19 Sources of Energy

Do you know that to engage in every day-to-day activity you need energy ? We get energy from the sources of energy.

The Table 19.1 shows some day-to-day activities and their sources of energy.

Table 19.1 ▼ Different activities and energy sources

Activity	Energy source
Boiling water, cooking	Firewood. L.P. gas, electricity
Transportation	Petrol, diesel
Drying clothes and different things	Solar energy (Sun)
Using the T.V, radio, computer	Electricity
Operating machines in factories	Electricity, diesel

Energy sources can be divided into two groups.

- Renewable energy sources
- Non-renewable energy sources

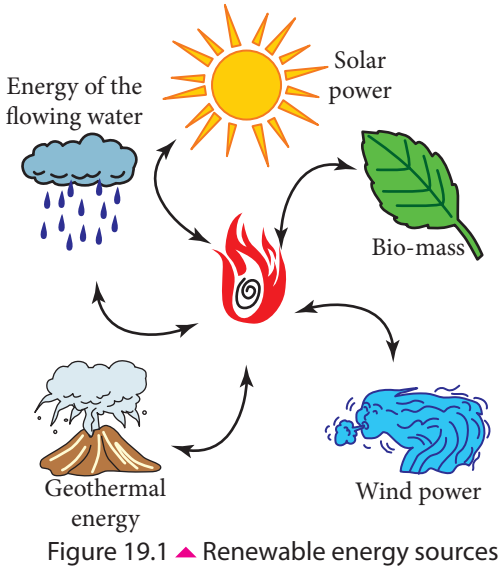


Figure 19.1 ▲ Renewable energy sources

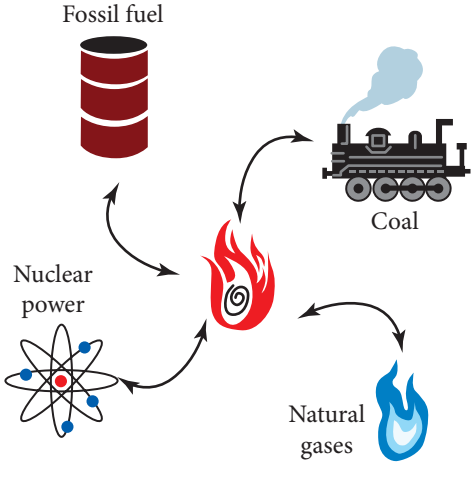


Figure 19.2 ▲ Non-renewable energy sources

To understand the concepts of **renewable** and **non-renewable** energy sources engage in Activity 19.1. Do it in groups.

Activity 19.1

Understanding the concepts of renewable and non-renewable energy sources

You will need :- Two same sized glass fish tanks, three same sized cups, another cup half in size than the other cups, four buckets

Method :-

- Name the two tanks as "A" and "B".
- Ask two of your friends to be near the tank "A" and another two near the tank "B".
- Fill ¾ of each tank with water.
- Give two same sized cups to the friends near tank "A". Give the other two cups to the friends near tank "B".
- Ask one friend near the tank "A" to take out a cup of water from the tank and ask the other to put a cup of water into the tank. Notice the level of water in the tank.
- Ask the friend with the big cup who is near the tank "B" to take out a cup of water from the tank and ask the other friend with the smaller cup to put a cup of water into the tank. Notice the level of water in the tank "B".

The tank "A" represents renewable energy sources while the tank "B" represents non-renewable energy sources.

Renewable energy sources are energy sources that are reproduced during use or within a short period of time after use.

e.g. :- ● Sun ● Wind ● Geothermal energy
● Flowing water ● Bio-mass

Non-renewable sources are not reproduced after use. Otherwise it takes a long period of time to be reproduced.

e.g.:- ● Fossil fuel ● Natural gas
● Coal ● Nuclear power

19.1 Renewable energy sources

Solar power

Solar power gives us light as well as heat. The reason for the wind in the atmosphere and waves in the sea is also the solar power. In some houses solar heaters can be seen on roofs. These heaters are used to boil water for purposes such as bathing.

