EXPLORING CLEAN ENERGY

THE CLIMATE PROJECT FOUNDATION

The Climate Reality Project INDIA

ENERGY

Energy is a kind of force or power that enables us to do work. We need the energy to do physical work, to run electrical appliances, to cook food , etc. The muscular energy required for carrying out the physical work or the electrical energy that we use for running various appliances, chemical energy used for cooking food or running a vehicle all come from some source. The prime source of energy on Earth is Sun. The energy on earth is constant it only changes from one form to another.

For example: The energy of the sun in the form of heat reaches earth, and it is trapped by plants. Plants convert this energy into chemical energy by the process of photosynthesis and store it. When animals and humans eat these plants, this chemical energy provides them with energy to do work. When plants and animals die, they get buried under earth and with time under earth's heat and pressure they turn into coal and petroleum. This is called fossil fuel which is further used to produce energy.

SOURCES OF ENERGY

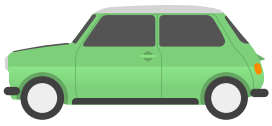
There are two types of energy: Renewable and non renewable energy

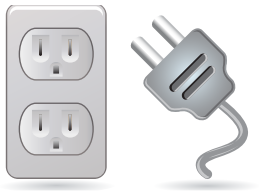
- **Non renewable energy** is the energy that takes so much of time in formation that if once consumed cannot be renewed in foreseeable future. For example: Coal and petroleum.

- **Renewable energy** also called clean energy can be replenished quickly. Hydel energy, wind energy and solar energy are considered clean energy sources as they do not add pollutants in the environment on electricity generation.

WHERE DO YOU GET YOUR ENERGY FROM?

Match the items with the source of their energy





RENEWABLE ENERGY

Renewable Energy is the energy harnessed from natural sources like sun, water, air and can be used without worrying about it to get exhausted. It is also called 'green' or 'clean' energy as no pollution is caused in harnessing this energy.

Solar Energy is the energy produced from the heat and power of the sun's rays. The energy is harnessed with the help of solar panels. This energy can help in producing electricity, cooking food, heating water etc.

Wind Energy is the energy produced from the spinning of turbines with the help of winds. Wind energy is harnessed with the help of huge windmills on windy farms.

Hydel Energy is produced from moving water. When water is made to fall from high dams, it rotates the turbine and generates electricity.

Bio-gas Energy is produced from plants and animal waste like cow dung, wood, leaves and other organic waste like agricultural and food waste. This waste is decomposed in tanks which produces methane.

Fact: India has 60 GW installed capacity of renewable energy as of October 2017

Guess which renewable energy it is?

Dams are built to harness this energy from rivers and lakes. India is the 7th largest producer of producing electricity from this source of energy.

_____

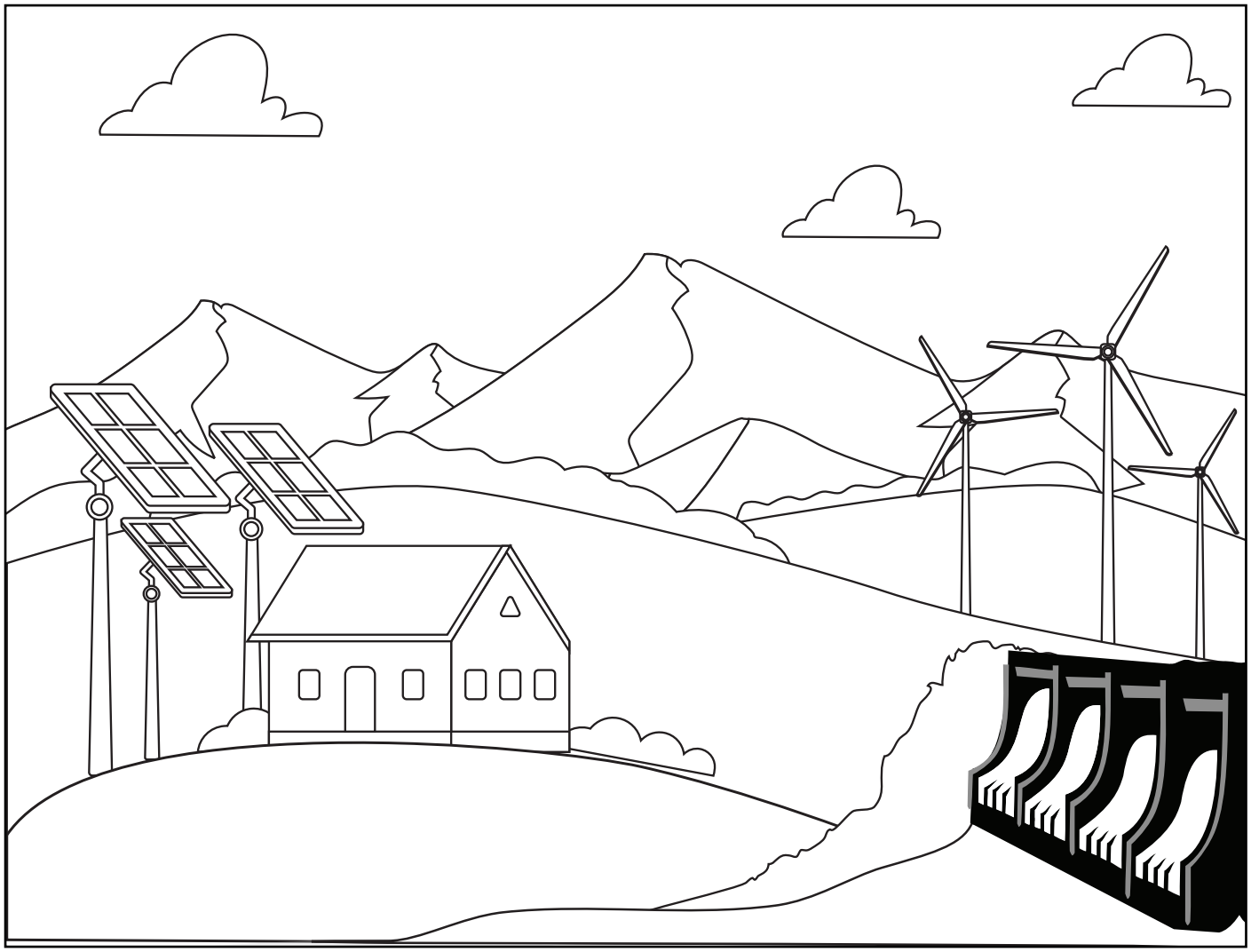
This energy is produced by using organic substances like wood, straw, manure andothernaturalresources that have stored energy.

