

6.5 Lessons – Generating Electricity

Lesson 1 Sources of Energy for Electricity

Q Why is electricity such a useful energy?

It easily made from other energies.

It can be transported from one place to another very quickly.

It is easily converted to useful energies.

It can be stored.

There are two types of sources:

1. **Non Renewable energy** refers to those that will run out eventually. Can you name some?

Coal, Oil, Gas, Uranium (or Nuclear), Chemicals (in batteries), Geothermal (or steam from underground), plant and animal fuels (such as oil, ethanol and methane gas)

The first three (Coal, Oil and gas) are often called Fossil Fuels because they come from past life that has decayed.

Fossil, plant and animal fuels have environmental issues because they involve burning which makes pollution particularly of Greenhouse gases which contribute to Global warming. Coal, Oil and Gas are getting very expensive too especially when they get in short supply.

Sources of energy to be converted to electricity are either renewable or non renewable.

2. **Renewable energy** refers to those that don't run out or will take a very very long time to use up. Can you name some?

Wind, Solar, Water (in Hydroelectric Power, Wave or Tidal Power)

Renewable energy can be quite cheap to run and freely available.

Q. Unfortunately Renewable energy has some disadvantages too! Can you name some?

Expensive to setup.

Sometimes not available.

Hard to transport.

Reliability and availability can be a big issue:

1. Wind Generators need plenty of wind and regularly.
2. Solar Generators need plenty of Sun and regularly (not too cloudy).
3. Water Power needs to come from plenty of fast flowing water available (From rivers, waves or tides) and regularly.

Second Hand data Activities:

1. Look up No Renewable energy and Greenhouse gas emissions data :

<http://www.epa.gov/climatechange/students/basics/today/greenhouse-gases.html>

2. Look up data on Clean energy and usage in Australia:

<http://ret.cleanenergyregulator.gov.au/REC-Registry/Data-reports>

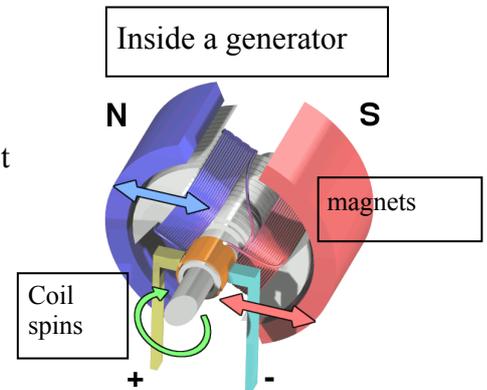
Generating Electricity

Most Sources of energy use **generators** to make electricity.

These are in power stations, used for caravans and camping, as a back up for hospitals and many other applications. This is also what keeps the electrical parts of the car going and charges up the battery as a car moves. (also called an alternator)

Generators use coils spinning inside magnets to make electricity.

This electricity flows from the coils into powerlines that can connect all the way across the country to your house.