Figure 19.3 ▲ A solar heater on roof

Activity 19.2

Constructing a simple solar heater

You will need:- A water tank, a rubber pipe, plastic pipes, a black coloured coverlet

Method:-

- Prepare the set up as shown in the figure. It is a model of a solar heater.
- Record the temperature of the water in the tank.

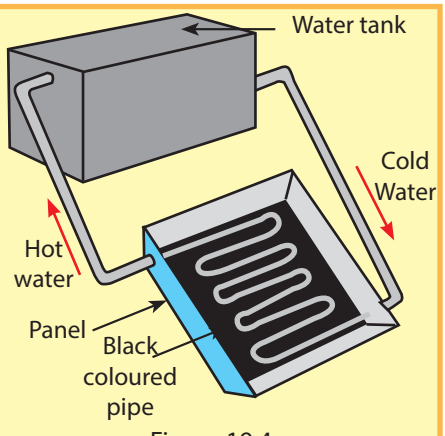


Figure 19.4 ▲

There is a longer pipe of which the surface is black in the panel. It is fixed on a black coloured surface too. It should be fixed in a manner as to allow solar heat to fall on the panel. As the black coloured surface absorb more solar heat. The water inside the pipe is heated by solar heat.

The heated water flows the water tank through the pipe above the water tank. Cool water is at the bottom of the tank. That water flows into the coiled pipe through the pipe at the bottom. When that water is also heated, it flows to the tank through the pipe above. As this is a continuous process water can be heated by this process.

Activity 19.3

Find the effect of the size of the solar heat cooker on its function

You will need :- Several torch reflectors of different sizes, several matchsticks, clay

Method :-

- Fix a matchstick in the hole of the torch reflector with the help of clay. Turn the reflector towards sunlight. Place it in a position in which the top of the match is set at the point where sunlight is collected. Measure the time it takes to light the match.
- Do this experiment by using torch reflectors of different sizes. Measure the time at each occasion. (Do this activity as a instructive model)

Figure 19.5 ▲ A torch reflector

You will observe that the time taken to light the match is decreased when the size of the reflector increases. A similar process takes place in the solar heat cooker too.

When the area of a solar heat cooker is increased, the amount of heat that can be obtained from it also increased.

Solar energy is transformed to electricity by solar cells. Solar cells were first produced to provide electricity to artificial satellites. At present, they are used in calculators, experimenting electric cars, street lamps and aeroplanes.

Activity 19.4

Generating electricity from solar batteries

You will need :- Solar batteries, multimeter

Method :-

- Find a solar panel if possible.
- Connect it to a motor and direct the solar panel towards the sunlight. If not remove the solar panel in a calculator with the help of an adult.

- Connect the connective wires to the multimeter.
- Adjust the multimeter to the scale of milliampere (mA).
- Direct the solar batteries to the sunlight and check the index of the multimeter.

Figure 19.6 a ▲ A street lamps operating from solar batteries

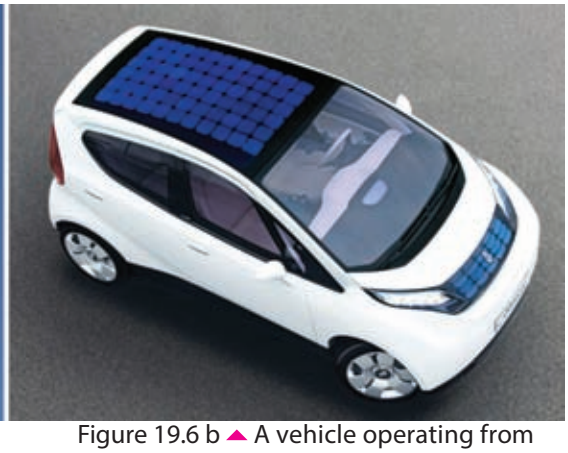


Figure 19.6 b ▲ A vehicle operating from solar batteries

Eventhough solar power is renewable and profitable, there are some disadvantages of it.