_____

This is the most abundant form of energy and produces both light and heat. It is harnessed by solar panels to produce electricity

In ancient times, people used this energy to sail their ships. It is harnessed by large fan shaped structures standing tall on the farms.

Below is the picture of a farm. Find, name and colour the different Renewable sources of Energy



SOLAR ENERGY

Energy that is derived from the sun is called solar energy. Solar is the main source of energy on Earth and makes the biggest source of renewable energy.

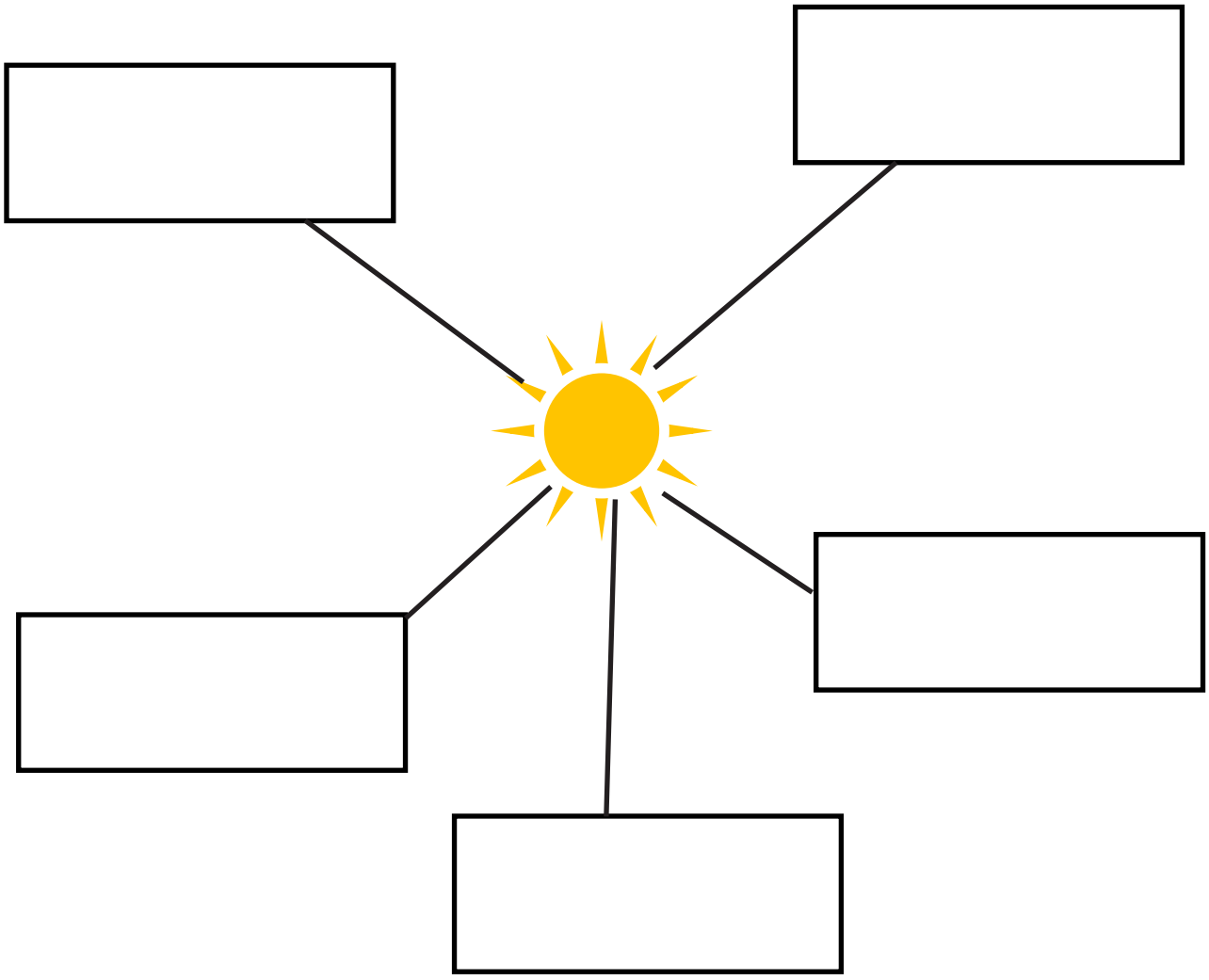
Sun is a natural nuclear reactor and produces heat and light energy in the form of small packets called photons. Every second earth receives enough energy to meet our energy requirements for a year. This energy keeps the earth warm, and plants harness solar energy by photosynthesis and produces food that provides energy to all living beings. It is solar energy that causes the natural phenomenon like wind and precipitation to occur.

