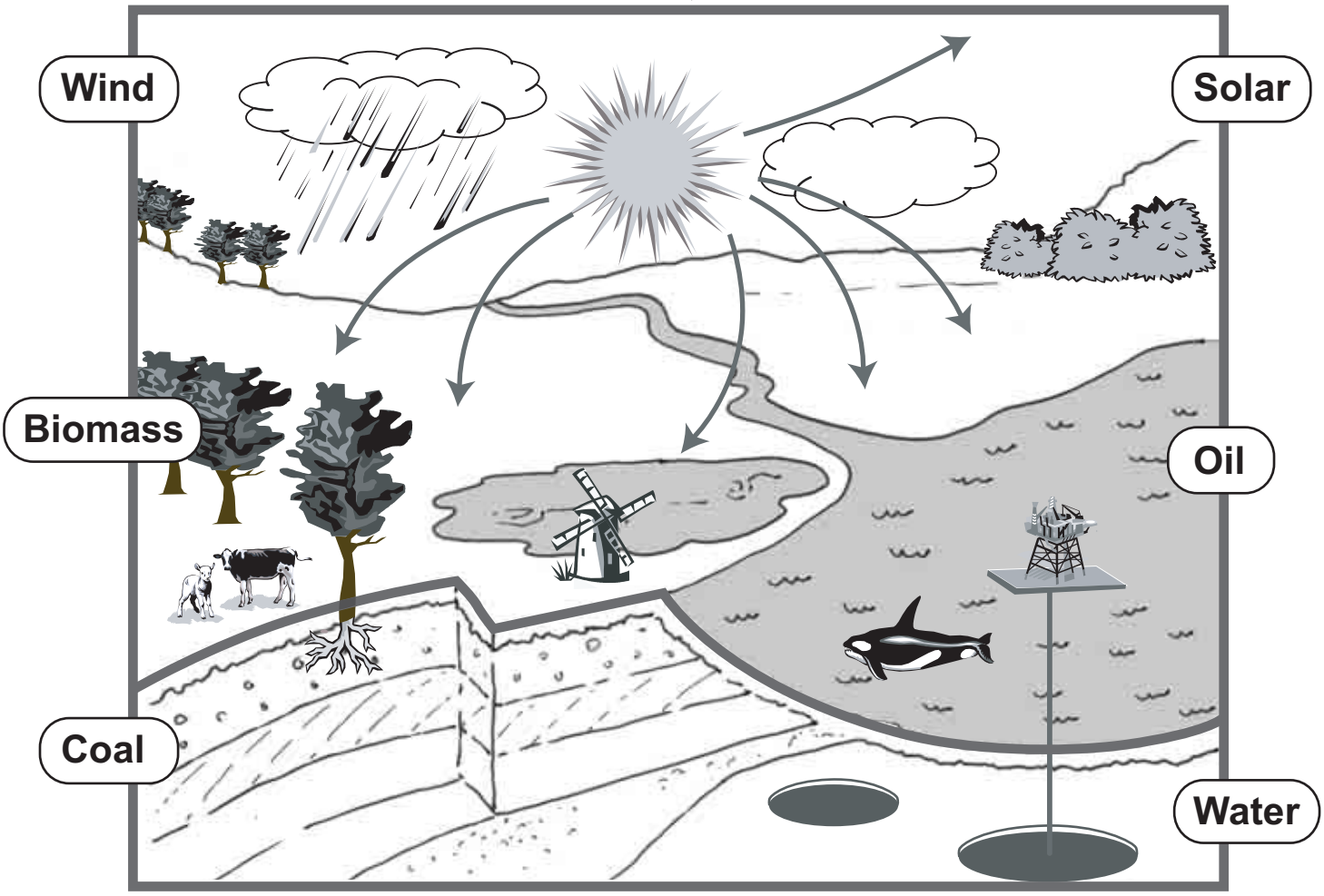
Energy in short supply

The Solar Detectives

Investigating the science,
maths and technology
behind engineering

Your task is to find out about solar power and put together a short report on this type of energy source. Our Planet provides us with many sources of energy; some of these sources are running out.

Here is a diagram showing some of the main energy sources available to us.



Add arrows to the labels on the above diagram to show where the energy sources are. Code your labels so that they clearly show which sources are renewable and which are non renewable.