Figure 19.7 ▲ A bus stop which lightness up in the night using solar power stored during the day time

- Solar batteries are very expensive.
- Cloudy sky reduces the effectiveness of solar batteries.
- The electricity generated by solar power can be stored in batteries. However, only small amount of electricity can be stored in batteries and they should be disposed in a proper method after discharging. Improper disposal will cause environmental pollution.

Wind power

Solar power heats different places of the earth unevenly. When the air is more heated, it rises up generating a low pressure area in the atmosphere. The cool air from other places flows into the gap. This

circulation of cool air is called the wind. Ancient man has used wind for many purposes.

e.g. :- ● for cleaning paddy ● for grinding grain using windmills
● for transportation of sail boats

Electricity can be generated using wind. Do Activity 19.5 to get an idea about it.

Activity 19.5

Generating electricity using wind power

You will need:- A car cassette motor of 12 V, a LED bulb, a biscuit tin of which the diameter is 14 cm and the height is 10 cm, three plastic water bottles of one litre each (without water), three mega bottle lids, three bolt nails, a small pulley which can be fixed to the axis of the motor, twine or any other thread.

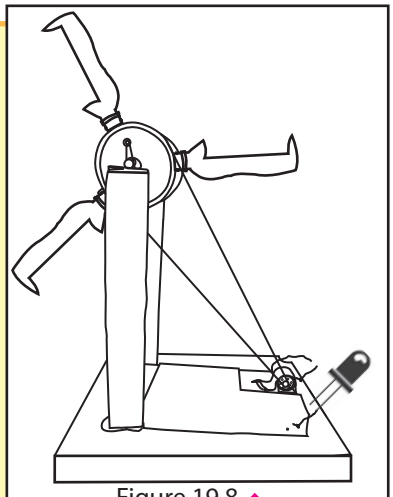


Figure 19.8

Method:-

- Fix the three mega bottle lids at a similar distance to the biscuit tin with the bolt nails.
- Fix three wind blades made by cutting and removing a part of the bottle, to those three bottle lids.
- Do not forget to fix the bottle lids towards corner of the biscuit tin and not in the middle.
- Fix the small pulley to the axis of the motor.
- Connect the car cassette motor of 12 V with the twine thread in a manner as to be able to rotate it.
- Connect a LED to the motor and rotate the turbine with the help of a fan.
- Record your observations.
- Increase the speed of the wind flow and observe the lighting of the LED.

It can be decided that electricity is produced thare as the LED is lighting. It is visible that electricity can be generated with the help of wind power. There are advantages as well as disadvantages in the wind power. The

advantages are that it does not cause any air pollutions, can be obtained free of charge and less environmental damage.
But, wind sufficient to generate electricity can be found in limited areas. Sound pollution takes place due to electricity generators powered by wind.

Geothermal energy

Thermal energy generated and stored in the earth is known as geothermal energy. Below earth's crust there is a hot and molten rock called magma. Because of this high temperature in this layer the water gets heated and turns into steam. This steam is pumped out to turn a turbine. This turbine operates a dynamo and generates electricity.

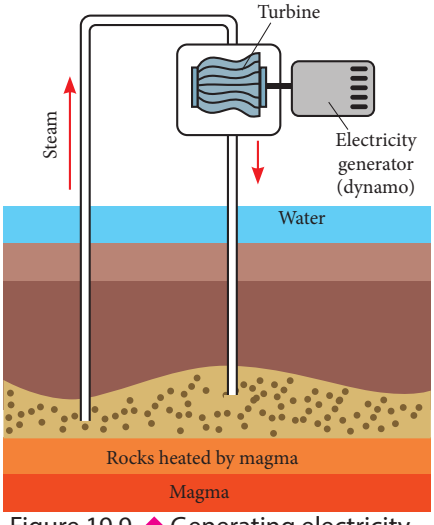
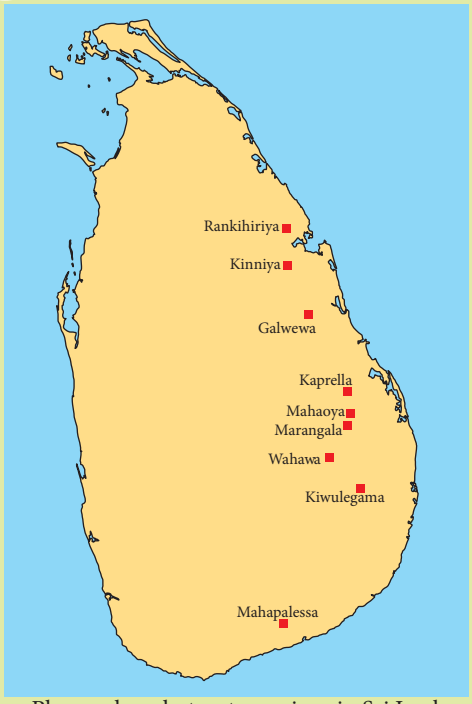