Solar energy causes the wind to blow by heating up the air above the land. When the air closer to the land heats up, it rises and moves to the colder place. This moving air is called wind. When ocean water gets heated up, it vaporises and turns into clouds and later falls on the earth in the form of rain.

Solar energy can be used by us humans to produce electricity also. Solar energy is harnessed with the help of solar panels which have small units called solar cells. When these photons strike on the solar cells, it knockselectrons. With the flow of electrons in the circuit, electricity is generated. The more the number of panels, the more energy we can generate from the solar energy for our houses and industries.

Fact: India's solar capacity has increased 370% times in last 3 years (2015-2017) from 2.6 GW to 12.2GW.

1. ***The heat and light from the sun help us in many ways. Think and Fill the boxes with five ways in which you think Sun helps us.***



2. ***Name two Solar Devices and what are they used for.***

1. _____

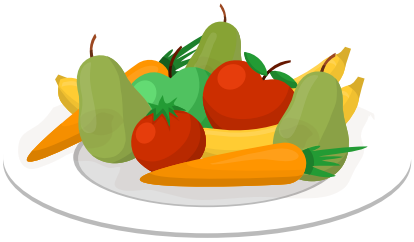
_____

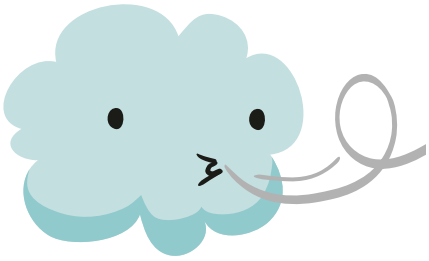
2. _____

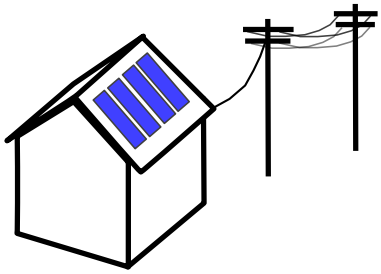
_____

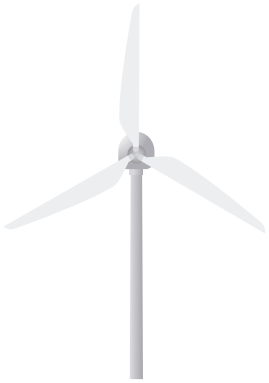
ACTIVITY

Sun is the main source of energy on Earth.
Connect the various things given below









WORKSHEET : SOLAR ENERGY

1. There is a lot of buzz about shifting to solar energy from coal and petroleum. List five things that make solar energy so efficient.

1. _____
2. _____
3. _____
4. _____
5. _____

2. True or False

1. Solar energy can be used only in daytime. _____
2. Solar panels are blue that helps in increasing its absorbing capacity. _____
3. Although solar energy is abundant, it is difficult and expensive to transform into a usable form. _____
4. Solar panels have become 100 times cheaper than it was in the 1970s _____.