Start Investigation 6.6 Investigation- Generating electricity Part 1 By Hand

Lesson 2 Electricity Generators

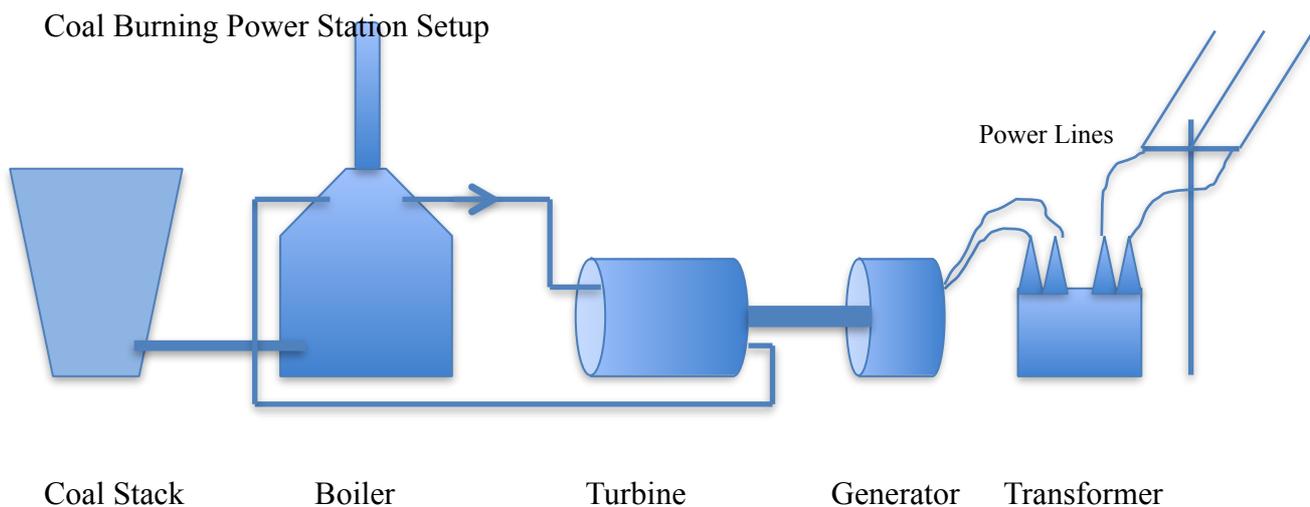
In Australian Power Stations

The spinning of coils in very large generators requires large amounts of energy.

These are obtained by burning coal, oil or gas to create steam.

High pressure steam is made by heating great boilers of water.

The fast flowing steam is used to turn large Turbines that are connected by the axle to the coils of the generators. These generators are constantly spinning and generating hundreds of thousands of volts of electrical energy for homes and industry.



For more details see <http://www.power-technology.com/projects/ihi-tarong/> and http://www.oresomeresources.com/interactives_view/resource/interactive_coal_fired_power_station

In some places in Australia using **hydroelectric power**, where large water **turbines** are turned by the push from fast flowing water instead of steam is much cheaper and viable because of fast flowing rivers e.g. Snowy River Hydroelectric Scheme

For more details see:

<http://www.originenergy.com.au/4235/Hydropower>

Portable Generators

Small generators can also be made. Such as a fuel powered generator or even a manually powered generator where the coil can be turned by hand.

In Bicycle lamps often a Dynamo is used (a small generator) where the tyre on the wheel turns a little wheel inside the dynamo.



Solar Power

An amazing technology used everywhere today are solar cells which use the Sun's power to generate electricity. Solar cells are like tiny batteries that are recharged by the sun. Solar cells can't store energy though but only convert the solar energy directly into electricity. So if the energy needs be stored than chemical batteries are needed.

Solar cells today are used on houses, for large scale generation sites and even portable uses where they can be folded up like a suitcase and opened up for a picnic in the sun. Solar cars are available too where the power generated is stored in batteries in the car.



Q. List some advantages and disadvantages of Solar Power?

Advantages

Sun's energy is free

Clean (no pollution)

Quiet (just works away on the roof without you noticing)

Disadvantages

Unreliable (some places have more sun than others. But nights are an issue)

Expensive to setup (although this is getting cheaper with better technology)

Needs large areas (for cars etc. the size is a problem)

Wind Power

Wind power is probably the oldest technology for harnessing energy. Sail boat and windmills have been around for thousands of year. Wind generators too have been used for over 100 years but recent technology has made the process as cheap as fossil fuel generators particularly in consistently windy areas.

How do wind generators work?

They work basically the opposite of a fan. Wind hits the propeller-like blades which turn a shaft connected to coils inside the closed housing behind the blades. The generator inside then transmits electricity down the pole and usually joins up with many others, sometimes hundreds on large wind farms.

See website: <http://energy.gov/eere/wind/how-do-wind-turbines-work> for more information on how wind turbines work.

Wind Power has grown in recent times and Australia has many wind farms (at least 9 in Queensland) website details: <http://ramblingsdc.net/Australia/WindQld.html>



Q. List some advantages and disadvantages of wind generators?

Advantages

Wind energy is free

Clean (no pollution)

Renewable

Disadvantages

Unreliable (some places have more wind then others. Even windy places can have calm days)

Expensive to setup

Needs large areas

Can be very Noisy.

Q Is Wind power available for cars. Do some research to find out!

Sails for cars have been used and even wind turbines on cars generating electricity is being researched today.

Water Power

As mentioned hydroelectric power stations are very common where fast flowing rivers or steep descent pipes and channels from dams are made to speed up the water jets that push large water turbines.

Other methods of using water for generating power are:

Tidal power is just beginning with just a few around the world such as the Seagen off Northern Ireland.



Wave power is only in the research phase but is a definite future alternative.

Fuel Cells are like batteries except the chemical is water and electricity can turn water into hydrogen and oxygen. These gases can then be turned back into electricity. So essentially it just stores electrical energy to be used later in cars and as small generators. Presently fuel cell cars can't be bought but much research is being done for the future (when petrol becomes too expensive).

Complete 6.6 Investigation- Generating Electricity Part 2 Using Energy Sources