Figure 19.9 ▲ Generating electricity using geothermal energy

For extra knowledge



Places where hot water springs in Sri Lanka

The hot thermal springs (hot water springs) in different areas in Sri Lanka is an example for an instance where geothermal energy is used.
More experiments should be carried out about generating energy from these thermal springs.
Using geothermal energy seems very profitable because energy in deep down the earth's crust is used.
But, there are many drawbacks of using geothermal energy.
The places of earth with a very

high temperature are very deep in the earth's crust. Therefore, to use the geothermal energy the earth has to be drilled very deep. It needs a lot of energy and a high cost. Also many hazardous gases and many chemicals can seep up from the under ground and finding a way to safely dispose of them is very difficult and dangerous.

The energy of flowing water

From ancient time people used the energy of flowing water to rotate water turbines. Those wheels were used to grind grain.

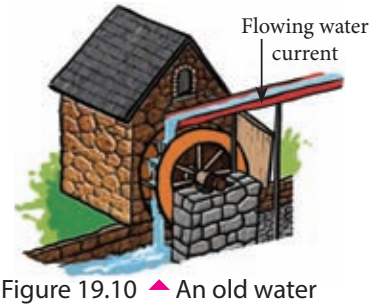


Figure 19.10 An old water wheel

Assignment 19.1

- Use a cork, a bicycle spork, yoghurt spoons, papers, clips and prepare a water wheel
- Hold the wheel to a flow of water and make a thread to coil in the cork. Prepare a method to lift a weight using the thread

Activity 19.6

Generating electricity with a water current

You will need :- 12V car cassette motor, a LED, a biscuit tin of which the diameter is 14 cm and the height is 10 cm, eight mega bottle lids, eight bolt nails, a small pulley which can be fixed to the axis of the motor twine or any other thread.

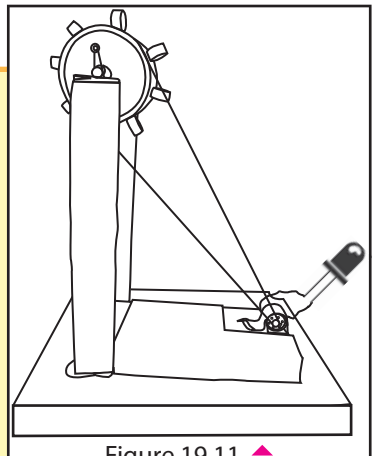


Figure 19.11

Method :-

- Fix the eight mega bottle lids at a similar distance to the biscuit tin with the bolt nails.
- Do not forget to fix the bottle lids towards corner of the biscuits tin, not in the middle.
- Fix the small pulley to the axis of the motor.
- connect the car cassette motor of 12V with the twine thread in a manner as to be able to rotate it.

- Connect a LED to the motor and rotate the turbine with the help of water current.
- Record your observations.
- Increase the speed of the water current and observe the lighting of the LED.

Electricity can be generated by using the energy of the flowing water. A location where electricity is generated using water is known as a hydropower station.