3. ***Have you ever seen a solar panel in your home, community or school? If yes, where and Draw a picture of the building with the panel or paste a photograph in the space.***

4. ***Discuss with elders/peers and tell why even though Solar energy is a clean and abundant source of energy still solar panels are not very common in homes and schools? And share the picture of the discussion in the photo gallery.***

WIND ENERGY

When sun unevenly heats the surface of the earth, the air close to the earth moves and this space is filled in by the cold air, and this moving air is called wind. Since ancient times, humans have been using wind to sail boats, to grind grain and pump water. We can also use wind energy to produce electricity. To produce electricity from the wind, we need windmills. You must have seen huge fan shaped windmills on the farms or your textbooks. When air strikes the blades of these windmills, it rotates the turbine which converts wind energy into electricity. It is free, clean and renewable!

To harness enough electricity, wind farms are created with many wind mills mounted on a windy area. These wind mills or turbines can be as long as 200-300 ft. A large wind farm may consist of several hundred individual wind turbines which are connected to the electric power transmission network and can be located either in-land (onshore) or in bodies of water (offshore). Offshore wind farms can harness more frequent and powerful winds than are available to land-based installations.

Fact: India has added 5.5 GW of wind energy capacity in the year 2016-2017.

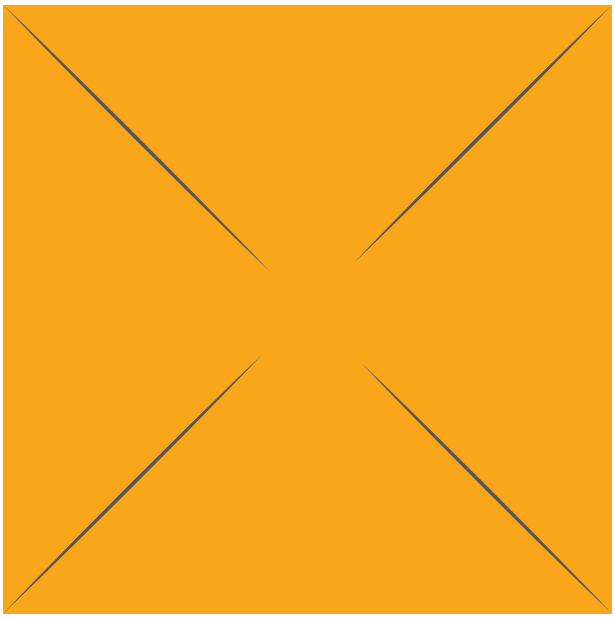
ACTIVITY

Do you want to see how air rotates the blades of a windmill? You can create your own paper windmill by following the below steps!

You will need: Chart paper, push pins, pencil, scissor and a straw

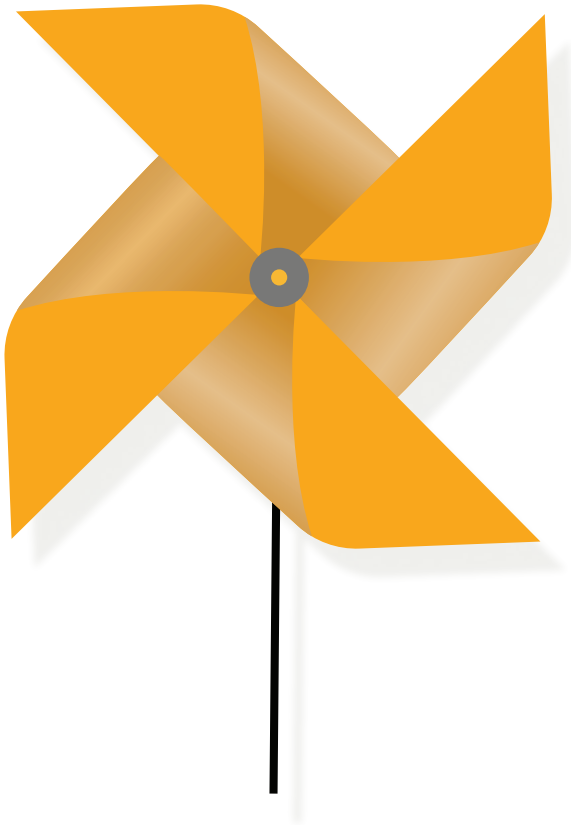
Steps:

1. Take a square piece of paper.
2. Fold the paper corner to corner and then unfold it.
3. Make a mark at 1/3rd way from the centre.
4. Cut along all the four folded lines up to the pencil marks.