To do

Your task is to work in a team to plan and then make a poster. Your poster must be about solar energy. On completing your poster your team will give a 5 minute presentation to your classmates. You and your team will need to explain what your poster is about. Scientists call this making a poster presentation.

This type of presentation is like show and tell.

To get you started we have included some background case notes on solar cell technology.

Case 1: (continued)

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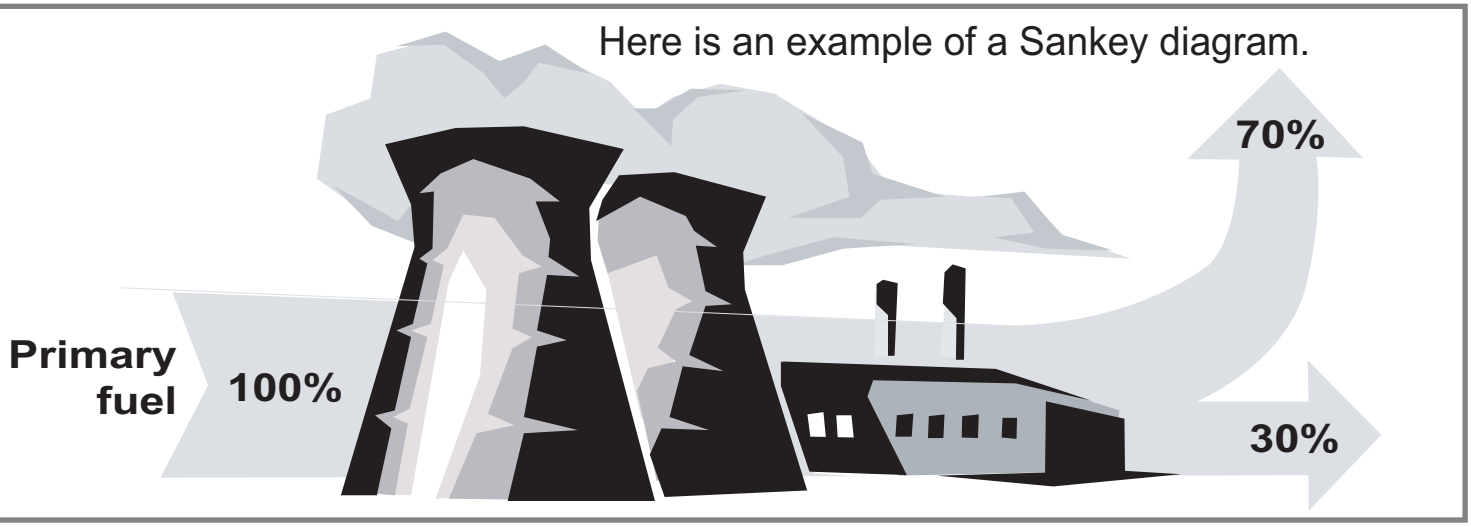
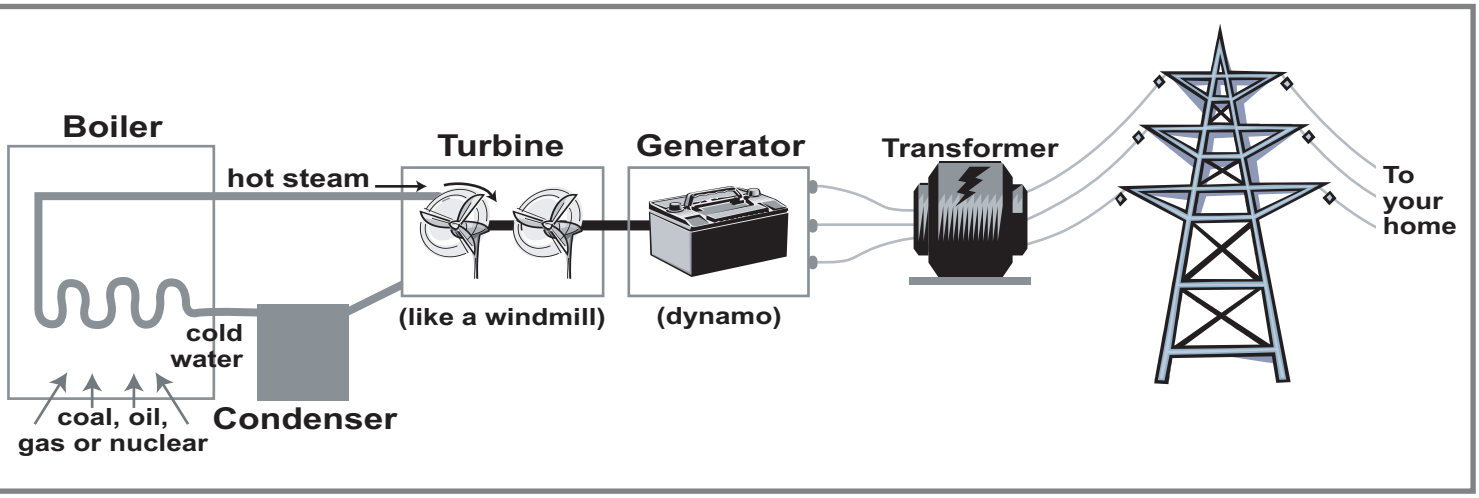
A technologist called Sankey made a way of showing how well the sources of energy can be converted into electricity at power plants.