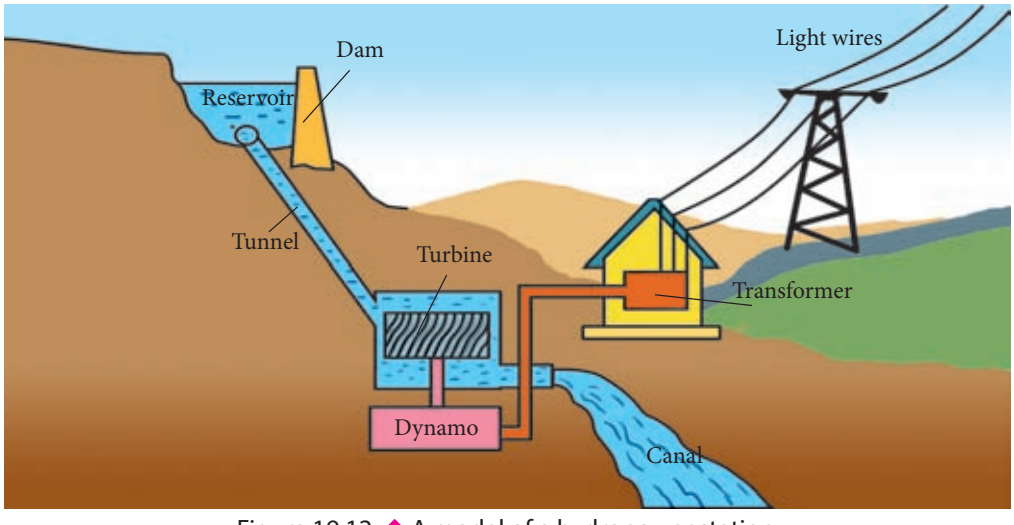


Figure 19.12 ▲ A model of a hydropower station

A concrete dam is constructed by obstructing the flow of water to generate hydro electricity. An artificial reservoir is created by that. The water thus collected in the reservoir is carried to the power station located in a lower level through tunnels and pipes. That water currents used to rotate the turbines. Dynamos (electricity generators) produce electricity by rotating turbines.

Hydropower is an environmental friendly and profitable source of energy. However, the initial cost of constructing a hydropower station is high. Due to the artificial reservoirs, animals lose their habitats. These reservoirs are filled with sediment which cause an issue as well.

In sri lanka, it is not possible to construct dynamo hydropower stations. All the possible locations have been used so far. If the expected amount of rain is not obtained, it is not possible to operate hydropower stations.

Energy of biomass

Biomass energy is the energy which is contained inside the animals and plant materials. Firewood is also considered as biomass. The amount of heat generates depends on the type of firewood.

In India, dried cow dung is used as a fuel to prepare food. Indian government encourages people to use cow dung to make biogas and use it as a fuel. Fuels produced using plant materials are considered as renewable energy sources. As long as we continue to plant new trees to replace those cut down we will always be able to get those fuels.

For extra knowledge

In some countries Gasohol which is a mixture of petrol (gasoline) and alcohol is used as a fuel for vehicles.

Gasohol supply station

Electric rice cooker is used in many homes to cook rice.
NERD institute has introduced a cooker that needs pieces of coconut shells as fuel. It can be used instead of the electric rice cooker.

Assignment 19.2

- List out the advantages and disadvantages of renewable energy sources.

19.2 Non-renewable energy sources

Mineral oil

Mineral oil is a fossil fuel. Fossils are made out of plant and animal matter, subjected to different reactions in underground. The fuels extracted from these fossils are called fossil fuels. Mineral oil is trapped among the rocks in the earth's crust. Metal tubes should be drilled inside these rocks to take the mineral oil. Mineral oil is a very common fuel used in factories and in transportation.
The advantages of mineral oil are easy to use (handle) and can be

converted to energy by modern machines easily.
Limited supply and emitting gas pollutants when combust, are the disadvantages.