5. Now, bring all the four alternate sides to the centre and hold them in centre with a push pin.

6. Make sure the pin is stuck in the centre holding the four sides.



7. Turn it over and attach the straw to the push pin.
8. Now take this pinwheel in front of a fan and watch it spin!

You can see when air strikes the blades the pinwheels rotates. In this same way, large windmills are constructed on windy farms, air strikes the blades of the windmill and makes it rotate. This rotating shaft in turn rotates the turbine which produces electricity.

Gift this to your friend! Give the name of your friend here

_____

Click a picture of your wind mill and paste the picture in the photo gallery

WORKSHEET : WIND ENERGY

1. ***List the advantages of wind energy as the renewable source of energy.***

2. ***Do you have wind farms in your city? If yes, share a picture in the photo gallery on the last page.***
   If not, why do you think there are no wind farms in your city?

3. *From the below landscapes which one is the best to have wind farm and why?*

4. What do you think are the limitations of wind energy?

_____

_____

_____

_____

HYDEL ENERGY

Earth is covered with 70% of water and this makes water one of the clean and reliable source of renewable energy. Since ancient times the river water has been used for various purposes like grinding grains. In the 1800s, scientists first figured out the way to generate electricity from the water. To generate the electricity from water, it is made to fall from great heights on a turbine which is connected to an electric generator. When the water falls from a height with speed on the turbine, the turbine spins and the electricity is produced. This energy is called hydel energy or hydroelectricity.

For producing hydroelectricity water stored in the rivers is used. Huge dams are built over a source of water. Water is collected behind the dam in the form of a lake. When the water stored in the reservoirs and dams is made to fall on the turbine from a height, the turbine moves and thus the kinetic energy of the water gets converted into the electrical energy. Water in the reservoir is replenished with rainwater and so availability of water is not a problem for hydroelectricity. The dams built over the rivers also help in flood control. The first major 4.5 MW hydroelectric power station in India was built near Sivasamudram falls of the Cauvery in Karnataka.

Fact: India is the 7th largest hydro electricity producer in the world.

ACTIVITY

To see how water can move a turbine to produce electricity

Electricity is produced when the turbine is rotated by some force. In case of hydel energy, Dams are constructed over rivers to make a reservoir. Then the water is dropped from heights on to the turbines, and water force rotates the turbine and electricity is produced.

You will need: small paper cups, compass, stapler, cardboard, pencil, running water

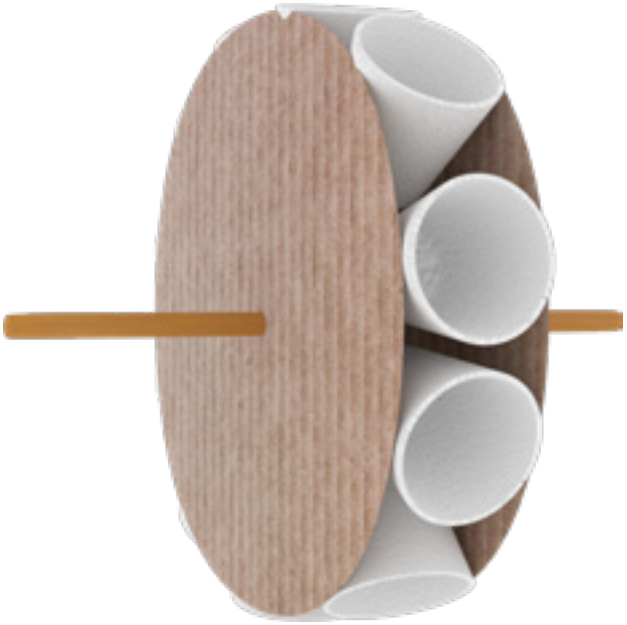
Steps:

1. Take a cardboard and make a circle of diameter 20 cm.
2. Cut two circles out of the cardboard each of 20 cm.

3. Make a hole in the centre of both the cardboards with the help of a pencil.

4. Now staple the paper cups around the edges of one of the cardboard circle.

5. Place the other cardboard circle on the opposite side.
6. Insert the pencil in the centre holes of the cardboards.



7. Your water wheel is ready. Make sure the hole is big enough for the wheel to rotate when water falls.

Now take this waterwheel and put it under a running tap, you can see the water wheel is rotating.

Click a picture of your water wheel and paste the picture in the photo gallery

Now take this waterwheel and put it under a running tap, you can see the water wheel rotating.

What do you think causes the water wheel to turn?

_____

_____

_____

How can you make water wheel turn faster?

_____

_____

_____

Can you think of a reason why dams are built at great heights?