Here is an example of a Sankey diagram.





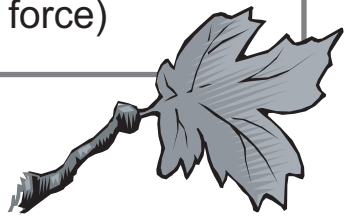
With a traditional power station energy sources such as coal, oil, gas or nuclear are transferred into electricity by a generator.

However with solar power a chemical reaction takes place within the solar cell itself.

This is called a photochemical reaction.

Photovoltaic cells are often called PVs or solar cells. Photo means light. Voltaic means making a voltage (generating an electrical force)

In nature within the cells of plant leaves light causes chemical reactions to take place. This is called photosynthesis.



PV's work by converting sunlight into electricity using silicon cells. More than one cell makes an array. Photovoltaics do not require mechanical generators or fossil fuels to make electricity.

Case 1: (continued)

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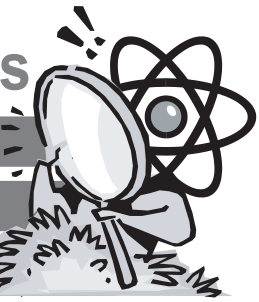


An introduction to photovoltaic cells

Devices called photovoltaic cells or solar cells produce electric current directly from sunlight.

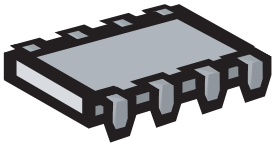
This ability results from the photovoltaic effect, a phenomenon in which the energy in sunlight causes electric charges to flow through layers of a conductive material to produce a useful electric current.

The development of photovoltaic cells

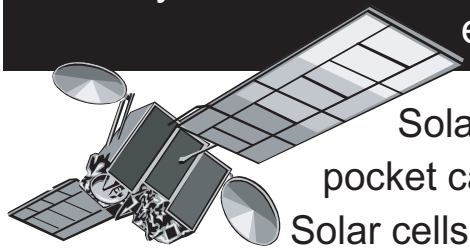
The French physicist Alexandre Edmond Becquerel discovered the photovoltaic effect in 1839. He immersed two metal plates in a solution and observed a small voltage when one plate was exposed to sunlight.

The first photovoltaic cells were made of a semi-metallic element called selenium. Selenium cells could convert only 1 percent of sunlight to electric power, so they remained just a curiosity for many years.

In 1954, scientists at Bell Telephone Laboratories invented the first photovoltaic cell that could produce a useful amount of electric power. The Bell scientists, chemist Calvin S. Fuller and physicists Daryl M. Chapin and Gerald L. Pearson, developed a solar cell with an efficiency of 6 percent, six times better than the best selenium cells. A solar cell's efficiency measures the percentage of sunlight striking the cell that it turns into electric power. The Bell scientists made their cell from purified silicon, the material used to make computer chips. Silicon is a semiconductor, that is a material that conducts electric current better than an insulator but not as well as a conductor.



Today the most efficient photovoltaic cells can convert up to 35% of the solar energy that falls upon them into electricity.



Solar cells provide power for spacecraft and artificial satellites, pocket calculators, some radios and even houses. Solar cells can also be used for electric power generation in remote places that can be difficult to reach with power cables. Most photovoltaic systems need a way to store excess energy. Usually rechargeable batteries are used. Excess energy is stored in the batteries during the day and can be used at night time.