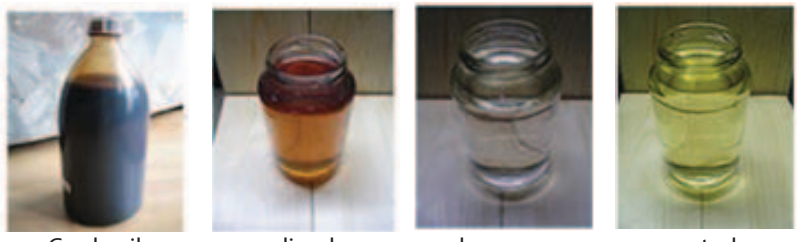


Figure 19.13 ▲ Crude oil and fuels extracted from it

Coal

Coal is also a fossil fuel similar to mineral oil. Coal mines are found among the inner rock layers of the earth.
A lot of heat can be generated by combustion of coal and also it can be handled easily.
It is easy to excavate coal mines from earth and easy to combust. There are more coal (mines) occur than mineral oil (mines) in the world. The gases emitted after combustion of coal cause environmental pollution.

Natural gases

The methane gases trapped within the rocks of the earth's crust are known as natural gases. Natural gases also are a type of fossil fuel. Metal tubes are drilled into the rocks and these gases are taken out. Natural gases are used to cook food and in cold countries they are used to heat the houses.

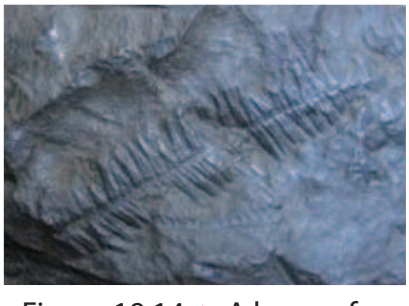


Figure 19.14 ▲ A lump of coal with marks of leaves


Figure 19.15 ▲ An instance of burning natural gases emitted from ground

Natural gases have many advantages; Cheap and easy to use. Pollution is less than coal and mineral oil. But, the supply is limited.

Nuclear Power

Energy is generated in the sun by nuclear reactions. During these reactions one type of atoms convert into another type of atoms.

Nuclear energy is generated by using Uranium which is a radioactive atom. In nuclear power plant electricity is generated using nuclear power.

Very little amount of radioactive atoms such as uranium, plutonium are sufficient to generate a vast amount of energy. This is an advantage of nuclear power.

There are mineral ores located in Sri Lanka, which contain uranium.

There are some disadvantages occurred when using nuclear energy. High expenditure of installing and maintaining nuclear power plants. Highly toxic materials are released as byproducts. Hence, need to be stored for thousands of years without exposing to the environment. That is again a highly expensive task.

Figure 19.16 ▲ A nuclear power plant (This is located in Kudankulum in India close to Sri lanka)

It causes hazardous conditions if radioactive substances are leaked by accidents. It will be harmful to man and the environment.

The discharge from these reactors are very toxic. They should be stored in a way that they would not expose to the environment for a very long time. Storing these discharge costs a lot. If accidently these radioactive substances expose to the environment it will affect people and the environment which will lead to a tragic end.

e.g. :- Explosion at the Chernobyl nuclear plant in Russia
Explosion at Fukushima nuclear plant in Japan.

Assignment 19.2

- Prepare a table that shows the advantages and disadvantages of non-renewable energy sources.

For extra knowledge

The time period of existence of some non-renewable energy sources are given below.

Mineral oil	- about 50 years
Natural gases	- about 70 years
Coal	- about 250 years

19.3 Sustainable usage of energy sources

It is our responsibility to use the non-renewable energy sources in a thrifty manner, as they will disappear one day. So, the future generation will not be able to use these energy sources.

Some strategies are given below for sustainable usage of these energy sources.

- Minimize using domestic electricity
- Walk or use a bicycle for travelling short distances (This will be good for your health too.)
- Use common transportation methods instead of using personal vehicles
- Tune the engine of vehicles to maximize the efficiency of fuel
- Use hybrid or electric vehicles
- Use optional energy sources whenever possible
  e.g. :- Solar water heaters can be used to boil water for bathing
- Use fuel that can be found from the nearby environment
  e.g. :- Using firewood, coconut shells for purposes such as cooking
- Avoid busy hours for travelling
- Minimize using plastic (a lot of fuel is needed to produce plastic)
- Make aware the public the necessity of minimizing the use of fossil fuels
- Fix catalytic converters to vehicles

Activity 19.7

Conduct a debate in the classroom on the topic "using renewable energy sources/non-renewable energy sources help for the country to get long term advantages."