_____

_____

_____

WORKSHEET : HYDEL ENERGY

1. Give three advantages and three disadvantages of Hydro energy?

Advantages	*Disadvantages*
_____	_____
_____	_____
_____	_____

2. Can you name five Dams that are found in India and the River on which they are built?

	_____		_____
	_____		_____
	_____		

3. Fill in the blanks with the correct word from the Box given below.

1. _____ % of Earth is covered by water but only _____% of it is fresh water, rest is stored in the form of _____ and ice caps.
2. Dams are used for irrigation and drinking water other than generating electricity. _____ is the largest dam of India.
3. Hydro energy is a type of _____ Energy which means it can be renewed easily.
4. Water is found in _____ states of matter. The process of water getting evaporated from oceans and rivers and then falling back on Earth in the form of rain is called _____ cycle.
5. _____ system is used to harness and store rain water that would otherwise flow into drains.

Clues:

Renewable, Three, Sardar Sarovar, Glaciers, Rainwater Harvesting, 75, Hydrological, Three

BIOMASS ENERGY

The plants and animals constitute the biomass. Firewood from plants is used as kitchen fuel. If large number of trees can be planted, then a continuous supply of firewood can be ensured. Farm waste such as stalks of harvested plants and dung of cattle can be used to generate methane. The decomposition of biomass produces methane which can be channelized for useful purposes.

Bio-gas Plant: Bio-gas plant can be very useful in solving the energy need of rural areas. A bio-gas plant is a dome-like structure which is usually built from bricks and concrete. In the mixing tank; the slurry is made from cow-dung and water. The slurry then goes to the digester; which is a closed chamber. Since oxygen is absent in the digester, the anaerobes carry on their work of decomposition. The process of decomposition produces biogas. Biogas has about 70% of methane and the rest is composed of other gases. The biogas is channelized through a pipe and can be utilized as kitchen fuel and as fuel for getting light. The slurry left behind is removed. It is used as manure, once it dries.

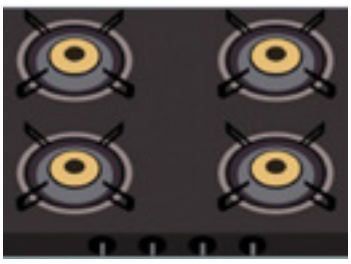
Fact: Biomass does not add carbon dioxide to the atmosphere as it absorbs the same amount of carbon in growing as it releases when consumed as a fuel.

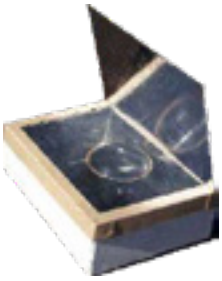
Deep diving:

https://climatekids.nasa.gov/menu/energy/

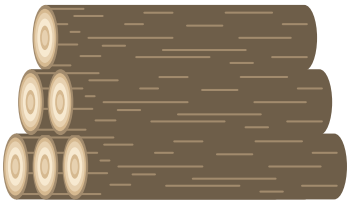
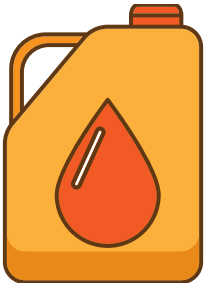
http://www.alliantenergykids.com/EnergyandTheEnvironment/RenewableEnergy/000625

In India, we cook our food by various means. Identify the various means of cooking given below. Find the source of heat in each of them for us to cook food





From the following fuel used for cooking, rate the fuels high/low in smoke emission & availability and circle the best fuel.

	Smoke emission	***Availability***
 ***Wood***	_____	_____
 ***Coal***	_____	_____
 ***Cowdung Cakes***	_____	_____
 ***L.P.G***	_____	_____
 ***Kerosene***	_____	_____

WORKSHEET

1. In rural India, 80% of people rely on cow dung and firewood. This type of energy is called _____ JUMBLED : SSIOMBA
2. Biogas is produced when organic waste like agricultural waste, animal waste, food waste is broken down in a digester. Which gas is primarily formed? _____ JUMBLED : EHMTNAE
3. In urban India, 86% homes have LPG for cooking. What does 'P' stands for in LPG? _____ JUMBLED : PREOTEUML
4. Biomass like sugarcane residue can be converted to a _____ that can drive a car JUMBLED : THALONE
5. Give two reasons why do you think most houses in rural India use biomass like firewood, cow dung to cook food even though its smoke causes eye irritation and respiratory problem?

_____

_____

6. Name the cleanest source of cooking and write its full form (if any).

_____

7. Draw a biogas plant in the given space. Discuss its advantages, disadvantages.

_____

_____

ELECTRICAL ENERGY

Look around your room, you have a bulb or tube light providing you light, a fan to keep you cool, computer, tv, all these things work on electricity. In India, most of the electrical energy that we use to run our appliances or to charge our phones, is produced by the burning of fossil fuels like coal that is limited in amount.

Suppose you wake up one day and due to some failure in the grid, there is no electricity in your home. You go to your friend's place and you find out that there is no electricity anywhere in your town. Now think and list the activities/things that you will not be able to do or the problems you will face in the absence of electricity for a day. (there is no inverter/generator)

_____

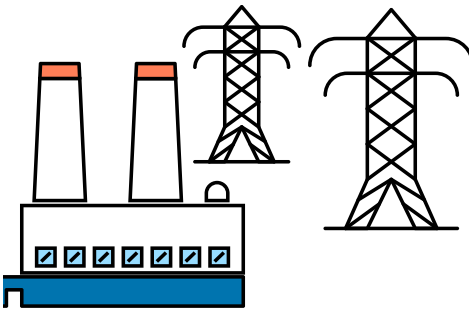
_____

_____

_____

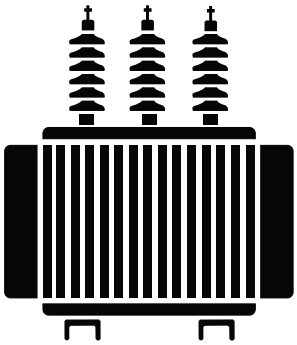
Draw pictures in the below box to show things in your room that consumes energy.

Number the below steps that gets energy from its primary source to your home.



Distribution station

Thermal power plant



Transformers

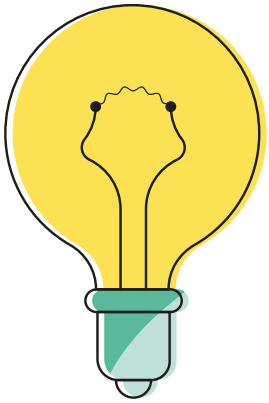
Homes

Coal mine

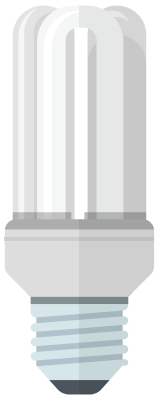
ENERGY EFFICIENCY : TYPES OF BULBS

Energy Efficiency is using technology to minimize the amount of electricity used in performing a particular action. For example: using LED bulbs instead of CFL to reduce energy usage or using a 5 Star rating appliance over a 2 star one.

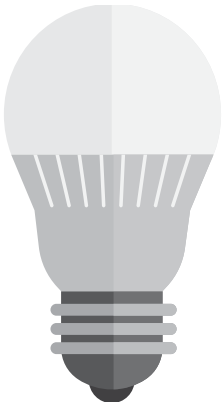
In our homes, we use different types of lightings to lighten up our houses.



Incandescent bulbs are the oldest type. They use a lot of energy in heating a filament of wire which emits light.



Compact Fluorescent Lamps or CFL use lesser energy than the incandescent bulbs as it wastes lesser energy in heating. But it contains mercury that can pollute the environment if not disposed of properly.



LED bulbs are most efficient, longer lasting and durable in comparison to the other two bulbs.

Now look around your house and answer following questions

1. How many Incandescent bulbs are there in your home? (if any)

   _____

2. How many CFLs are there in your home? (if any)

   _____

3. How many LEDs are there in your home? (if any) _____
4. How many hours are the lights on each day? _____ Hours.
5. Do you observe the usage of lights even when it is not required like in daytime? _____(Yes/No)
6. Do you have solar panel installed in your home? _____ (Yes/No)
7. Do you think energy can be saved in your home by making changes? _____ (Yes/No)
8. List the changes that you can make to save energy at your home or school

_____

_____

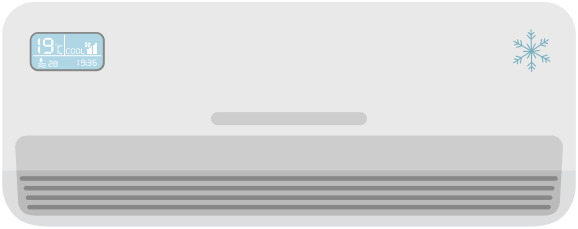
_____

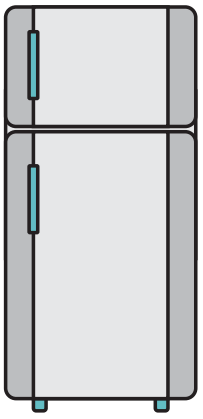
ENERGY STARS

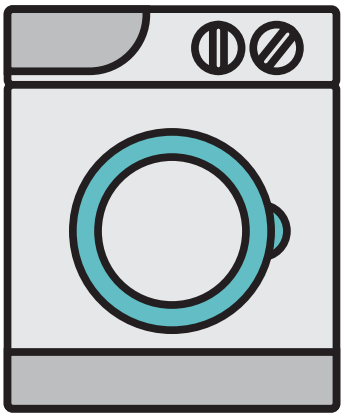
All the appliances that we use in our homes like TV, refrigerators, AC use electrical energy. Appliances that use less energy are called Energy efficient Appliances. For easy understanding, these appliances are given ENERGY STAR RATING. The more the number of stars on the appliances the lesser energy it consumes, and the more money is saved.