Assignment 19.3

Make a booklet containing measures that can be taken to reduce the electricity cost at home.

Summary

- Energy sources can be divided into two groups as renewable energy sources and non-renewable energy sources.
- Renewable energy sources must be used as much as possible. Then non-renewable energy sources can be protected.
- There are advantages as well as disadvantages of both renewable and non-renewable energy sources.
- Sustainable usage of energy sources will help for the future generation to use them.

Exercise

01) Select the correct answer.

1) "The price of L.P. Gas has been increased." This is a news. As a remedy for this problem what is the best renewable energy source that can be used by Sri Lankans ?

a) Biomass **b)** Solar power
c) Wind power **d)** Tidal energy

2) A non-renewable energy source is

a) Solar power **b)** Coal
c) Energy in flowing water **d)** Wind power

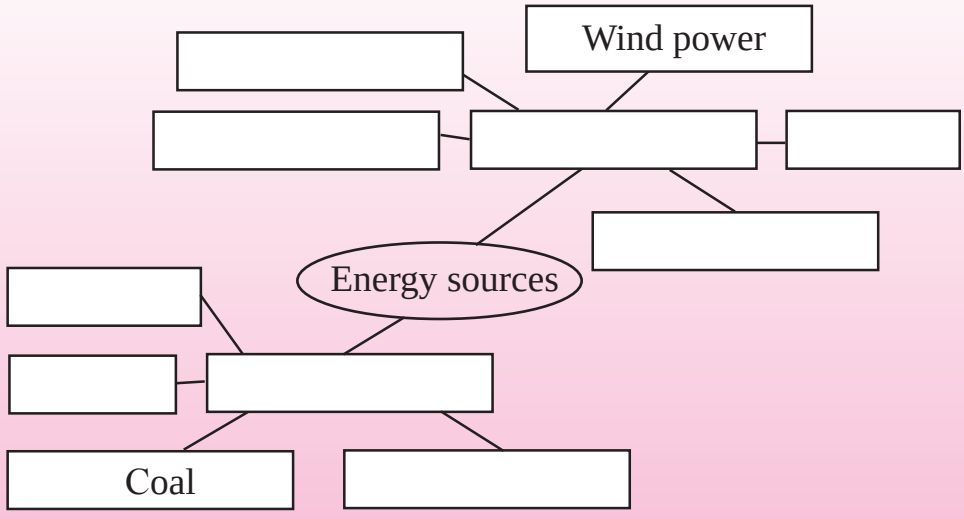
3) An energy source that does not fall into biomass category is

a) Dry cow dung **b)** Oil of castor seeds

c) Geothermal energy **d)** Chaff

02) Use the given words/ phrases and fill in the chart.

Hydro power, natural gases, solar power, mineral oil, biomass, renewable energy sources, geothermal heat, nuclear power, non-renewable energy sources



Technical Terms

Energy sources	-	ශක්ති ප්‍රභව	-	சக்தி முதல்
Renewable	-	පුනර්ජනනීය	-	புதுப்பிக்கக்கூடிய
Non renewable	-	පුනර්ජනනීය නොවන	-	புதுப்பிக்க முடியாத
Solar water heater	-	සූර්ය ජල තාපකය	-	சூரிய நீர் வெப்பமாக்கி
Solar cells	-	සූර්ය කෝෂ	-	சூரிய கலம்
Thermal springs	-	උණු දිය උල්පත්	-	வெந்நீரூற்று
Geothermal energy	-	භූ තාප ශක්තිය	-	புவி வெப்பம்
Biomass	-	ජෛව ස්කන්ධ	-	உயிர்த் திணிவு
Nuclear plants	-	න්‍යෂ්ටික බලාගාර	-	அணுக்கருச்சக்தி நிலையம்