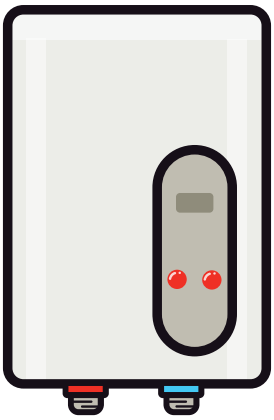
For example: A refrigerator with three stars is more efficient than a refrigerator with two stars.

From the below pictures, circle the appliances that are present in your home. Now take a closer look at all the appliances to figure out the number of stars on the appliances and colour the stars below the pictures accordingly.









Check if you are a high, moderate or less energy user.

Go through the activities given in the box and calculate how many stars you get.

Check from the below score if you are a High, moderate or Low energy user

Sr no	Activities	5 Stars	3 stars	2 stars
1	Total number of incandescent bulbs and CFLs in your home	None	Less than 2	More than 5
2	Do you leave TV, chargers plugged in?	Never	Sometimes	Always
3	How do you leave your computer after doing your work?	Switch it off properly	Put it on sleep mode	Leave it on
4	Do you use natural light in the daytime?	Always	Sometimes	Never
5	At what temperature do you use AC?	More than 25 degree	25 degree	Less than 25 degree
6	How do you dry your clothes	Always sunlight	Sometimes machine dry	Always machine dry
7	Do you use warm water for bathing?	Always cold	Sometimes warm	Always warm
8	How do you go to school?	Bicycle/ Walking	Bus/carpool	Car
9	Do you know about energy stars on the electrical appliances?	Yes	Kind of	No
10	Do you have solar panels installed at home?	Yes	Planning to get installed	No

So how many stars you got?

40-50 score: Congratulations your home is energy efficient and you use energy wisely. Spread awareness amongst your friends about energy saving.

30-40 score: You can make your home more energy efficient by following the steps given on the next page.

20-30 score: You are using a lot of energy. Check the table once again to look for the ways to save energy. By saving energy you can also save on electricity bill and money.

CLEAN ENERGY QUIZ

Take this Quiz to see what you have learnt

1. Which of these sources will never run out?
    a. Wind Energy
    b. Solar Energy
    c. Biomass
    d. Coal
2. Most of the energy that we use comes from-
    a. The moon
    b. The Sun
    c. The Wind
    d. The Oceans
3. Which of these is used to harness solar energy?
    a. Battery
    b. Solar panels
    c. Windmills
    d. Dams
4. There is a lot of water on Earth, we do not need to save water.
    a. True
    b. False
5. What are the ways to create a greener planet?
    a. Switching to Renewable sources of energy
    b. Using water sensibly
    c. Using energy efficiently
    d. All the above

6. The burning of fossil fuels produces-
    a. Carbon dioxide
    b. Sulphur dioxide
    c. Nitrous oxide
    d. All of the above
7. What do energy efficient appliances mean?
    a. They use less energy
    b. They use more energy
    c. They are expensive
    d. None of the above
8. When Electrical devices are connected to the electric source and not in use, they do not draw energy.
    a. True
    b. False
9. Energy star rating on the appliances shows that.
    a. How expensive the appliances are
    b. How energy efficient the appliances are
    c. Both a and b
    d. None of the above
10. Studying climate change, we have found that the earth is .....
    a. Cooling
    b. Heating
    c. No change
    d. All of the above

11. Currently which source provides most of the energy for power, transportation etc.?
    a. Fossil fuels
    b. Renewable
    c. Nuclear
    d. Sun
12. Which of these steps will help in reducing your carbon footprint?
    a. Replacing bulbs and CFLs with LED bulbs
    b. Conserving water
    c. Carpooling to school
    d. All of these
13. Recent flash floods in different parts of India were a result of Climate change?
    a. True
    b. False
14. Which of the following is the most energy efficient?
    a. Compact Fluorescent Lamp (CFL)
    b. Incandescent bulb
    c. Fluorescent tubes
    d. LED bulbs
15. We can produce energy from wood, leaves, animal waste, it is called.
    a. Waste energy
    b. Biomass
    c. Wood energy
    d. None of the above

PICTURE GALLERY

NOTES